

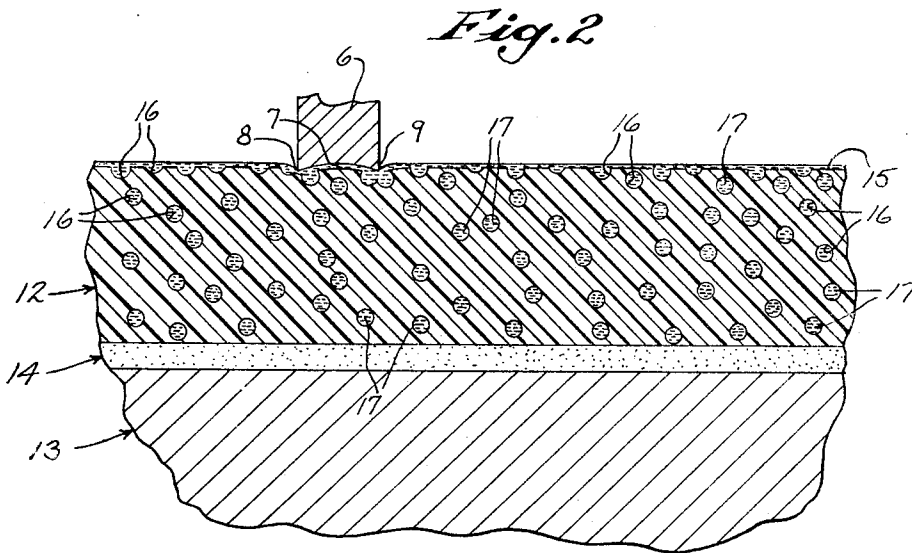
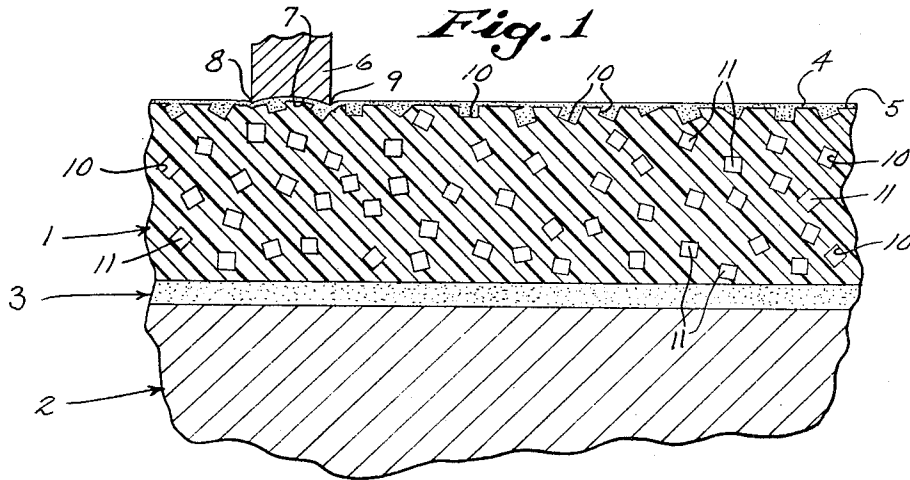
April 28, 1970

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3,508,945

ARTIFICIAL SKATING SURFACE

Filed Sept. 28, 1967



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3,508,945

ARTIFICIAL SKATING SURFACE

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Filed Sept. 28, 1967, Ser. No. 671,458

Int. Cl. B44c 1/20, 1/22, 5/00

U.S. Cl. 117—8

8 Claims

ABSTRACT OF THE DISCLOSURE

In both embodiments, sheets are cemented to a backing board. The vinyl sheets have cavities dispersed throughout. In the first embodiment, the cavities are created by suspended salt crystals that can be washed away to leave lubricant reservoirs as the vinyl wears. In the second embodiment, droplets of silicone oil are suspended in the vinyl to be released as lubricant as the vinyl wears.

