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B. MARKWITZ ETAL  
SUPPORTING MEANS TO PREVENT PARTS OF THE BODY FROM  
CONTRACTING BED-SORES

3,462,775

Filed June 1, 1967

2 Sheets-Sheet 1

Fig. 1

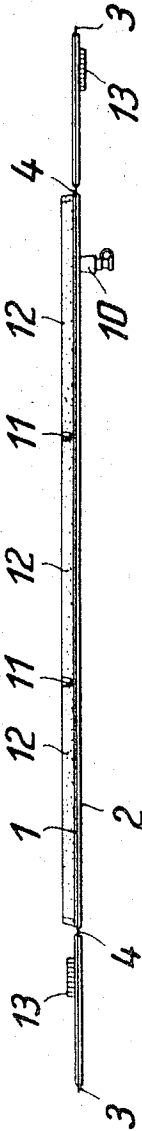
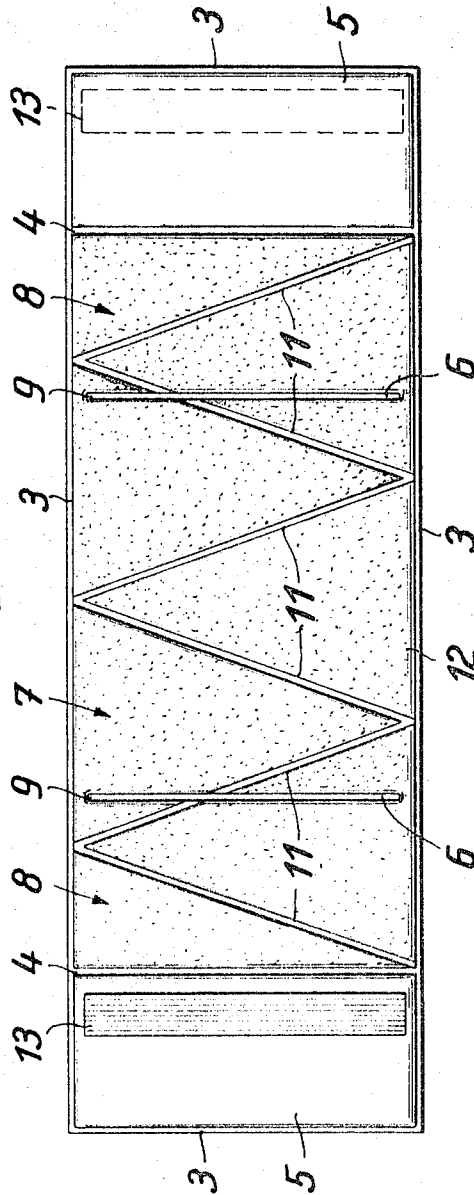


Fig. 2



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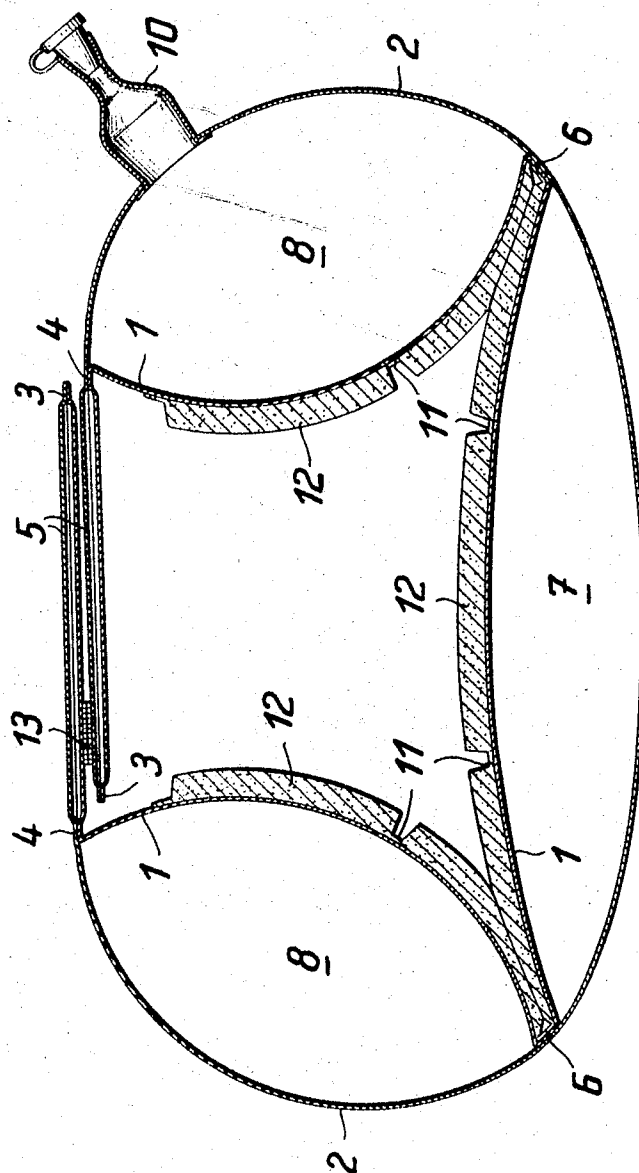
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2 Sheets-Sheet 2

