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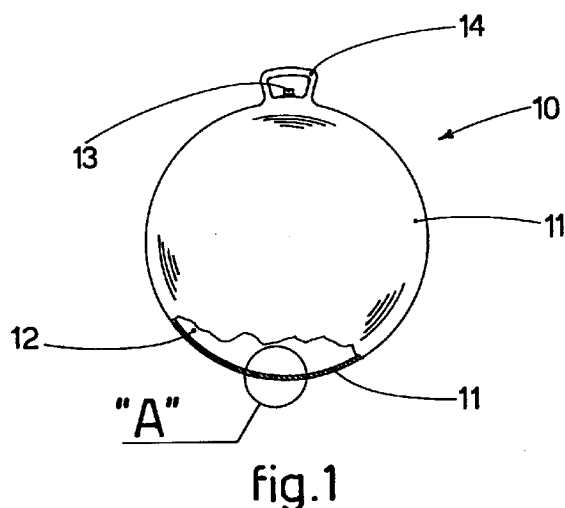
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(54) **Non-burstable ball for psychomotor exercises and relative method of production**

(57) Non-burstable ball for psychomotor exercises relating to sporting, recreational and/or therapeutic activities, the ball being of the pre-inflated or inflatable type and comprising at least a casing made of plastic film of a substantially spherical shape defining an inner chamber (12) filled with air under pressure, at least part of the casing (11) being made of PVC (polyvinyl chloride) with a cellular structure made by means of incorporating microcells (15) of air over at least part of its thickness.

Method to produce non-burstable balls for psychomotor exercises relating to sporting, recreational and/or therapeutic activities, the balls being of the pre-inflated or inflatable type and comprising at least a casing made of plastic film of a substantially spherical shape defining an inner chamber (12) filled with air under pressure, the casing (11) being obtained by mixing basic vinyl resins of the emulsion type, in suspension or in microsuspension, with plasticising and stabilising additives and with expansion agents which have the effect of cellularising the PVC, the mixture being then heated and subjected to shaping and forming.



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Description

This invention concerns a non-burstable ball for psychomotor exercises and the relative method of production as set forth in the respective main claims.

The term "ball for psychomotor exercises" means any kind of ball of a diameter of between 20cm and 200cm used for sporting and/or recreational and/or therapeutic activities.

The state of the art includes balls for psychomotor exercises used for sporting, recreational and therapeutic activities and made of plastic material, with different shapes and sizes according to their use.

The balls consist of a casing made of plastic film, normally PVC, to which the appropriate stabilising and plasticising agents have been added, and into which air under pressure is injected.

One considerable problem with this type of ball is that there is a danger that it may burst.

For when the casing is scratched or slit, even only slightly, because the casing is not very thick, the inner pressure of the air and/or the stresses to which the ball is subjected during use can cause the ball to burst, and may cause the user to fall.

Due to the inner pressure of the air, the impact and/or the compression, even a small scratch or slit tends to expand rapidly and causes the ball to burst.

This problem is particularly serious when the ball is large, of the type used for recreational or therapeutic activities, on which the user sits or partially lies.

US-A-4.169.594 discloses a ball with a casing made of two or more layers glued or welded together, the outer layer being made of PVC and the inner layer of plastic components with greater hardness and strength.

However this solution makes the ball less elastic and therefore less able to bounce; it also lengthens the production process and increases costs.

DE-44.34.889 describes a ball with a PVC casing including distributed areas of reinforcement consisting of fragments of hard plastic film. In this solution the structure of the casing is not homogeneous and this means that the ball does not bounce regularly.

The inclusion of reinforcing materials which are harder than PVC makes the outer surface of the ball more slippery.

Moreover, in its inner thickness the casing has ridges and depressions which limit the rolling properties of the ball.

Furthermore, the composition of the casing causes the ball to become oval under pressure, which is particularly disadvantageous in particular applications of the ball.

The present applicant has designed, tested and embodied this invention to overcome the shortcomings of the state of the art and achieve further advantages.

The invention is set forth and characterised in the respective main claims, while the dependent claims describe variants of the idea of the main embodiment.

The purpose of the invention is to obtain a ball for psychomotor exercises, inflatable or pre-inflated, which, in the event that the casing is holed or damaged, deflates progressively, without bursting.

A further purpose of the invention is to obtain a ball which retains its elasticity, its bounce, its ability to roll and its non-slip property unchanged, and a ball wherein these properties can be differentiated according to the specific requirements of use.

The ball according to the invention has a casing made at least partially of cellular PVC, that is, PVC which incorporates into its structural composition a plurality of air cells or air vacuums.

In a first embodiment, the PVC is cellularised by mixing the basic components of the PVC with expansion agents which evaporate, under certain conditions of temperature and pressure, during the step when the casing is formed.

