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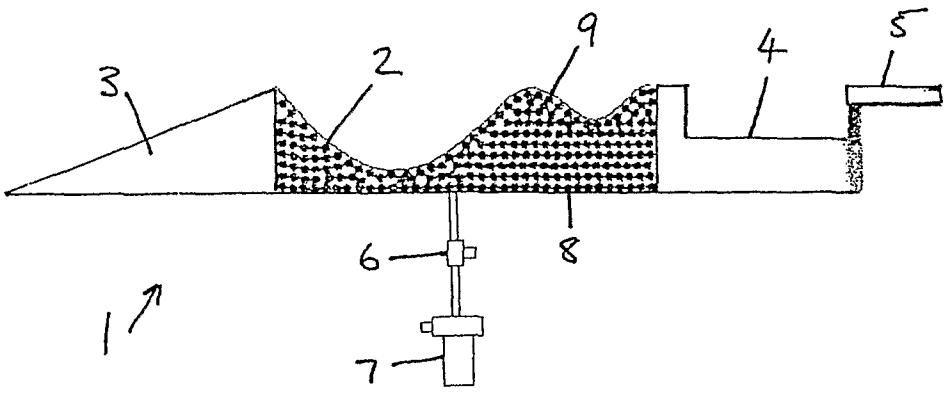

(57) **Abstract:** The invention relates to an improved mattress, particularly maternity mattresses for supporting the abdomen, or for supporting the abdomen and breasts, of a pregnant woman when lying in a prone position. A maternity mattress includes a support section for supporting the abdomen of a pregnant woman lying in a prone position. The support section may be configurable to a deformable state and a substantially non-deformable state. In use, the support section is able to be configured to the deformable state to allow it to deform to the shape of the abdomen of a pregnant woman, and is subsequently able to be configured to the substantially non-deformable state in which the support section is able to provide support to the said abdomen.

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Improved Mattress

The present invention is directed to an improved mattress, particularly maternity mattresses for supporting the abdomen, or for supporting the abdomen and breasts, of a pregnant woman when lying in a prone position.

During pregnancy, especially from the fourth month of pregnancy onwards, women become increasingly restricted in terms of movement and the positions they can adopt to relax or receive medical treatment. The enlarged abdomen and swollen breasts experienced during pregnancy make it difficult and/or painful for a woman to lie in a prone position. The woman lying on her back can cause discomfort and may be a contributing factor in a number of potential medical problems, such as supine hypotension, reduction in blood flow to the baby, swelling of the legs, varicose veins and haemorrhoids.

Furthermore, the increasing of weight of the uterus may lead to ligament pain and postural changes can cause back pain. The gradual increase in abdominal congestion can also cause oedema, constipation and heartburn.

If a pregnant woman is able to lie face down (prone) for short periods of time (for example, around 15 minutes) in a safe and supported position there are several possible benefits. The positioning of the baby may be more likely to be a good position for the birth, hence reducing the level of medical intervention during the pregnancy and birth. Blood flow, both to the mother and baby may improve, potentially increasing overall well being. Pressure on the nerves in the legs may be reduced, improving the quality of sleep and/or rest of the pregnant woman. A reduction in abdominal congestion may

lead to improved digestion and lymphatic drainage. The removal of load from the musculo-skeletal system can help reduce back and ligament pain caused as a result of the pregnancy.

Lying in a prone position would also allow the spine to be treated by physiotherapists and osteopaths. Massage of the pregnant woman would also be more easily facilitated.

Products currently exist that are aimed at enabling pregnant women to lie in the prone position, but all suffer from certain limitations and/or disadvantages.

US 2005/0188465 (Fahey) discloses an air mattress/raft for supporting a pregnant woman lying prone on the mattress/raft, the mattress/raft being in water or on the beach. A cavity in the mattress/raft includes side bolsters which may or may not be removed depending on the size of the abdomen of the pregnant woman. Not all of the abdomen is adequately supported and the mattress is adjustable in only a very crude way. Furthermore the support offered by the mattress/raft is relatively low and a pregnant woman may have difficulty getting on and off such a mattress/raft.