BACKGROUND OF THE INVENTION

To make ice skating the increasingly popular entertainment spectacle it has become, expensive bulky ice making machinery has been required to make indoor rinks. To achieve the perfection required of ice skating in competitive sports and to provide a sufficiently long season to interest amateur participants, ice skating had to be released from the vagaries of weather, the confinement of climate and the limitation of seasons. Until now, this could only be accomplished with indoor rinks having the tremendous investment of space and money in artificial ice making machinery. To realize the potential of ice skating as a popular participating sport and for night club type entertaining, a less expensive, less bulky and more portable skating surface has long been needed and sought for.

All sorts of materials have been tried in an effort to make a suitable skating surface, but until the present invention none has come sufficiently close to the properties of ice to make them usable. An early Patent No. 2,057,906 described a wax surface for skating. Linoleum was also tried, and while it provided good glide, it was too soft and would not withstand the wear and tear of skating. A type of muck ice was tried using a soda mixture over wood, but this was too slow. Even slate was tried without success. Ice skating movies have been made employing some type of plastic with two inches of black oil over it, but aside from the lack of durability of the plastic the disadvantages of such an arrangement are obvious. An ice skating company worked extensively on the use of Teflon with a lubricant, but the Teflon chipped apart and had to be nailed back together between performances. Also, Teflon provided almost no glide so that, but for the artistry of the skaters, the performance would have been mere walking. Such a slow surface not only limits the possible skating maneuvers but requires great skill and is extremely tiring. A number of different substitutes for snow have also been provided for skiers, but the requirements of skiing are so entirely different from those of ice skating that the knowledge thus obtained is of no help. An early Patent No. 2,057,906 describes the use of hard wax.

SUMMARY OF THE INVENTION

The present invention is an artificial ice skating surface made of a sheet of polymeric material that has a plurality of cavities in its upper surface that serve as reservoirs for lubricant, and a film of lubricant spread over the upper surface of the sheet of polymeric material sub-

stantially filling such cavities. Preferably, a plurality of cavities are dispersed throughout the sheet of polymeric material and the lubricant substantially fills such of said cavities as open through the upper surface of the sheet of polymeric material.

The sheet of polymeric material mentioned above may be a laminate. Commonly, the sheet of polymeric material will be cemented or otherwise mounted on a rigid backing material, such as a fiberboard, plywood or other suitable materials for support. This combination provides a rugged, lightweight, inexpensive substitute for ice that can very closely approximate the skating characteristics of ice.

The cavities in the upper surface provides a roughened surface which will readily hold the edge of a skate. In the preferred form in which the cavities are dispersed throughout the sheet, the surface texture remains uniform as the material wears from use because of successively lower cavities being opened to the upper surface as higher ones are worn away. It has been found essential that the lubricant wet the surface if adequate glide is to be provided, and glide is essential to skating. The cavities serve not only to roughen the surface, but also to hold the lubricant to insure that there will always be adequate lubricant uniformly spread over the surface. While properly conditioned ice at the optimum temperature still remains unequalled as a skating surface, the present invention provides the first artificial skating surface that approximates ice closely enough to be capable of popular, as well as professional, use. Moreover, it is inexpensive, easy to install and light enough to be portable.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a side elevation in section of a segment of an artificial ice skating surface embodying the present invention showing the surface material, a portion of an ice skate blade engaging the surface and the backing for the surface.

FIG. 2 is a similar side elevation in section of a second embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The segment of the embodiment in FIG. 1 illustrates a sheet 1 of polymeric material cemented to a backing board 2 supported by a suitable adhesive 3. A thin film of lubricant 4 is shown spread over the upper surface 5 of the sheet 1 of polymeric material. A portion of a skate blade 6 is shown in section standing on the upper surface 5 of the sheet 1 of polymeric material. The skate blade 6 has the usual concave bottom surface 7 to define two edges 8 and 9 by which the skating surface is engaged for propulsion and maneuvering. Dispersed throughout the sheet 1 of polymeric material are a plurality of small cavities 10 which combine to total approximately 25 percent of the volume of the sheet 1 of polymeric material. The cavities 10 are created by a suspension of sodium chloride crystals 11 which define the shape of and fill the cavities.

