Sept. 29, 1942. C. L. BEAL 2,297,127

PNEUMATIC CUSHION

Original Filed Dec. 10, 1936

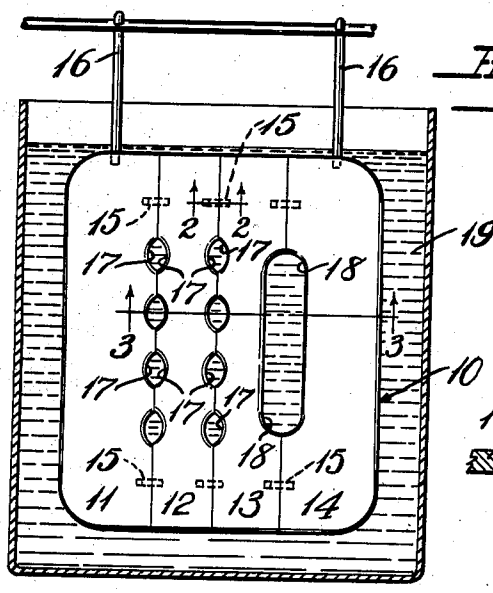


Fig-1

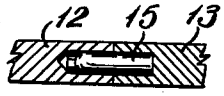


Fig-2

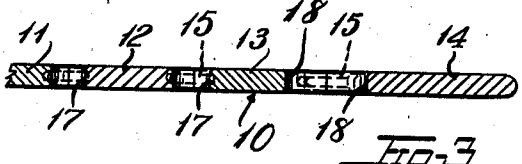


Fig-3

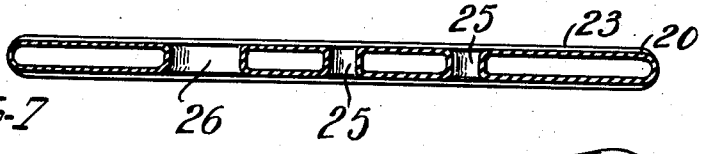


Fig-7

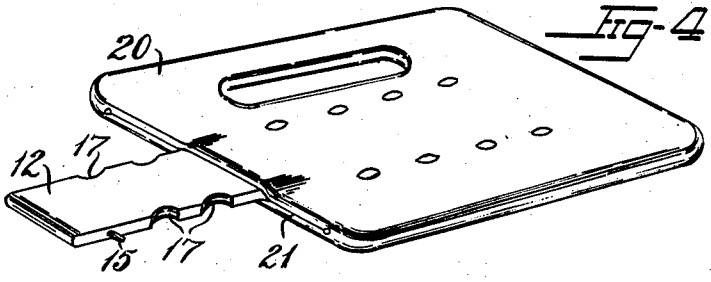


Fig-4

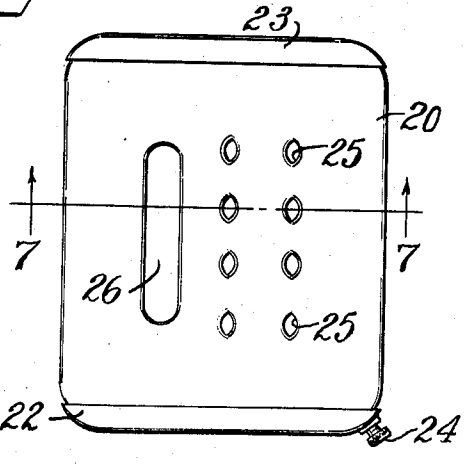


Fig-6

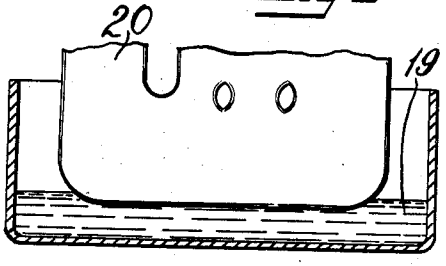


Fig-5

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PNEUMATIC CUSHION

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Original application December 10, 1936, Serial No. 115,240. Divided and this application October 12, 1940, Serial No. 360,926