US 4,819,287 (Halverson) discloses a mattress to support a woman during pregnancy, in which the mattress comprises an opening, the opening being filled with a plurality of cushions, at least one of which is non-inflatable. The arrangement of cushions is adjusted to best suit the abdomen of the pregnant woman using the mattress. Clearly the adjustment is limited to the size and shape of the cushions, which may not suit some users. Also, the correct configuration of cushions must be determined

prior to the pregnant woman using the mattress, or determined by trial and error.

US 5,412,824 (Emerson et al) discloses a maternity mattress with a first and second cavity. The first cavity accommodates the enlarged abdomen of the user, the second cavity the breasts of the user. The cavities are adjustable in volume by the addition or removal of a fluid from the cavity. Prior to use the volume is adjusted to that thought required, the user lies on the mattress and further adjustments can be made. The adjustment of volume within the cavities able to be effected is such that some users may experience more or less support than others. Also, the support offered by the cavities is inconsistent. Should any pressure be applied to the back of the woman, say during massage, the cavities supporting the breasts and abdomen of the user would further deform.

The present invention seeks to mitigate at least some of these problems. Alternatively, or additionally, the present invention seeks to provide an improved mattress on which a pregnant woman may lie in a safe and supported prone position.

The invention provides a maternity mattress including a support section for supporting the abdomen of a pregnant woman lying in the prone position, wherein the support section is arranged to be configurable to a deformable state and a substantially non-deformable state, whereby in use the support section is able to be configured to the deformable state to enable its shape to adapt to the shape and size of the abdomen of a pregnant woman, and subsequently to be configured to the substantially non-deformable state in which the support section is able to provide support to said abdomen.

Advantageously, enabling a pregnant woman to lie safely and supported in the prone position may help reduce or prevent one or more of the problems experienced throughout a pregnancy as described above, and/or may result in any of the benefits also described above. The adaptability of the deformability and therefore the type of support provided by the support section means that the same mattress may be used by the same woman as her pregnancy progresses and her abdomen increasingly becomes enlarged. Also, the same mattress may be used by a plurality of different women, all with abdomens of different sizes and shapes.

The support section may be at least partially filled with beads. The beads may be approximately spherical or approximately ellipsoidal. The beads may be, but are preferably not, hard and rigid. The beads are preferably deformable during normal use. The beads may be made of expanded polystyrene or polypropylene. The support section may be filled with more than one type of bead. The beads may differ in respect of the materials from which the beads are made. The beads may differ in respect of the size and shape of the beads. Advantageously, the beads are shaped and arranged such that they readily flow around and over each other and hence easily adapt to the size and shape of the abdomen on the support section when in the deformable state. The beads may be similar in size, shape and composition as those that are present in bean-bags. The beads may be in the form of a flowable particulate material. The beads may be in the form of flowable granular material.

The maternity mattress may further comprise means for adding fluid to the support section. The maternity mattress may further comprise means for removing fluid

from the support section. The fluid may be a liquid or a gas. The addition of fluid to the support section makes it easier for the beads to flow over each other and so increases the deformability, hence adaptability, of the support section. The fluid may be air. It will of course be understood that the support section may advantageously be made from air-tight material.

The top surface of the support section may be made from a different material to the bottom surface of the support section. At least some of the support section, for example an upper surface and/or the top surface, may be made of an elastic material. The support section may comprise of a bag at least partially filled with beads. At least some of the bag may be made of an elastic material. Advantageously, if the bag is made of an elastic material it can stretch to adapt to the size and shape of the enlarged abdomen and will not fold or crumple, possibly forming pressure points or friction that reduce the comfort of the support section. The bag may be made out of plastic (or plastic-based material). The bag may be made out of rubber (or rubber-based material). The bag may be made out of latex. The bag may be made out of a thermoplastic film.

