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POLYVINYL CHLORIDE RESIN COMPOSITION CLOSELY SIMULATING A GRASS PLAYING SURFACE IN ITS BOUNCE CHARACTERISTICS

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18 Claims

ABSTRACT OF THE DISCLOSURE

A synthetic pitch or field for cricket, tennis, and like ball games is provided, which, in contrast to previous proposed pitches, closely simulates grass, particularly in its bounce characteristics, especially for spinning balls. The synthetic pitch or field contains 25% to 75% of plasticized polyvinyl chloride material, 5% to 20% of a finely divided fibrous material, 0% to 20% of a natural or synthetic rubber, preferably a nitrile rubber, and 10% to 60% of a finely divided, preferably low density filler, for example chalk and clay, and may also contain a green pigment.

The invention relates to improvements in or relating to synthetic pitches or fields for cricket, tennis and like ball games and to methods of manufacturing such pitches or fields.

Synthetic pitches or fields have been made from various materials, particularly woven and non-woven fibrous materials. These materials have been found suitable for games in which the bounce of the ball is relatively unimportant. Such surfaces used hitherto have not always proved entirely suitable, and not having, in many cases, bounce characteristics, particularly in relation to spinning balls, sufficiently close to that of natural grass. In other cases solid materials have been employed, for example wood, but such materials is only satisfactory, on the ground of expense, for games in which there is relatively small pitch or field, for example tennis. Such solid materials also have the disadvantage that the bounce characteristics are not always sufficiently close to that of grass. For these reasons, such surfaces as have been generally employed hitherto have not proved entirely satisfactory for winter practice in preparation for summer activities. In games such as cricket, the balls tend to bounce on a relatively small area of the pitch or field, which small area tends to wear, while the remainder of the surface of the pitch or field is relatively unworn. The pitch or field then would need to be discarded, while the majority of the surface thereof would still be useable.

The present invention provides a pitch or field which has bounce characteristics closer to that of natural grass than those pitches or fields of an equivalent cost hitherto employed, particularly in relation to the bounce characteristics of spinning balls and for fast and medium bowling in cricket. The pitch or field of the present invention may easily be made in parts which can be interchanged so that the whole area of the pitch or field can be made to wear evenly, and the pitch or field can be removed for temporary storage. The pitches or fields of the present invention do not normally need to be bonded to the surface on which they are placed but can be placed on a flat surface. They have the further advantage that they require no maintenance.

In use, the pitches or fields remain true, with no bad bounces, and do not normally reflect light to such an extent that gives rise to an unacceptable amount of glare. The pitches or fields are resilient and certain types of boots or shoes with studs can be worn without causing serious damage.

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Accordingly, the invention comprises a synthetic pitch or field for cricket, tennis and like ball games containing 25% to 75% of plasticized polyvinyl chloride, 5% to 20% of a finely divided fibrous material, 0% to 20% of a natural or synthetic rubber compatible with the plasticized polyvinyl chloride, and 10% to 60% of a finely divided particulate filler, all parts being by weight of the total weight of the composition.

Any conventional polyvinyl chloride may be employed in the present invention. Copolymers of vinyl chloride with other monomers, which copolymers have physical properties similar to that of conventional polyvinyl chloride, and desirably contain at least 70 mole percent, preferably at least 80 mole percent, of vinyl chloride monomer, may also be employed. Mixtures of the copolymers with homopolymer may be employed. Suitable comonomers that may be employed include vinylidene dichloride and vinyl acetate.

Any suitable conventional plasticizer for polyvinyl chloride may be employed to plasticize the polyvinyl chloride. Suitable plasticizers that may be employed include was conventional, preferably liquid, ester plasticizers, including the diesters of aliphatic and aromatic dicarboxylic acids, for example the phthalic acids, succinic acid, adipic acid, azelic acid, suberic acid, sebacic acid and homologues thereof and mixtures of such acids. The esters may be of aromatic alcohols, or of straight or branched chain alkanols, for example butanol, 2-ethylhexanol, 3,5,5-trimethylhexanol, heptanol, decanol, dodecanol, various branched and straight chain tridecanols and benzyl alcohol. Other types of plasticizers that may be employed include the alkyl phosphates, particularly the trialkyl and triaryl phosphates.