5 Claims. (Cl. 155—179)

This invention relates to pneumatic cushions, mattresses, and similar inflated or inflatable articles, and has for its principal objects the provision of such pneumatic articles having a novel, light-weight yet adequately strong, integral rubber structure including distension-limiting tubes seamlessly connecting opposite faces of the article and providing apertures for circulation of air or for other purposes; and the provision of simple, economical and efficient procedure for manufacturing such pneumatic articles by deposition of rubber substantially in final form directly from a liquid dispersion of rubber, whereby the characteristic continuous rubber structure produced in such deposition processes may be embodied in the complicated structures of ventilated pneumatic cushions and the like with a complete elimination of seams and reenforcements in the apertured cushioning zone of the article. The manner in which these and other objects of the invention are attained may be readily understood from the following detailed description of a preferred embodiment of the invention as exemplified by the manufacture of an inflatable cushion for an aviator's parachute pack, which must be as light and compact as possible without sacrifice of cushioning qualities, must be ventilated, i. e. must have several apertures to provide for free circulation of air about the cushion, and also must include a relatively large opening to accommodate the straps which attach the cushion to the parachute pack. In the description of the invention, reference will be had to the accompanying drawing, of which

Fig. 1 is a sectional elevation illustrating a step in the process of the present invention and showing an assembled deposition form immersed in a liquid dispersion of rubber;

Fig. 2 is a vertical section taken on line 2—2 of Fig. 1;

Fig. 3 is a vertical section taken on line 3—3 of Fig. 1;

Fig. 4 is a perspective view illustrating a further step in the process and showing a portion of the deposition form being removed from a rubber deposit produced thereon;

Fig. 5 is a sectional elevation illustrating a later step in the process;

Fig. 6 is an elevation showing the finished cushion made according to the present invention; and

Fig. 7 is a vertical section taken on line 7—7 of Fig. 6.

In manufacturing, for example, an aviator's parachute pack cushion, I utilize a deposition form generally designated 10, comprising four complementary aluminum or other metal members 11, 12, 13, and 14 designed to fit together in edge-to-edge mating relation, guided by tight-fitting dowel pins 15, to constitute the generally rectangular planar deposition form 10. The form 10 is provided with supporting pins 16, 16, removably threaded in the top edges of two of the members, preferably the outer two members 11, and 14, for supporting the form with the individual form members in vertical positions so that no complicated locking means is required for holding the members in proper relation, the tight-fitting dowel pins usually being adequate for that purpose. Auxiliary locking means may be provided however, if desired. The mating edges of the form members 11 and 12, and 12 and 13, are provided with a plurality of oppositely disposed semi-elliptical edge indentations 17, 17 which mate in the assembled form 10 to provide two rows of generally elliptical apertures in the form. The mating edges of the form elements 13 and 14 are provided with longer and deeper indentations 18, 18 which mate in the assembled form to provide a rounded-end slot of substantial length designed to provide in the cushion to be produced thereon an opening of suitable size and length for accommodating the parachute pack straps.

In the process, the assembled form 10 is preferably immersed in a liquid dispersion of rubber such as a suitably compounded concentrated natural rubber latex 19, and a deposit of rubber 20 of a desired thickness, for example, about 0.090 inch (when finished) is produced upon the form by any well known procedure, but preferably with aid of a coagulant preliminarily applied to the form together with a pulverulent separating material as described in U. S. Patent No. 1,924,214, granted to Edwin B. Newton, August 29, 1933. In order that the desired tubular connecting links may be formed, the thickness of the rubber deposit 20 should never be sufficiently great to fill the apertures in the deposition form. As indicated above and more particularly in Fig. 7 of the drawings, the deposit 20 ordinarily will be relatively thin as compared with the extent of the apertures.

After the deposited rubber has been washed and dried according to the conventional practice, the supporting pins 16 are removed from the form 10, and a slit 21 is cut along the edge of the rubber deposit between the openings left by the pins. The rubber deposit is stretched enough to permit spreading the form members

sufficiently to free the dowel pins of one of the central form members, such as the member 12, and the free member is removed through the slit. Thereafter, the remaining form members are individually removed in a similar manner. As the tubular rubber connecting links produced in the several apertures in the form prevent more than slight manipulation of the form members within the deposit, care must be exercised to avoid damaging of the rubber deposit by excessive stretching during removal of, especially, the two outside members 11 and 14. To avoid such damage, it may be desirable in some cases partially to vulcanize the rubber before effecting removal of the form, but dried latex rubber, even though unvulcanized, is quite tough and ordinarily will withstand the requisite stretching without damage, and it is therefore preferred not to vulcanize the rubber at this stage so that more perfect adhesion may be secured upon application of a sealing deposit of rubber to the slit edge.

The application of such a sealing deposit of rubber is preferably accomplished (Fig. 5) by immersing the slit edge of the deposit 20 to a depth of about one inch in a liquid dispersion of rubber which may be the compounded latex 19 previously used, and depositing a coating of rubber about 0.045 inch thick (when finished) upon the immersed portion of the main rubber deposit 20 to produce a sealing deposit 22 capping the slit end of the main deposit. For symmetry of appearance, and also to provide reenforcement, a similar capping deposit of rubber 23 may be produced upon the opposite edge of the main deposit as more clearly shown in Fig. 6. Finally a conventional valve 24 is inserted in a corner edge of the deposit, and the assembled article is vulcanized in any usual manner, as in a hot air oven, the article retaining its proper shape without the use of molds or the like by reason of the low temperature coefficient of plasticity of unmasticated latex rubber deposited directly from liquid rubber latex.