Fig. 3



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## SUPPORTING MEANS TO PREVENT PARTS OF THE BODY FROM CONTRACTING BED-SORES

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5 Claims

### ABSTRACT OF THE DISCLOSURE

The supporting device for supporting the body or a part thereof of a bedridden patient serves to prevent formation of bed-sores at the mainly pressed areas of the body part. The supporting device is an inflatable tubular sheet closed at the ends and subdivided into several air cushions by transverse welding seams. The sheet is placed around the body parts, i.e. the calves, and after inflation its end portions are connected, i.e. by a Velco-type closure.

### Background of the invention

The invention relates to supporting means adapted to prevent parts of the body, especially the heels, of bedridden patients from contracting bed-sores.

With patients confined to bed for long periods of time, it often occurs that the parts of the body which are mainly pressed, such as heels, seat, shoulders and the hind-head contract bed-sores (decubitus) whereby the already weakened overall state of health of the patient goes still to worse. One has already tried to prevent the heels from contracting bed-sores by putting them into elastic rings. This support, however, in practice has the great disadvantage that the heel is supported only in one position of the leg.

One object of the invention is to provide a supporting means adapted to prevent parts of the body from contracting bed-sores and which allow a patient to turn in bed and particularly to lie on one side without impairing thereby the supporting effect.

Another object of the invention is to provide a supporting means, in particular, a supporting means for the shanks by which the danger of contracting bed-sores is eliminated; the free mobility of the parts of the body, especially the shanks, is guaranteed; normal blood circulation and perspiration of the supported parts are not impaired; and the formation of perspiration water at the pressed areas of the body is prevented.

### Summary of the invention

In accordance with the invention, the supporting means for the parts of the body consists of a double-walled inflatable sheet adapted to be placed around the parts of the body. This sheet consists of a hose portion which is placed around the part of the body to be supported and after having been inflated because of the compressibility thereof takes care that said part of the body is resiliently supported without having contact with the bed. The part of the body projecting from said inflated hose as well as the parts of the body not resting on the supporting hose are freely suspended in the air. The supporting effect is maintained even after the patient has turned onto the side because the inflated region of the foil surrounds the periphery of the part of the body by at least  $\frac{3}{4}$ .

In accordance with a preferred embodiment of the invention, particularly when used as supporting means for heels, the walls of the hose-like sheet are at least par-

tially connected with each other essentially transversely to the hose longitudinal direction especially along narrow welded strips, thus forming several air cushions. Suitably, the inflated hose sheet is brought into such a relative position with respect to the part of the body that the arteries are lying in these contact-free zones so that the blood circulation is not impaired even if the patient has to lie motionless in bed for an extended period of time. The connection of the sheet walls along the strips between two adjacent cushions is not effected over the entire width of the foil but with small channels being suitably left open, particularly at the ends of said welded strips through which channels the individual cushions are interconnected. So, one air inlet suffices to inflate all the cushions of the hose sheet.

In accordance with the preferred embodiment, the hose sheet is subdivided into three cushions, at least one welding seam being provided between two adjacent cushions. Two adjacent cushions may be turned about their common welding seams. The leg of the patient may rest on the intermediate cushion, while the two side cushions are capable of being turned-up and are serving to support the leg when the patient turns round. It is possible to provide between two adjacent inflatable cushions several welding seams in small distance from each other and arranged substantially in parallel. In dependence upon the width of this non-inflatable region defined between said welding seams, more or less broad contact-free zones are resulting between the leg and the sheet after having placed the latter around the leg and inflating it. Preferably a broad intermediate cushion is arranged between two small side cushions. The two contact-free zones between the center cushion and the two side cushions correspond to the position of the leg arteries. After the sheet has been placed around the calf and is inflated, the arteries approximately lie in the notches formed between the inflated center cushion and the two inflated side cushions. In the case of the supporting means for the protection of the heels, the dimensions of the inflatable hose sheet in the non-inflated condition are about 47 cm. x 20 cm. The center cushion in the non-inflated condition has a length of approximately 23 cm. The side cushions for example have a length of 10 cm.