Low molecular weight substantially straight chain polymers may also be employed, for example polyesters having molecular weights of between about 700 and about 2000, derivable, for example, from the reaction of dicarboxylic acids with diols. Suitable dicarboxylic acids include those listed above; suitable diols include ethylene glycol, propylene glycol, butan-1,4-diol, butan-2,3-diol and 2,2-dimethylpropan-1,3-diol. Suitable polyester plasticizers include also those derivable by the reaction of a monohydroxymonocarboxylic acid, for example 6-hydroxycaproic acid. Polymeric esters are preferably terminated by a non-reactive group, for example by the introduction of a monohydroxyalcohol. Other types of plasticizer include epoxidized esters for example oleate esters and soya bean oil, and those based on trimellitic acid or on pentaerythritol.

Examples of the aforementioned types of plasticizers include di-n-butyl phthalate, di-2-ethylhexyl terephthalate, di-iso-octyl phthalate, didodecyl phthalate, butyl benzyl phthalate, di-iso-butyl adipate, di-n-octyl sebacate, the diazolate of mixed straight chain cuts of C₉ to C₁₁ alkanols, butylene phthalate polyester, ethylene terephthalate polyester, propylene adipate polyester, polycaprolactone, epoxidized octyl oleate, and trixylyl phosphate.

Any convenient ratio of plasticizers to polyvinyl chloride may be employed in order to ensure that, under the conditions under which it is proposed to use the pitch or field, the pitch or field will be sufficiently flexible. As a guide, a proportion of less than 2 parts polyvinyl chloride to 1 part of plasticizer will often be convenient, and a ratio of about 1 is preferred.

Any suitable fibre may be employed in the present invention. Such suitable fibres are, in general, organic fibres, either natural or synthetic, for example cotton, cellulose, polyamide and polyester fibres. By "finely divided fibrous material" it is meant that the fibres should desirably have a length of less than about 15 mm. and preferably less than 10 mm. It will be understood, how-

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ever, that a portion of the fibres, preferably less than 25%, may be longer than 15 mm., but such a portion are preferably shorter than about 25 mm. The fibres may be compounded in a mixture with the polyvinyl chloride material, as, for example, is the case if the source of the fibres is shredded or comminuted conveyor belting or oil-cloth or the like, or the fibres may be added separately, for example as a floc.

Any finely divided particulate filler may be employed for the pitches or fields of the present invention, but it is preferred to use fillers having a relatively low density, for example finely divided chalk, clay and like minerals. Desirably the quantity of filler employer is less than 50% and a preferred quantity of filler is between 20% and 40% by weight.

Any natural or synthetic rubber may be employed in the present invention, provided that it is compatible with the polyvinyl chloride material in the quantity employed. Suitable rubbers include chloroprene rubbers, isoprene rubbers, buna rubbers, styrene-butadiene rubbers, ethylene-propylene rubbers, acrylonitrile-butadiene-styrene rubbers and chlorosulphonated polyethylene rubbers. Preferred rubbers are nitrile rubbers which are copolymers of acrylonitrile with butadiene or isoprene or similar dienes. It is believed that the amount and nature of the bounce obtained will vary with the amount of the rubber present and the type of rubber present. Accordingly, the amount and type of rubber may be varied in order more accurately to reproduce the bounce characteristics of the grass surface it is intended to simulate. A preferred amount of rubber is between 3% to 10%.

The synthetic pitch or field may contain a pigment, preferably green to simulate grass. The synthetic pitch or field may contain conventional lubricants, stabilizers and processing aids.

The pitch or field may be compounded by mixing the constituents in a conventional way at an elevated temperature, for example between about 120° C. and 160° C., in a Banbury mixer. The pitch or field may then be formed by extrusion through a roller die to produce a smooth synthetic pitch or field. Alternatively the pitch or field may be compression moulded. The synthetic pitch or field may, advantageously, be of such a thickness that it can be cut into pieces, the edges of which can abut one another so that, when lying on a smooth surface, a smooth pitch or field is formed. The individual pieces may be interchanged in order, as described, to facilitate the even wear of the pitch or field. A suitable thickness of the synthetic pitch or field is between 2 mm. and 15 mm., about 5 mm. being preferred.

Typical compositions for synthetic pitches or fields are set out in Tables 1 to 5 below. In each case the pitch or field may be manufactured by compounding the constituents in a Banbury mixer at a suitable temperature so that a homogeneous mixture is formed. The homogeneous mixture may be extruded through a roller die to form a sheet. Testing is carried out empirically.