The means for adding and/or removing fluid from the bean filled bag may include a controllable valve. The controllable valve may be an air valve. The controllable valve may be a one-way valve. The controllable valve may be a two-way valve. There may be a plurality of control valves. There may be a safety valve to prevent the support section being over filled with fluid. The means for adding and/or removing fluid to the support section may include a pump. The means for adding and/or removing fluid to the support section may include an air pump.

The pump may be an integral part of the mattress. The pump may be external to the mattress.

The upper surface of the support section may be arranged to have an adjustable height (distance from the ground), independent of the adjustment of deformability of the support section. The adjustment for height may be provided by means of the support section comprising an upper portion and a means for raising the upper portion. For example, the upper portion may be in the form of a bag as described above. The upper portion may be able to be lifted by means of a suitable lifting mechanism, for example a further bag, which has a volume able to be adjusted. The height of the upper portion may be able to be adjusted by means of selecting one or more of a range of inserts, that are located beneath the upper portion.

Advantageously, in use the support section supports the breasts of a pregnant woman. It will of course be understood that the support section is preferably unitary in form so that in use the support structure provides substantially continuous and even support from the abdomen to the breasts by means of the same upper surface. During pregnancy, breasts typically become swollen and may become sore. Lying in a position in which they are supported in such a way may reduce soreness or relieve pain. Preferably, in use the support section supports (preferably in the form of substantially continuous and even support) from the hips to the upper area of the bust of a pregnant woman. Preferably, in use the mattress (and preferably a portion thereof other than the support section) also provides support to the user from the hips to the knees. Also advantageously, in use the mattress (and preferably a portion thereof other than the support section) also provides support to the user from the upper area of the bust to the shoulders. In

order to further improve the position of the spine whilst lying on the mattress a central guiding-line could be provided on the cover of the mattress to ensure that a user lies with her spine in straight line when viewed from above. Alternatively, a grid could be provided on the cover to ensure a user lies with her spine in a straight line.

Advantageously, the mattress further comprises a head rest. Preferably the headrest is adjustable. Preferably the headrest is adjustable to accommodate women of different heights. The head rest may reduce stress on the neck of the pregnant woman using the head rest. The headrest may be suitable for a head positioned in a face down position. The headrest may be suitable for a head positioned facing to the side.

It is advantageous for the mattress to include firm support sections for supporting the iliac crests of a woman using the mattress. It is further advantageous to provide firm support sections for supporting the shoulder and/or collar bone area of a woman using the mattress. The firm support section for supporting the shoulder and/or collar bone area may be approximately 'V' shaped in order to be suitable for a larger selection of the female population, and based on the assumption that as a woman gets taller, she also gets wider in the shoulders. The firm support section for supporting the shoulder and/or collar bone area may comprise a pair of spaced-apart separate supports angled towards each other to define the approximately 'V' shaped support.

At least one section of the mattress excluding the support section may be made out of foam. Foam has the advantageous properties of being firm and supportive, relatively inexpensive and easily manipulated. It is

also light therefore making the mattress easily portable. In order to give the mattress a solid structure, it may further comprise a rigid underlying framework. Alternatively, at least one section of the mattress excluding the support section may be made out of a fluid-filled bag. The fluid-filled bag may for example be in the form of an air-filled mattress section.

The mattress may have a washable cover. This would make it easier to keep the mattress clean and hygienic by removing and washing the cover at regular intervals.

Preferably, the maternity mattress is foldable. Preferably, the maternity mattress weighs less than 15Kg, and more preferably less than 10kg. Both of these features increase the portability of the mattress. One possible use, for example, would be a mid-wife visiting pregnant patients at home and taking the mattress with them to provide relief to the patient and/or offer them treatment.

Advantageously, when using the mattress a pregnant woman experiences relief of back pain. Advantageously, in use the maternity mattress improves foetal positioning. This may in turn lead to better labour with less likelihood of medical intervention. Advantageously, when using the mattress a pregnant women may experience reduced swelling in the legs, relief from the pain of varicose veins and haemorrhoids, and/or improved digestive performance. Advantageously, when using the mattress a pregnant woman experiences improved blood circulation. Advantageously, when a pregnant woman uses the mattress the foetus experiences improved blood circulation.