According to another embodiment, the cellularisation of the PVC is caused by chemical reactions of the basic substances which compose the PVC.

According to yet another embodiment, the cellularisation of the PVC is obtained by blowing in air or gas under pressure during the step when the PVC is formed.

The cellular structure of the casing of the ball according to the invention, which is substantially defined by air vacuums distributed over the thickness of the casing, prevents the ball from bursting in the event of damage or holes.

The violent expansion of any tears caused by the damage or holes is prevented because it is contained inside areas which are limited at the periphery by the cells of the casing itself; in fact, the inner pressure which might tend to cause the ball to burst is absorbed by these cells or air vacuums.

The ball's features of elasticity, rolling and bounce are kept substantially unchanged in that the elements added to cellularise the PVC are no harder than normal PVC.

These characteristics moreover can be modified according to necessity by adapting the percentage composition of the vinyl resins and/or the composition additives of the basic PVC.

According to a variant, the casing of the ball according to the invention has a cellular structure diversified in thickness.

According to this variant, the PVC is cellularised only in the inner part of the casing, the outer part consisting of a layer of normal PVC.

In this way it is possible to obtain a ball with a smooth, compact and strong outer surface, yet without changing the characteristics which prevent it from bursting in the event of damage or holes.

The attached figures are given as a non-restrictive example and show some preferred embodiments of the invention as follows:

Fig. 1 shows partly in section a non-burstable ball for psychomotor exercises according to the invention;

Fig. 2 shows the detail "A" from Fig. 1;

Fig. 3 shows a variant of Fig. 2;

Fig. 4 shows the block diagram of the method of production of the non-burstable ball according to the invention.

The non-burstable ball 10 shown in the Figures is the type used for recreational and/or gymnastic and/or therapeutic activities on which the user sits or partly lies.

The non-burstable ball 10 according to the invention substantially consists of a casing 11 defining an inner chamber 12 which is filled with compressed air through the inflation valve 13.

In this case, to give an example, the non-burstable ball 10 has a gripping handle 14, but this is not restrictive since the preferred use of the non-burstable ball 10 is without the handle 14.

In this case, the casing 11 is made of cellular PVC to which have been added plasticising and stabilising additives which give the desired physical and mechanical characteristics.

The cellular structure of the PVC is obtained according to the method shown in Fig. 4, that is, by mixing the basic components, consisting of vinyl resins in emulsion or in suspension or in microsuspension, and plasticising and stabilising substances, with cellulising additives in granular form.

During the heating step which follows the mixing of the components, the cellulising additives evaporate due to the effect of the heat and the pressure, causing the formation of microcells of air 15 incorporated in the structure of the basic PVC.

The cellular PVC thus obtained is then subjected to shaping and forming, in order to obtain the desired shape of the casing 11.

In a preferred embodiment of the invention, plasticising substances are added to the basic material for the composition of the casing 11; these substances are introduced in quantities of between 30% and 120% of the quantity of vinyl resins used and with an epoxy co-stabiliser in quantities of between 0.5% and 5% of the quantity of the vinyl resins.

The cellulising additives are introduced in quantities of between 0.1% and 4% of the quantities of vinyl resins used; the granulometry of the cellulising additives is between 1 µm and 80 µm.

During the heating step, the mixture is brought to a temperature of between 120°C and 220°C.

According to a further embodiment, the microcells 15 are formed as a result of chemical reactions which are generated between the basic material and the various additives or between the various additives themselves.

According to yet another embodiment, the cellular

structure of the PVC is obtained by mixing gas or air blown under pressure and at a low temperature into the starting products, either fluid or reactive, for example by mixing CO₂ during the step when the PVC is formed; during the heating step these gases expand and cause the formation of microcells 15.

Thanks to the at least partly cellular structure of the PVC of which the casing 11 consists, in the event of scratches, cuts or holes in the casing 11, the ball 10 does not burst, but deflates progressively.

The expansion of any lesions formed as a consequence of any damage to the casing 11 is contained inside a "containment zone", limited by the microcells 15 which absorb the inner pressure and prevent the tear from spreading either on the surface or through the thickness of the casing 11.

Fig. 3 shows a variant of the casing 11 which has only a partially cellular structure. To be more exact, the casing 11 has a single layer and comprises an inner part 11a made of cellular PVC and an outer part 11b made of simple PVC.

This solution makes it possible to obtain an outer surface of the casing 11 which is substantially compact and homogeneous, therefore able to run more smoothly, yet at the same time keeping a cellular structure which defines the non-burstable property of the ball 10.

According to another variant, the cellularisation of the PVC concerns only a part of the casing 11, for example the lower semi-circumference.

According to yet another variant, the cellularisation of the PVC is more accentuated in correspondence with the lower semi-circumference and less accentuated in correspondence with the upper semi-circumference.