The first embodiment is made by calendering and extruding a vinyl compound. The salt crystals 11 are mixed with the vinyl compound to provide the cavities 10. The compound is an admixture, in parts by weight that is the same as vinyl floor covering, to wit: polyvinyl chloride resin 100, dioctyl phthalate plasticizer 17.4, butyl cyclohexyl phthalate 7.5, epoxidized soya oil 6.0 barium cadmium stabilizer 5.5, and stearic acid 0.3. Color pigments may be added if desired. The sodium chloride crystals 11 provide 35.5 parts by weight of the total mixture and

have the following screen analysis: None is larger than 40 mesh; 5.6 percent is coarser than 80 mesh; 35.6 percent is coarser than 100 mesh; 92 percent is coarser than 325 mesh; but only 8 percent is finer than 325 mesh. Actually material uniformly finer than 300-325 mesh would be too fine to provide adequate retention of lubricant, but the crystals may be as large as permitted by the minimal thickness of the polymer sheet 1. Sodium chloride salt has been chosen because it is readily available in various screened crystal sizes and it is soluble in water. However, any solid granular substance soluble in a solvent that does not attack the polymer sheet 1 itself may be used. The purpose of the solid granular substance, in this case the salt crystals 11, is in the first instance to define the cavities 10 and, secondly, to be readily washed away to provide reservoirs for lubricant.

The lubricant employed is a commercially available silicone oil having a viscosity of approximately 100 centistokes. Other lubricants, however, may also be used. It has been found that the lubricant must wet the surface 5 upon which the skate blade 6 is to glide. Also, the lubricant must have the viscosity and film strength to support the pressures of the skate blade 6. Thus, with some materials water might wet the surface, but it would lack film strength, and with other materials and lubricants there may be adequate film strength but no wetting of the surface. (Efforts to employ Teflon as a skating surface are believed to have failed largely because of the lack of a lubricant capable of wetting the surface of the Teflon.)

In the second embodiment, a polymer sheet 12 is anchored to a supporting board 13 by a suitable adhesive 14, and again the skate blade 6 is shown riding on an upper surface 15 of the sheet 12 of polymeric material. Dispersed through the polymer sheet 12 are cavities 16 filled with silicone oil droplets 17. The second embodiment is formulated using a plastisol and the silicone oil 17 is a lubricant which is dispersed through the material before it is hardened. The polymer sheet 12 of the second embodiment is then made up of the following admixture of components, the parts by weight being indicated: Polyvinyl chloride plastisol resin 55.0; polyvinyl chloride large particle size resin 45.0; dioctyl phthalate 17.5; butyl cyclohexyl phthalate 7.5; epoxidized soya oil 6.0; liquid barium cadmium stabilizer 3.0 and viscosity reducer (polyethylene glycol 200 monolaurate) 1.0. The silicone oil 17 of 100 centistoke viscosity 10.0 parts by weight and disperses readily in the plasticizer, but it can also be dispersed in the completed plastisol before fusion. It is critical that the lubricant, in this case silicone oil 17, be immiscible in the material of the polymer sheet so that it will form discrete droplets dispersed through the polymer sheets, instead of attacking the polymer sheet 12 itself. Also, it is particularly important in this embodiment that of the total volume of the polymer sheet 12, the cavities 16 containing the silicone oil droplets 17 comprise no more than 50 percent, and about 25 percent seems to be optimum. If the cavities 16 containing silicon droplets 17 make up an excessive portion of the volume of the polymer sheet 12, a spongy mass will result that will be too soft to serve adequately for the skating surface and will exude too much lubricant under pressure.