Provision has further been made for the arrangement of connecting means at the two ends of the inflatable sheet. By the connecting means, the turned-up side cushions can be connected with each other and retained in this position. Preferably, the sheet is longitudinally subdivided by transverse welding seams formed near its ends and extending over the entire width thereof to form an inflatable portion comprising said center cushion and said side cushions and two non-inflatable end portions with the closure means fixed thereon.

In this manner the entire supporting means may be made of one hose portion. The transverse welding seams formed near said hose sheet ends prevent air from entering said end portions during inflation. To make the supporting means according to the invention, two webs of a sheet of corresponding width may also be used instead of the hose as the starting material, said sheet webs being welded to each other along their longitudinal edges thereby forming a hose sheet. The simple division of the non-inflatable end portions by means of continuous transverse welding seams provides for an especially safe connection, and it is not necessary to fix any special end flaps as a carrier for the connection means. Buttons, press buttons, straps, etc. may for example serve as connecting means. Preferably, however, the supporting means in accordance with the invention is provided with a Velcro-type connection extending over the entire width of the foil. Such a Velcro-type closure strip may be pasted, or if being made

of thermoplastic material, welded onto said end portions. To improve the fastening of the Velcro-type closure strips on the end portions, one will weld the superposed walls of said end portions to each other at least partially in the region of the connection strips.

In accordance with a preferred embodiment of the invention the side of the sheet wall which faces the part of the body is provided with a layer of soft foam material with open pores. The foam material layer not only increases the resiliency of the supporting means but makes possible also the breathing of the skin at the areas being supported. Thus, the formation of perspiration water is avoided. What is essential to obtain this effect of the foam material layer is its open-porous character which ensures a diffusion of moist air through the soft foam material. In a further development of this embodiment, provision is preferably made for strips in said foam material layer which are free from foam material. The foam material layer may be connected to the sheet wall therebeneath by means of welding seams along these strips. The width of the strips free from foam material may be approximately equal to the thickness of the foam material layer. The strips extend towards the outer edges of the layer and serve to carry off the sweat and to improve the circulation of air. The welding of the foam material layer with the sheet wall disposed therebeneath adds to the durability of the foam material layer and avoids in particular the tearing-off of the foam material layer when connected only at an edge welding seam.

Furthermore an opening in a cushion wall together with closure means are provided which comprise a short hose portion of small diameter at said opening closable by means of a plug. This inflation port can be formed near the end of the inflatable part of the sheet at the outside thereof, said hose portion being adapted to be pushed into the interior of the side cushion together with the plug when the sheet is inflated. The air inlet because of its arrangement at the outside of the turned up side cushion will lie exposed even if the leg of the patient rests in the supporting means. If the patient turns round with his leg resting on the supporting means an outwardly projecting closure might be disturbing and might eventually open inadvertently. These disadvantages are avoided if the hose portion with said plug is pushed into the interior of the inflated side cushion.

The inflatable sheet consists of an airtight material having a certain elasticity and transparency, such as for instance plasticized polyvinylchloride. It is actually possible to use also other materials such as for instance polyethylene or natural rubber. The elasticity of the sheet material adds to the softness of the supporting means and the transparency makes possible an observation of the surface of the skin to a certain degree.

The invention will now be described in the following in more detail by way of a supporting means for a heel.

#### Brief description of the drawing

FIG. 1 is a side view of the non-inflated supporting means according to the invention;

FIG. 2 is a top plan view of the supporting means, and

FIG. 3 is a side view of the inflated supporting means on an enlarged scale.

#### Description of the preferred embodiment

The supporting means represented in FIGS. 1 to 3 consists of two rectangular sheets 1, 2 of the same dimension connected by welding at their edges. The foils are transversely welded near its opposing ends, said transverse welded seams extending to the longitudinal edges 3 and separating the non-inflatable end portions 5 from the inflatable portion. The inflatable portion is subdivided into a broad center cushion 7 and two smaller side cushions 8 by transverse welding seams 6. The transverse welding seams 6 between the cushion 7 and the cushions 8 are not extending completely to the welded edges 3, so

that the cushions 7, 8 are connected by air channels 9. A short air inlet hose portion with a plug 10 formed integrally with said inlet hose is fitted on the underside of the one side cushion 8. The air channels 9 ensure that all the three cushions may be inflated from the inlet 10.