The invention further provides a method of supporting the abdomen of a pregnant woman lying in the prone position comprising the steps of

providing a mattress including a support section in a first deformable state, the support section comprising an airtight deformable container at least partially filled by a plurality of beads,

pumping a fluid into the airtight deformable container,

the pregnant woman lying down in a prone position such that her abdomen is positioned on the support section,

the airtight deformable container being deformed and adapting to the size and shape of the abdomen

removing fluid from the airtight deformable container such that the support section changes to a second, substantially non-deformable state (and possibly substantially rigid), conforming to the shape of the abdomen, at least, of the woman.

As the airtight deformable container is deformed by the abdomen of the pregnant woman at least some parts of the said container may move upwards relative to their initial position in the first deformable state. Not all of the fluid in the container need be removed. The removal of the fluid may take more than 1 second, and may even take more than 2 seconds. Preferably, the removal of the fluid takes less than 20 seconds, and more preferably less than 10 seconds.

The invention further provides a method of supporting the abdomen of a pregnant woman comprising the steps of

providing a deformable surface

the pregnant woman lying down in a prone position such that her abdomen is positioned on the surface thereby deforming the surface,

reducing the deformability of the surface, thereby enabling the surface to provide even support to the pregnant woman's abdomen.

It will of course be appreciated that features described in relation to one aspect of the present invention may be incorporated into other aspects of the present invention. Thus, in the method of the aspect of the invention described immediately above, the step of reducing the deformability of the surface may be performed such that the surface becomes substantially non-deformable, or even substantially rigid.

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

Figure 1A is a plan view of a maternity mattress according to one embodiment of the invention,

Figure 1B is a three dimensional view of a maternity mattress according to one embodiment of the invention,

Figure 2 is a cut away side profile of the maternity mattress in a first, unloaded state, and

Figure 3 is a cut away side profile of the maternity mattress in a second, loaded state.

Figures 1A and 1B show a maternity mattress 1 including a support section 2. The mattress 1 may be positioned on the floor, on a bed or on a treatment table. The mattress 1 may be used as a day bed. The mattress 1 further includes an inclined leg rest section 3, a head rest 5 and a cut away section 4 (shown more clearly in Figure 1B). The areas of the mattress surrounding the

support section 2, including the inclined leg rest section 3, the cut away section 4 and the head rest 5 are made of polyurethane foam. The support section 2 includes an elastic covering 9 and beneath that, a bag (not shown in Figures 1A and 1B) which is partially filled with a plurality of polystyrene beads 8. The bag and beads are similar in form to a bean bag.

In order to lie on the mattress a user kneels at the base of the inclined leg rest section 3, facing towards the head rest 5. The head rest 5 may be adjusted, by sliding it towards or away from the support section 2, to accommodate different user heights. The user then lowers herself onto the mattress, using her arms as support, such that her abdomen and breasts are placed on the support section 2. The user rests her head on the head rest 5 and places her arms in one of the various positions that are allowed by the cut away section 4. This may be folded in front of her, extended to the side and in front of the shoulders, or placed alongside the body pointing backwards. The head may be positioned facing downwards or to the side. Between the inclined leg rest section 3 and the support section 2 there are areas of the mattress that are firmer than the surrounding areas. These firmer areas (not illustrated) are placed to receive upon them the iliac crests of the user, thus offering firm support to the iliac crests. In the area between the support section 2 and the cut away section 4 there are also two further areas (not illustrated) of the mattress that are firmer than the surrounding areas, in this case positioned such that the user places their collar bone and shoulder areas upon them. These two firmer areas are shaped such that they define a shape generally in the form of a 'V' (although their lower ends do not meet) the bottom of the 'V' being furthest from the head rest 5. The iliac crest supports

and the collar bone/shoulder supports are shaped and positioned such that they align the spine of the user in a neutral position both when viewed from the side and when viewed from above. The dimensions of the support section 2, the inclined leg rest section 3, the cut away section 4 and adjustability of the head rest 5 are such that they will be suitable for supporting the 5th to 95th percentile range of the UK female population. It will be appreciated that the figures are schematic representations only and no dimensions or proportions should be inferred from them.