The finished cushion illustrated in Fig. 6 is therefore seen to consist of a generally rectangular hollow body 20 provided with ventilating apertures 25, 25 and a strap-receiving aperture 26 extending through the body of the cushion. The walls throughout the cushioning zone including the apertures are of substantially uniform thickness and are entirely free of seams and seam-reenforcing strips which have been required in prior products with consequent undesirable stiffening of the structure and impairment of cushioning qualities as well as an undesirable increase in weight. The cushion embodies substantially throughout the characteristic tough, strong, continuous rubber structure produced only when rubber is deposited in final form directly from a liquid dispersion of rubber. The present invention accordingly provides a generally more satisfactory ventilated cushion of simple and durable construction, and provides procedure for manufacturing such pneumatic cushions in an economical and efficient manner not possible in prior methods.

The term "liquid dispersion of rubber" has been used in the specification and claims in a broad sense to include all flowable dispersions of rubber and analogous natural or synthetic materials in liquid vehicles, whether solvents or non-solvents of rubber, and including artificially prepared aqueous dispersions, and solvent dispersions such as the so-called "rubber cements" as well as the natural rubber latex hereinabove specifically mentioned. All such dispersions may be compounded, uncompounded, vulcanized, unvulcanized, thickened, thinned, concentrated, diluted, stabilized, or otherwise prepared for use according to known procedures, and may contain any desirable added compounding or conditioning agents.

While the invention has been described in considerable detail with reference to certain preferred procedures, apparatus, and materials as applied to the manufacture of an aviator's cushion, it is obvious that numerous modifications and variations therein are possible, and that the principles of the invention may be applied to the manufacture of other pneumatic articles including mattresses, chair cushions, invalid cushions, and the like as well as other rubber articles designed for a variety of uses. All such modifications and variations are included within the spirit and scope of the invention as defined by the appended claims.

This application is a division of my co-pending application Serial No. 115,240, filed December 10, 1936, which now has matured into U. S. Patent No. 2,272,289, granted February 10, 1942.

I claim:

1. A pneumatic cushion or the like comprising an inflatable hollow rubber body having opposed walls thereof connected by an integral tubular member comprising transversely extending continuations of the walls defining a transverse opening through the body, the rubber constituting the said tubular member being structurally a seamless continuation of the rubber constituting the said walls and all the rubber of said tubular member and of the walls in the region surrounding the tubular member having a substantially uniform thickness.

2. A pneumatic cushion or the like comprising a pair of opposed sheet rubber walls joined along their perimeters to provide an inflatable hollow body, and a sealing deposit of rubber capping a portion of the joined perimeters, the said opposed walls being connected, within the perimeters, by an integral tubular member comprising transversely extending continuations of the walls defining a transverse opening through the body, the rubber constituting the said tubular member being structurally a seamless continuation of the rubber constituting the said walls and all the rubber of said tubular member and of the walls in the region surrounding the tubular member having a substantially uniform thickness.

3. In an inflatable cushion, a pair of opposed sheet rubber walls joined along their perimeters to provide an inflatable body, a plurality of tubular members comprising transversely extending continuations of the said walls connecting the walls within the perimeters and defining a plurality of transverse openings through the cushion including a ventilating opening and a strap-receiving opening, the rubber constituting the said tubular members being structurally continuous with the rubber constituting the said walls, and all the rubber of said tubular members and of the walls in the region including and surrounding the tubular members having a substantially uniform thickness.

4. A hollow rubber article including a pair of walls disposed in generally opposed spaced-apart relation and a tubular member connecting the opposed walls together and providing an aperture through the article, the rubber constituting the said tubular member being structurally a

seamless continuation of the rubber constituting the said walls and all the rubber of said tubular member and of the walls in the region surrounding the tubular member having a substantially uniform thickness.

5. A bag-like hollow rubber article including a pair of walls disposed in generally opposed spaced-apart relation and a plurality of tubular members connecting the opposed walls together and providing a plurality of apertures through the article, a substantial portion of the article including all the said tubular members and all the said walls in the region of the tubular members having a one-piece seamless rubber structure, the rubber of the tubular members being a seamless continuation of the rubber constituting the said walls and all the aforesaid rubber portions having a substantially uniform thickness.

CARL L. BEAL.