Claims

1. Non-burstable ball for psychomotor exercises relating to sporting, recreational and/or therapeutic activities, the ball being of the pre-inflated or inflatable type and comprising at least a casing made of plastic film of a substantially spherical shape defining an inner chamber (12) filled with air under pressure, the ball being characterised in that at least part of the casing (11) is made of PVC (polyvinyl chloride) with a cellular structure made by means of incorporating microcells (15) of air over at least part of its thickness.
2. Non-burstable ball as in Claim 1, in which the casing (11) includes an inner layer (11a) made of cellular PVC and an outer layer (11b) made of normal PVC.
3. Non-burstable ball as in Claim 1 or 2, in which at least the lower semi-circumference of the casing (11) is made of cellular PVC.

4. Method to produce non-burstable balls for psychomotor exercises relating to sporting, recreational and/or therapeutic activities, the balls being of the pre-inflated or inflatable type and comprising at least a casing made of plastic film of a substantially spherical shape defining an inner chamber (12) filled with air under pressure, the method being characterised in that the casing (11) is obtained by mixing basic vinyl resins of the emulsion type, in suspension or in microsuspension, with plasticising and stabilising additives and with expansion agents which have the effect of cellularising the PVC, the mixture being then heated and subjected to shaping and forming. 5% of the quantity of vinyl resins. 5 10 15
5. Method as in Claim 4, in which the PVC is cellularised during the step when the mixture is heated as a result of the evaporation of the expansion agents through heat adduction, the expansion agents consisting of cellulising additives of a granular type. 20
6. Method as in Claim 5, in which the cellulising additives of the granular type are present to a quantity of between 0.1% and 4% of the quantity of vinyl resins. 25
7. Method as in Claim 5 or 6, in which the cellulising additives of the granular type have a granulometry of between 1µm and 80µm. 30
8. Method as in Claim 4, in which the PVC is cellularised during the step when the mixture is heated due to the expansion and subsequent gelling of the expansion agents consisting of gases blown in under pressure and at low temperature while the PVC is forming. 35
9. Method as in Claim 4, in which the PVC is cellularised during the mixing step due to the liberation of expansion agents deriving from chemical reactions of the basic components and/or the plasticising and stabilising additives. 40
10. Method as in any claim from 4 to 9 inclusive, in which the mixture of cellular PVC is heated at a temperature of between 120°C and 220°C. 45
11. Method as in any claim from 4 to 10 inclusive, in which the plasticising additives are present to a quantity of between 30% and 120% of the quantity of vinyl resins. 50
12. Method as in any claim from 4 to 11 inclusive, in which the stabilising additives consist of at least an epoxy costabiliser. 55
13. Method as in Claim 12, in which the epoxy co-stabiliser is present to a quantity of between 0.5% and

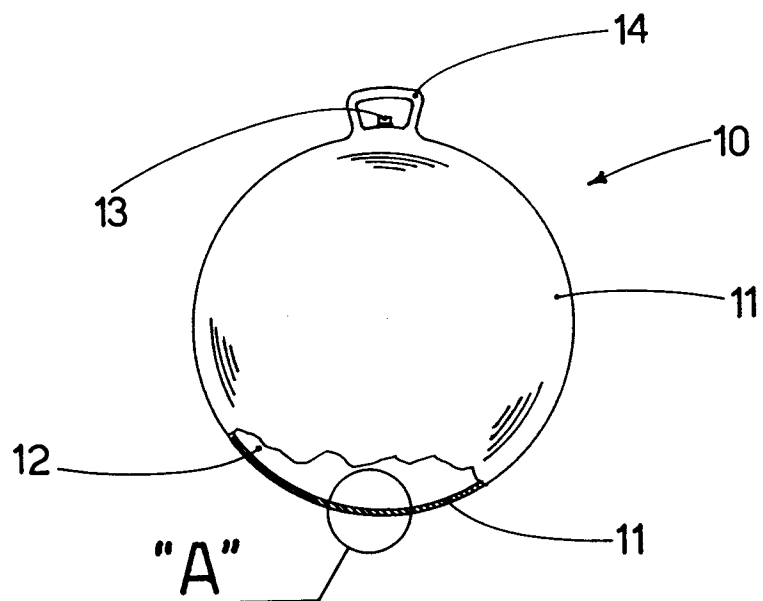


fig.1

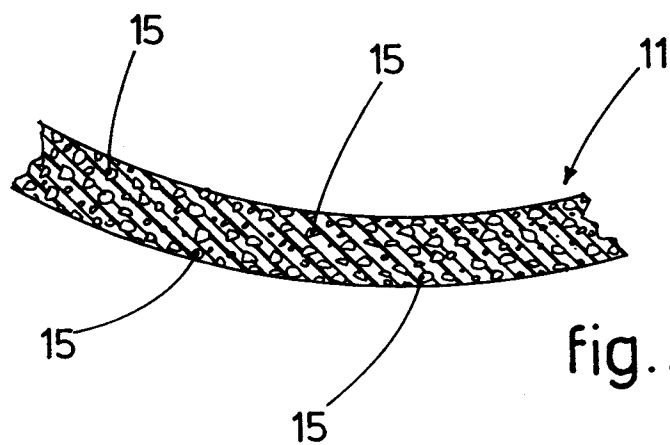


fig.2 ("A")