As the user lies on the mattress in the way described above, her abdomen and breasts apply pressure to the support section 2. The change in state of the support section 2 is now described with reference to figure 2 and figure 3.

Figure 2 shows the mattress in a first, unloaded, state, where no one is lying on the mattress, and the support section 2 is deformable. Figure 3 shows the mattress in a second, loaded state 3 where a pregnant woman (not shown) is lying on the mattress and the support section 2 has become substantially non-deformable. Prior to a user lying on the mattress, an external air pump 7 connected to the support section blows air through a two-way valve 6 connected to the support section 2 until the support section is inflated sufficiently to allow the beads 8 to flow over each other and allow the user to easily get onto the support section 2. The increased amount of air in the support section 2 allows the polystyrene beads 8 to flow easily over each other. The support section 2, in this first state (as shown in figure 2) is easily deformable. The valve 6 is then switched to allow air to escape from the support section 2 when extra external pressure is applied to the support section 2. The user

then gets onto the mattress 1 and lies down as described above. The main part of the torso of the user, including the abdomen and breasts, rests on the support section 2, the support section 2 being deformed such that it matches the size and shape of the abdomen and breasts of the user. The loading of the support section 2 by the user compresses the support section 2 and some of the polystyrene beads 8. The beads 8 move, and to some extent flow over each other, within the support section in response to the loading of the support section by the user. Thus, some of the beads 8 are displaced from their original positions so that the shape defined by the upper surface of the support section 2 deforms to match substantially the shape of the abdomen and breasts of the user. The weight of the user also causes some of the air in the support section to be gradually released through the valve 6 as the support section 2 is compressed. Once the user has found a comfortable position, during which time the support section 2 is fluidly changing to match the position, size and shape of the abdomen and breasts, the polystyrene beads' ability to move and flow is reduced by means of operating the pump 7 in reverse resulting in more air in the support section 2 being sucked out, and a near vacuum being created in the support section 2. The polystyrene beads 8 of the support section 2 firmly pack together (and are effectively locked substantially in place relative to each other) in such a way that they mould to the abdomen and breasts of the user and the removal of the air from the support section 2 means they are no longer fluidly moving around but offer firm support (as shown in figure 3). If the abdomen is large then the elasticity of the elastic covering 9 means that some of the beads may have been pushed upwards from their original positions, raising the sides of the support section 2 and offering even more support to the sides of the pregnant woman.

The woman is therefore able to rest in the prone position with even support over her abdomen and breasts with a substantially correctly aligned spine.

Whilst the present invention has been described and illustrated with reference to a particular embodiment, it will be appreciated by those of ordinary skill in the art that the invention lends itself to many different variations not specifically illustrated herein. By way of example only, certain possible variations will now be described. The support section could initially be inflated to a much greater extent (initially reducing deformability) to make it easier for the user to get onto the support section. In such a case the deformability of the support section would increase, and then decrease, during the subsequent deflation of the support section. The mattress may be smaller so that, whilst it supports the abdomen, the thorax (in particular the lower part of the thorax) and the breasts, the mattress does not afford support to other parts of the body. Such a (smaller) mattress may be used in conjunction with other support means (for example a bed) to provide full support to the body, if required.