The upper sheet 1 of the cushions 7, 8 has welded thereonto a foam rubber padding 12 along the welded seams 11. The padding consists of a foam rubber web having open pores and a thickness of for example 4 mm. The end portions 5 can be interconnected as shown in FIG. 3 after the supporting hose has been inflated and the side cushions 8 have been turned up. For this purpose, a Velcro-type closure in the form of a strip is fastened each on the upper side of the one end portion and the underside of the other end portion 5. The Velcro-type closure may be welded to said end portions or pasted by means of a synthetic adhesive.

To make use of the supporting means in accordance with the invention, the shank of the patient is placed onto the center cushion 7. Thereupon, the hose is inflated, i.e. by means of a simple air pump. The side cushions 8 are turned-up into the position as shown in FIG. 3. Finally, the end portions 5 are placed atop of one another over the shin-bone and connected by simple pressing together the Velcro-type closure 13. The Velcro-type closure 13 is adjusted such that the supporting means is altogether close to the shank leaving little clearance. The displacement of the compound air cushion composed of three parts in a vertical direction thus is prevented by the two end portions forming a rigid ledge over the shin-bone which prevents the air cushion from performing upward and downward rolling movements. The end portions overlap at the end of the shank support near the foot in a greater extent than at the end near the knee. In order to prevent the projecting hose portion with the plug 10 from obstructing the turning movement of the supporting means and eventually inadvertently opening, the hose portion may be pushed into the side cushion 8.

The supporting means in accordance with the invention may be adapted to the part of the body which is to be protected. Especially the subdivision of the cushions may be changed in such a manner, that, for example, several smaller cushions are provided. The supporting means may also be varied by enlarging or reducing, respectively, the selected arrangement so that it may be used to put at a rest and support the limbs or the body which will be necessary in connection with certain sicknesses. Owing to the fact that the supporting means is formed by an inflated sheet, the formation of pressure points by small creases as generally is the case with the usual cushions, is eliminated. To avoid a pointed foot-position a flap may still be fastened at the supporting means.

The supporting means is of a very light weight and of such an elasticity that also very weakened patients may turn on it in any direction without any additional physical effort being necessary. If a patient turns round in bed, he may also turn the foot in the supporting means. Owing to the fact that the heel is freely suspended, the bone of the foot cannot exert any pressure on the tissue surrounding it thereby ensuring the blood circulation of the foot and preventing the formation of bed-sores.

The device is simple to handle and constructed in such a manner that it is impossible to use the device in a manner other than the proper one. The supporting means in accordance with the invention thus constitutes a device to prevent the formation of bed-sores which will have a favourable effect in the first place on the patient; but it means also a considerable relief to the nursing personnel because nursing activities to treat bed-sores such as massages and embrocations with means enhancing the blood circulation are eliminated.

What we claim is:

1. An inflatable device for supporting the limbs of a bedridden patient to prevent bed-sores comprising, in combination, a flexible tubular, envelope having a longi-

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tudinal length defined by ends, and a transverse width, means defining said envelope into a central inflatable cushion portion and a pair of inflatable cushion end portions, said end portions each being located adjacent an envelope end and said central portion being located intermediate said end portions, means for inflating said inflatable portions, and interconnectible connecting means mounted on said envelope at said ends thereof whereby said envelope may be embracingly disposed about a limb such that the limb is supported upon said central inflated portion, and said inflated side portions redispersed laterally alongside the supported limb and said connecting means maintains said device in an embracing condition upon the limb.

2. In an inflatable device as in claim 1 wherein said envelope is formed of a pair of flexible sheets of material interconnected at their edges, and said means defining said envelope into central and end portions comprises bonding means interconnecting said sheets in a direction transverse to said longitudinal length.

3. In an inflatable device as claim 2 wherein air passages are defined adjacent said bonding means establishing communication between said inflatable portions.

4. In an inflatable device as in claim 3 wherein a soft foam material is affixed to the exterior of one of said sheets, said foam material being disposed adjacent the embraced limb upon interconnection of said connecting means to cushion a limb supported upon said device.

5. An inflatable device for supporting a limb of a bed-

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ridden patient comprising, in combination, a first inflatable cushion chamber defined by flexible sheet members adapted to be inserted beneath the limb to be supported and having oppositely disposed end regions, second inflatable cushion chambers defined by flexible sheet members each having oppositely disposed end regions and an end region of each second chamber being attached to an end region of said first chamber, and connecting means defined upon the unattached end regions of said second chambers for mutual interconnection to maintain said second chambers adjacent the lateral sides of the limb supported.

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