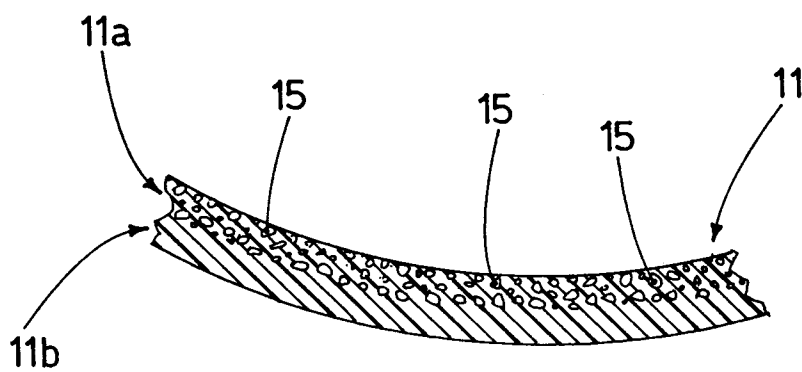


fig.3 ("A")

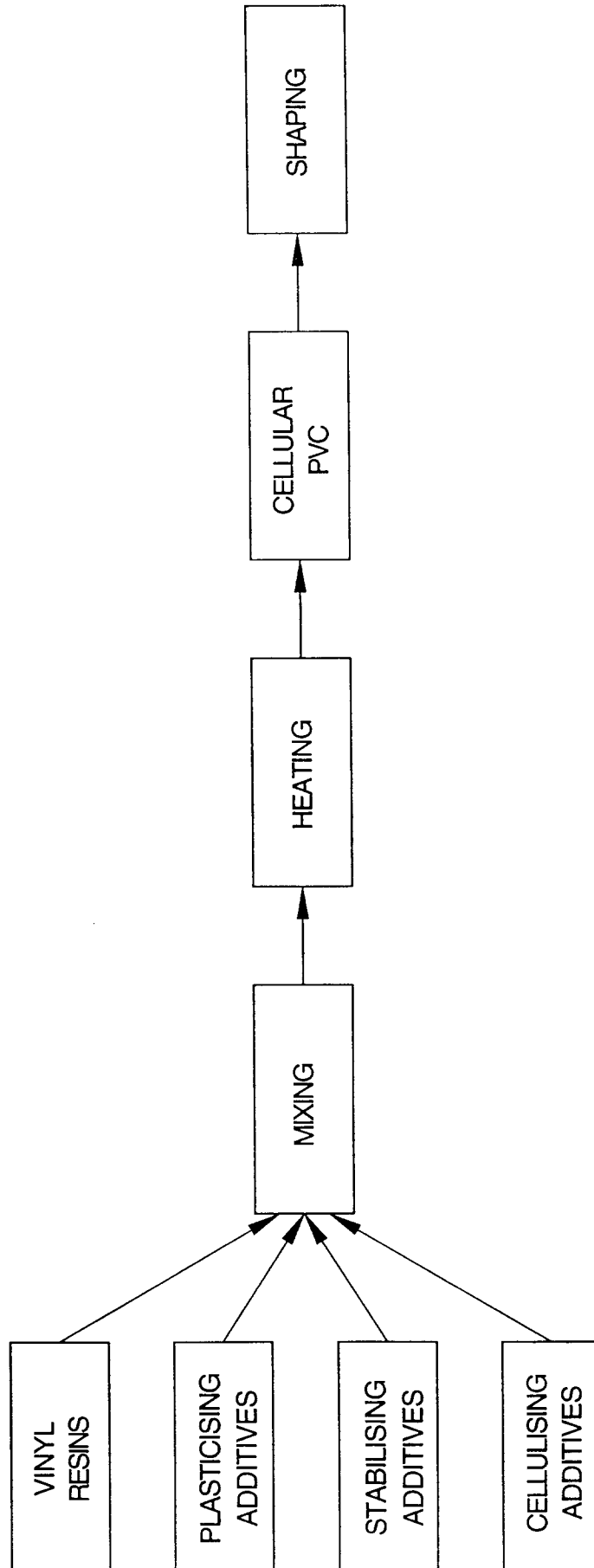


fig. 4