The invention could be applied to apparatus used for supporting and providing relief to people with disabilities. Those that are clinically obese may suffer problems similar to those of pregnant women, and a similar mattress may offer relief. The invention could even be applied to car seats or seats on aeroplanes in order to make them more comfortable. Thus, embodiments of the present invention may have in common that they provide a support surface (for example in the form of a mattress) for supporting an object (possibly a human), wherein the support surface is arranged to be configurable to a deformable state and a substantially

non-deformable state, whereby in use the support surface is able to be configured to the deformable state to enable its shape to adapt to the shape and size of the object, and subsequently to be configured to the substantially non-deformable state in which the support section is able to provide support to said object. When the object is a human, the human may be supported in part only by the support surface. It will be appreciated that features described above in relation to other embodiments or in relation to other aspects of the present invention may be incorporated into this aspect of the invention. For example, the deformability of the support surface may be provided by means of a multiplicity of beads in a changeable volume of fluid.

Where in the foregoing description, integers or elements are mentioned which have known, obvious or foreseeable equivalents, then such equivalents are herein incorporated as if individually set forth. Reference should be made to the claims for determining the true scope of the present invention, which should be construed so as to encompass any such equivalents. It will also be appreciated by the reader that integers or features of the invention that are described as preferable, advantageous, convenient or the like are optional and do not limit the scope of the independent claims.

Claims

1) A maternity mattress including a support section for supporting the abdomen of a pregnant woman lying in the prone position, wherein the support section is arranged to be configurable to a deformable state and a substantially non-deformable state, whereby in use the support section is able to be configured to the deformable state to enable its shape to adapt to the shape and size of the abdomen of a pregnant woman, and subsequently to be configured to the substantially non-deformable state in which the support section is able to provide support to said abdomen.

2) A maternity mattress as claimed in claim 1, wherein the support section is at least partially filled with beads.

3) A maternity mattress as claimed in claim 2, wherein the beads are expanded-polystyrene beads.

4) A maternity mattress as claimed in any preceding claim including means for adding and/or removing fluid to the support section.

5) A maternity mattress as claimed in claim 4, wherein the means for adding and/or removing fluid includes a controllable valve.

6) A maternity mattress as claimed in claim 3 or 4, wherein the means for adding and/or removing fluid includes a pump.

7) A maternity mattress as claimed in any preceding claim wherein the support section comprises a bag.

8) A maternity mattress as claimed in any preceding claim, wherein at least some of the support section is made of an elastic material.

9) A maternity mattress as claimed in any preceding claim so configured that in use the support section supports the breasts of a pregnant woman.

10) A maternity mattress as claimed in any preceding claim so configured that in use the support section supports from the hips to the upper area of the bust of a pregnant woman.

11) A maternity mattress as claimed in any preceding claim wherein the mattress supports from the hips to the knees of a pregnant woman.

12) A maternity mattress as claimed in any preceding claim wherein the mattress supports from the upper area of the bust to the shoulders of a pregnant woman.

13) A maternity mattress as claimed in any preceding claim wherein the mattress further comprises a head rest that is adjustable to accommodate women of different heights.

14) A maternity mattress as claimed in claim 13 wherein the headrest is configured to support a head positioned facing to the side.

15) A maternity mattress as claimed in claim 13 or 14 wherein the headrest is configured to support a head positioned in the face down position.

16) A maternity mattress as claimed in any preceding claim where at least one section of the mattress excluding the support section is made out of foam.

17) A maternity mattress as claimed in any preceding claim, wherein the mattress further comprises firm support sections configured to support the iliac crests of a pregnant woman.

18) A maternity mattress as claimed in any preceding claim, wherein the mattress further comprises firm support sections for supporting the shoulder and/or collar bone area of a pregnant woman.

19) A maternity mattress as claimed in any preceding claim wherein the mattress has a washable cover.

20) A maternity mattress as claimed in any preceding claim that is foldable.

21) A maternity mattress as claimed in any preceding claim that weighs less than 10kg.

22) A method of supporting the abdomen of a pregnant woman lying in the prone position comprising the steps of

providing a mattress including a support section in a first deformable state, the support section made up of an airtight deformable container in which there is a plurality of beads,

pumping a fluid into the airtight deformable container,

the pregnant woman lying down in a prone position such that her abdomen is positioned on the support section,

the airtight deformable container being deformed and adapting to the size and shape of the abdomen

removing the fluid from the airtight deformable container such that the support section changes to a second, substantially non-deformable state.