In both embodiments, as polymer sheet 1 and 12 is used it will wear away eliminating some of the higher cavities 16, in the upper surface 5 and 15 and uncovering other cavities 10 and 16 that had originally been below the upper surface 5 and 15. As a result, the same surface texture is retained throughout the life of the polymer sheet 1 and 12 and, in the second embodiment, a constant supply of lubricant from the silicone oil droplets 17 is automatically provided. Even with extensive use, however, it should be pointed out that the life of the polymer sheet 1 and 12 of the first and second embodiments, respectively, is measured in years. If dust, polymer shavings and other debris collects on the surface 5 and 15, it may be necessary from time to time to wash the

surface with detergent, in which case additional lubricants might have to be added after the washing.

Irregularity in the upper surface 5 and 15, respectively, of the polymer sheet 1 and 12, respectively, serve two functions: first, they provide reservoirs for lubricants; and second, they allow the skate blade 6, edges 8 and 9 to grasp the surface for propulsion and maneuvering. For the latter function, the size and number of the irregularities required will depend upon the hardness of the material used in the polymer sheet 1 and 12. In this connection it is worth noting that the polymer sheet 1 and 12 need not be a homogeneous material throughout, but might be a laminate of two or more separate materials having different hardness characteristics. However, it has been found that a hardness range between Shore D30 and Shore D70 is suitable. As the material becomes softer, smaller and fewer irregularities are needed to allow gripping by the edges 8 and 9 of the skate blade 6, but as the material becomes harder, more and larger irregularities are required. In the first embodiment, then, the size of the salt crystals 11 may be determined in part by the hardness of the material used by the polymer sheet 1. In addition to the materials shown in the specific examples, the following polymers will also be suitable for use as the polymeric sheet 1 and 12: polyvinyl chloride copolymers and blends, chlorinated polyethylene, polypropylene, polyethylene, ionomer resin, copolymers of polypropylene and polyethylene, copolymers of ethylene and vinyl acetate, copolymers of ethylene and acrylates, polystyrene, acrylonitrile-styrene-butadiene - terpolymers, blends of polystyrene with SBR or NBR, polymethyl methacrylate, urethane polymers, cellulose acetate butyrate, ethyl cellulose, polyvinyl alcohol, epoxy resin compounds. These materials combine hardness, toughness, and surface characteristics which, along with a suitable lubricant, will have skating characteristics closely enough approximating ice to be successfully usable as a skating surface.

It is important to note that although cavities 10 and 16 are dispersed throughout the polymer sheet 1 and 12, respectively, a sponge of foam material is not employed. The sponge and foam materials are too soft and found to be unsuitable for use in an artificial skating surface. For that reason, it is important that aggregate volume of the cavities 10 and 16 be limited to less than half of the total volume of the polymer sheet 1 and 12, respectively.

The invention has thus far been described in relation to the preferred form in which cavities are dispersed throughout the polymeric sheet. However, a sheet of polymeric material can also be used in which the cavities, or irregularities, are formed only in the upper surface thereof. The cavities will function as reservoirs for the lubricant and also provide the roughened surface necessary to hold the edge of the skate. The depth of the cavities or irregularities will be dependent upon the hardness of the material. The sheet of polymeric material having the hardness and durability described in relation to the preferred embodiments can be formed with cavities on its upper surface by sanding, buffing, molding, embossing or machining. As previously described, a lubricant is used which wets the surface and is contained in the surface cavities. Such a surface effect will eventually be worn smooth and it will then be necessary to refinish the same in contrast to the preferred embodiments in which a new upper surface with cavities is continuously being exposed.

As can be seen from the foregoing description, the materials used in carrying out the present invention are determined by physical properties and not chemical composition, except, insofar as the physical properties are determined by chemical composition. However, the essential features are physical and accordingly no attempt is made to define the invention chemically. Inasmuch as numerous materials presently known as well as numerous materials to be developed in the future share the necessary properties for use in the present invention, the invention may appear in many forms and embodiments. Accordingly, the

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invention is not limited to the two preferred embodiments described above but rather in the claims that follow.