TABLE 1

Unplasticized polyvinyl chloride	29
Dialphanol phthalate plasticizer	21
Finely divided polyester fibres	7
Acrylonitrile-butadiene rubber	5
China clay	33
Pigmentary titanium dioxide	1
Calcium stearate	2
Green pigment	2

TABLE 2

Unplasticized polyvinyl chloride	25
Dialphanol phthalate plasticizer	17
Shredded conveyor belting	15
Acrylonitrile-butadiene rubber	5
Whiting (coated chalk)	34
Calcium stearate	2
Green pigment	2

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TABLE 3

Unplasticized vinyl chloride/vinyl acetate copolymer (15% vinyl acetate)	20
Dialphanol phthalate plasticizer	17
Acrylonitrile-butadiene rubber	5
Shredded conveyor belting	15
Whiting	34
Calcium stearate	2
Green pigment	2
Extender (chlorinated paraffins containing 42% chlorine)	5

TABLE 4

Plasticized polyvinyl chloride (40% plasticizer)	47
Finely divided cotton fibres	10
Nitrile rubber	5
Chalk Filler	34
Green pigment	2
Lubricants and stabilizers	2

TABLE 5

Unplasticized polyvinyl chloride	26
Commercial dioctyl phthalate plasticizer	18
Commercial dioctyl adipate plasticizer	2
Styrene-butadiene rubber	10
Polymer mix comprising 70% nitrile rubber (34% acrylonitrile, 66% butadiene) and 30% unplasticized polyvinyl chloride	10
Asbestos fibres	7
Whiting	23
Calcium stearate	2
Green pigment	2

The shredded conveyor belt contains about 50% fibres, mostly polyester, 25% polyvinyl chloride and 25% liquid polyester plasticizers. The conveyor belt is shredded or comminuted in a Z-blade mixer, to a size mostly less than about 10 mm. The "alphanol" is a mixed C-alkylated alcohol, a cut of about C₇ to C₉ being used.

We claim:

1. A composition closely simulating a grass playing surface in its bounce characteristics useful as the pitch or field for cricket, tennis and like ball games in which games a spinning ball bounces on a grass playing surface said pitch or field containing 25% to 75% of a plasticized polyvinyl chloride material comprising polyvinyl chloride material and plasticizer wherein the proportion of plasticizer to polyvinyl chloride material is greater than 1 to 2, 5% to 20% of a finely divided fibrous material, 3% to 10% of a natural or synthetic rubber, compatible with the plasticized polyvinyl chloride material in the quantity employed, and 20% to 40% of a finely divided particulate filler all parts being by weight of the total of the total weight of the composition.

2. The composition of claim 1 wherein the polyvinyl chloride material is a copolymer of vinyl chloride with a comonomer, said copolymer containing at least 70 mole percent of vinyl chloride monomer.

3. The composition of claim 2 wherein the comonomer is vinylidene chloride or vinyl acetate.

4. The composition of claim 1 wherein the polyvinyl chloride material is a homopolymer of vinyl chloride.

5. The composition of claim 1 wherein the synthetic rubber is a chloroprene rubber, a styrene-butadiene rubber, an ethylene-propylene rubber, an acrylonitrile-butadiene rubber, or an acrylonitrile-butadiene-styrene rubber.

6. The composition of claim 1 wherein the polyvinyl chloride material is plasticized with a liquid ester plasticizer.

7. The composition of claim 6 wherein the liquid ester plasticizer is a monomeric dialkyl ester of a dicarboxylic acid.

8. The composition of claim 7 wherein the dicarboxylic acid is a phthalic acid, succinic acid, adipic acid, azelic acid, suberic acid, sebacic acid or a mixture thereof.

9. The composition of claim 8 wherein the alkyl group is derived from a straight or branched chain alkanol selected from butanol, 2-ethylhexanol, 3,5,5-trimethylhexanol, heptanols, decanols, dodecanols and tridecanols.

10. The composition of claim 6 wherein the ester is a triphosphate.

11. The composition of claim 6 wherein the ester is a substantially straight chain polyester having a molecular weight of between about 700 and about 2000.

12. The composition of claim 1 wherein the filler is chalk or clay.

13. The composition of claim 1 wherein the finely divided fibrous material comprises fibers having a mean length of less than about 15 mm.

14. The composition of claim 13 wherein less than 25% of fibers have a length between 15 mm. and 25 mm.

15. The composition of claim 14 wherein the fibrous material is an organic fibrous material.

16. The composition of claim 15 wherein the organic fibrous material is cotton cellulose polyester or polyamide.

17. The composition of claim 1 including also a green pigment.

18. The composition of claim 17 comprising:

	Percent
Unplasticized polyvinyl chloride	About 29
Dialkylated alcohol phthalate plasticizer containing 7-9 carbon atoms	About 21
Finely divided polyester fibers	About 7
Acrylonitrile-butadiene rubber	About 5
China clay	About 33
Pigmentary titanium dioxide	About 1
Calcium stearate	About 2
Green pigment	About 2

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