23) A method of supporting the abdomen of a pregnant woman according to claim 22, wherein as the airtight deformable container is deformed by the abdomen of the pregnant woman at least some parts of the said container move upwards relative to their initial position in the first deformable state.

24) A method of supporting the abdomen of a pregnant woman comprising the steps of

providing a deformable surface,

the pregnant woman lying down in a prone position such that her abdomen is positioned on the surface, thereby deforming the surface,

reducing the deformability of the surface, thereby enabling the surface to provide even support to the pregnant woman's abdomen.

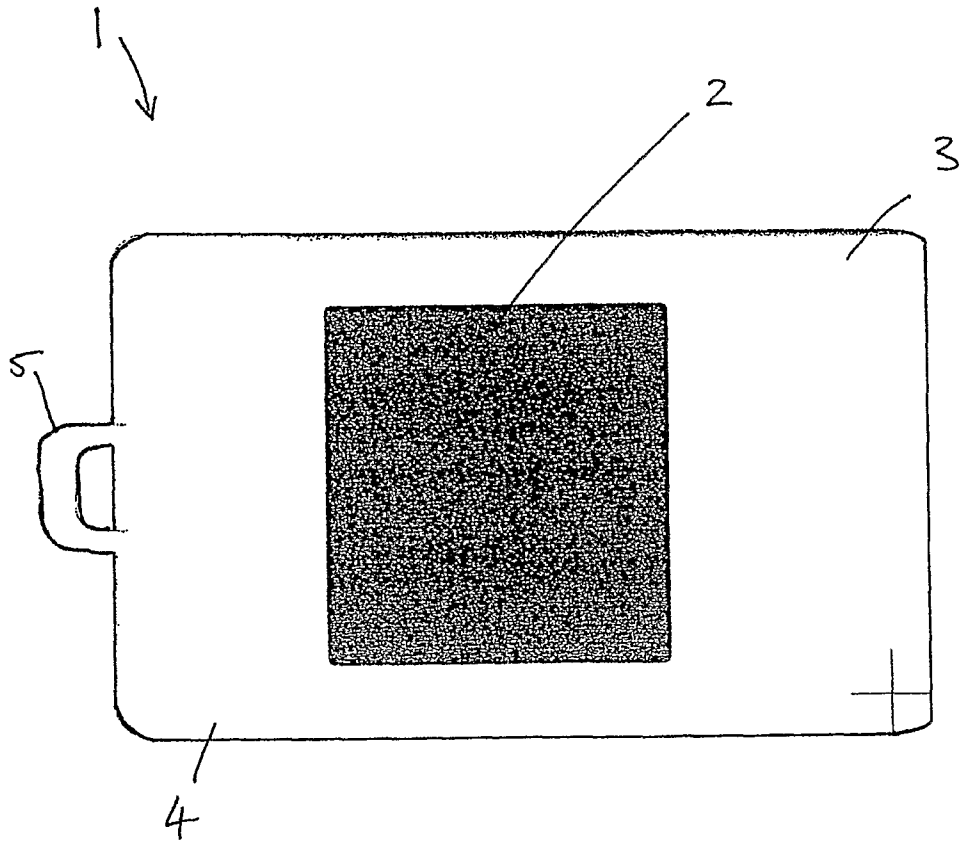

FIG 1A

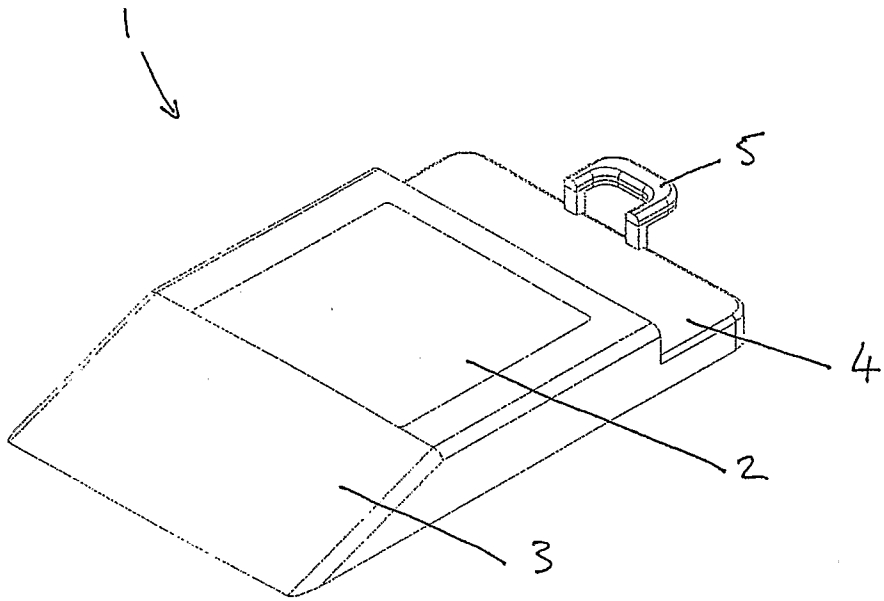

Fig 1B

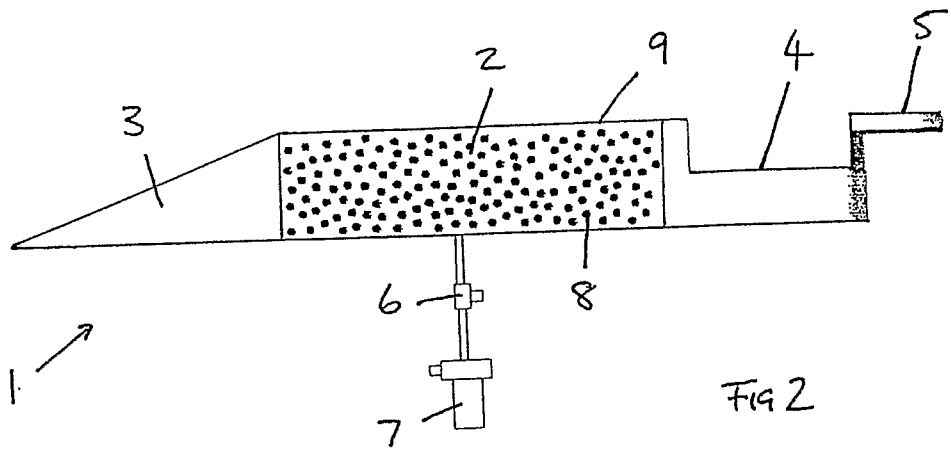

Fig 2

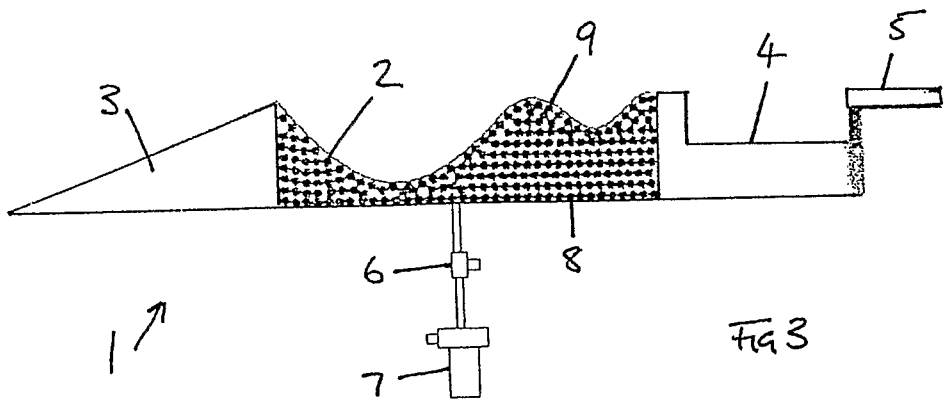

Fig 3