What is claimed is:

1. An artificial ice skating surface comprising:
a flat sheet of polymeric material of a hardness within the range of Shore D30 and Shore D70 and having an upper skating surface;
a plurality of cavities dispersed throughout said polymeric material to serve as reservoirs for lubricant, some of said cavities opening through said upper surface, said cavities comprising not more than 50% by volume of said sheet and being defined by and containing a crystalline soluble salt adapted to be washed away as said cavities are exposed through said upper skating surface, the major portion of said salt being coarser than 325 mesh;
and a lubricant capable of wetting said upper surface of said sheet of polymeric material, said lubricant spread over said upper surface in a thin film and substantially filling said cavities opening through said upper surface.
2. An artificial ice skating surface in accordance with claim 1 wherein a substantial portion of said salt is in the size range between 80 mesh and 325 mesh.
3. An artificial ice skating surface in accordance with claim 2 wherein
said polymeric material is an admixture in parts by weight of about 100 parts polyvinyl chloride resin, 17.5 parts of dioctyl phthalate plasticizer, 7.5 parts of butyl cyclohexyl phthalate, 6.0 parts of epoxidized soya oil, 5.5 parts of barium cadmium stabilizer, and 0.3 parts of stearic acid.
said salt comprises approximately 25% of the volume of said sheet of polymeric material and is dispersed throughout said admixture, said salt having the following approximate screen analysis: none larger than 40 mesh, 5.6 percent coarser than 80 mesh, 35.6 percent coarser than 100 mesh, and 92 percent coarser than 325 mesh, and
said lubricant is a silicone fluid.
4. A method of making an artificial ice skating surface comprising:
forming a polymeric material having a hardness in the range of Shore D30 and Shore D70 into a flat sheet with an upper skating surface and with a plurality of discrete cavities dispersed throughout said sheet to serve as reservoirs for lubricant and including cavities opening through said upper surface, said cavities comprising not more than 50% by volume of said sheet,
and applying a lubricant over said upper surface which will wet said upper surface and form a thin film and

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- substantially fill said cavities opening through said upper surface.
5. The method of making an artificial ice skating surface in accordance with claim 4 wherein said cavities constitute approximately 25% of the volume of said sheet of polymeric material.
 6. A method of making an artificial ice skating surface comprising:
forming a polymeric material having a hardness in the range of Shore D30 and Shore D70 into a flat sheet with an upper skating surface and with a plurality of discrete cavities dispersed throughout said sheet including cavities opening through said upper surface, said cavities comprising not more than 50% by volume of said sheet and said cavities containing and being defined by a lubricant that is immiscible with said polymeric material and which lubricant wets said upper surface to form a thin film on said upper surface and to substantially fill said cavities opening through said upper surface.
 7. The method of making an artificial ice skating surface in accordance with claim 6 wherein said lubricant is a silicone fluid.
 8. A method of making an artificial ice skating surface comprising:
forming a polymeric material having a hardness in the range of Shore D30 and Shore D70 into a flat sheet having an upper skating surface,
forming a plurality of cavities in said upper surface to act as reservoirs for a lubricant, said cavities each having a maximum dimension substantially less than the width of the blade of an ice skate,
and applying a lubricant over said upper surface which will wet said upper surface to form a thin film over said surface and substantially filling said cavities.

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DAVID KLEIN, Primary Examiner

U.S. Cl. X.R.

117—138.8; 252—11, 12, 12.2; 260—2.5; 94—3, 7; 272—70

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3, 508, 945

Dated April 28, 1970

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VINCENT J. STOLTZ, JR.

It is certified that error appears in the above-identified patent
and that said Letters Patent are hereby corrected as shown below:

Column 2,	Line 2	for "cavities tre dispersed" read --cavities are dispersed--
Column 2,	Line 68	for "plasticizer 17.4, " read --plasticizer 17.5, --
Column 2,	Line 69	for "oil 6.0 barium" read --oil 6.0, barium--
Column 4,	Line 10	for "wirth" read --worth--
Column 4,	Line 40	for "sponge of foam" read --sponge or foam--

SIGNED AND
SEALED

SEP 29 1970

(SEAL)

Attest:

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