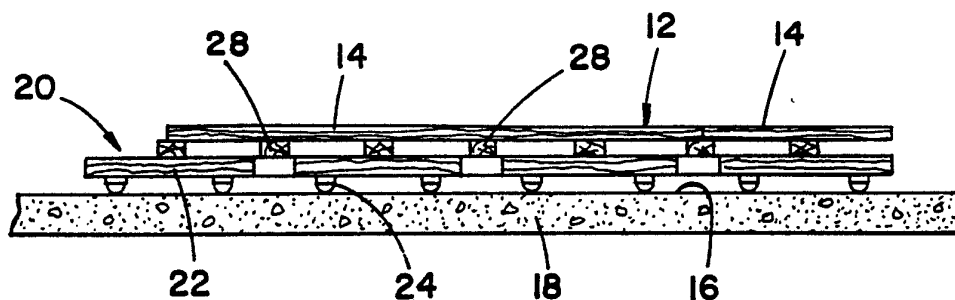




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<p>(21) International Application Number: PCT/US91/06320</p> <p>(22) International Filing Date: 4 September 1991 (04.09.91)</p> <p>(30) Priority data: 654,944 13 February 1991 (13.02.91) US</p> <p>(71) Applicant: CONNOR/AGA, CONNOR FOREST INDUSTRIES, INC. [US/US]; 251 Industrial Park Road, Amasa, MI 49903 (US).</p> <p>(72) Inventor: RANDJELOVIC, Erlin, A. ; 174 Swan Lake Road, Crustal Falls, MI 49920 (US).</p> <p>(74) Agent: HAMRE, Curtis, B.; Merchant, Gould, Smith, Edell, Welter & Schmidt, 3100 Norwest Center, 90 South Seventh Street, Minneapolis, MN 55402 (US).</p>		<p>(81) Designated States: AT (European patent), BE (European patent), CA, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), JP, KR, LU (European patent), NL (European patent), SE (European patent).</p> <p>Published <i>With international search report.</i></p>

(54) Title: SUBFLOORING ASSEMBLY FOR ATHLETIC PLAYING SURFACE



(57) Abstract

A subflooring assembly for an athletic playing surface (12) includes rows of parallel strut members (22), each of which are supported at spaced points by a pair of resilient shock absorber members (24). A sleeper member (28) is supported on top of each row of strut members (22) for supporting a floor of hardwood maple strips (14) or other desired material. The shock absorbing characteristics of the flooring can be selected by choosing a durometer value for the shock absorber members (24), and by preselecting the desired distance of separation between the shock absorber members (24) in each pair. A method of assembly using prefabricated panel sections is also disclosed.

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SUBFLOORING ASSEMBLY FOR ATHLETIC PLAYING SURFACE**BACKGROUND OF THE INVENTION**5 1. **Field of the Invention**

This invention relates to shock absorbing subflooring which is used beneath athletic playing surfaces, such as the hardwood floors which are frequently provided in gymnasiums. More specifically, 10 the invention relates to an improved subflooring and method of assembly which is easier to deploy, has presettable performance characteristics and which better isolates local shocks than subflooring arrangements which have previously been known and used.

15 2. **Description of the Prior Art**

Shock absorbing floors are in wide use for athletic and dance purposes in gymnasiums, stadiums and dance halls throughout the United States and the world. Such floors can reduce the likelihood of injury and 20 prolong the career of an athlete or a dancer by absorbing some of the shock that is associated with impacts between the athlete and the floor.

Unlike other types of floors, athletic floors must have some degree of elasticity under load, and yet 25 be quite firmly supported. Furthermore, such floors must have predictable and constant shock absorption characteristics throughout their surface area. Otherwise, dead spots may be created which could affect the play of an athletic contest, such as by influencing 30 the way a ball bounces. Uneven shock absorption characteristics could also affect a dancer's reaction to contact with the floor, which could cause less than satisfactory results.

Over the decades, numerous designs for athletic 35 floors have been advanced. U.S. Patent 4,879,857 to Peterson et. al. is exemplary and provides the basis for the preamble to claim 1. Peterson shows an athletic floor with intermediate layers of subflooring which are supported on individual resilient shock-absorbing

members uniformly located between the subflooring and a solid base. A great deal of additional prior art has also been developed in this field. While such designs have in many instances proven effective, certain aspects of prior art athletic floors are not entirely satisfactory to the athletes, dancers, or purchasers of such floors. For example, the performance characteristic of an athletic floor is in some part determined by the ability of the floor to provide a localized absorption of a shock, without transmitting the shock to other, adjacent portions of the floor. In fact, a sports floor standard has been developed to norms known as DIN by the Otto-Graf Institute of Germany to quantitatively evaluate such characteristics. Localized shock absorption is particularly important in a sport like basketball, because it provides that each athlete has a minimal effect on other athletes performing in close proximity because of the number of locations at which shocks are constantly being transmitted to the court, athletes could otherwise land on the floor when it has been "bottomed out" by the impact of another athlete.

In general, it is an expensive and time-consuming process to install an athletic playing surface. Any advances which would reduce the time and labor involved in such installation would be considered an important advance in athletic floor technology.

In some situations, the long-term placement of heavy objects can damage the performance characteristics of an athletic playing surface. For example, the pull-out type bleachers in many gymnasiums can permanently deform the resiliency of the subflooring beneath the areas in which they are positioned. An athletic floor design which provides a solution to this problem would likewise be considered an important advance in the art.

Optimal levels of shock absorption and floor resiliency vary, depending upon the particular

application to which a floor is to be put. Accordingly, it is desirable for an athletic floor design to be readily adaptable to different types of performance requirements.

5 It is clear that there has long existed an unfilled need in the prior art for an athletic playing surface which is easy to install, which provides efficient, localized attenuation of shocks, which can be readily be assembled to meet specific performance
10 requirements, and which can readily be protected against overloads in desired areas.

SUMMARY OF THE INVENTION

 Accordingly, it is an object of the invention to provide a permanent athletic playing surface which
15 can be installed more efficiently than playing surfaces heretofore known.

 It is further an object of the invention to provide an athletic playing surface which is more efficient at localizing force and shock inputs than
20 athletic floors that have previously been known.

 It is further an object of the invention to provide an athletic playing surface which can be more readily constructed to specific performance requirements than floors heretofore known.

25 It is yet further an object of the invention to provide an athletic playing surface which can readily be protected against force overloads in desired areas thereof.

 In order to achieve these and other objects of
30 the invention, a subflooring assembly for an athletic playing surface according to a first aspect of the invention includes a plurality of strut assemblies which are adapted to be supported on an underlying surface, each of the strut assemblies including a pair of spaced,
35 resilient shock absorber members which are constructed and arranged to be supported on the underlying surface and an elongate strut member which is supported at

spaced points by the shock absorber members, the strut assemblies being positioned in adjacent rows wherein each row is characterized by the strut members of adjacent strut assemblies being positioned in a parallel and evenly spaced relationship; and a plurality of elongate sleeper members, each of the sleeper members extending above one of the rows of strut assemblies and being supported by the strut members in the row at a support location which is between the spaced points, the sleeper members having an upper surface to which a desired flooring material may be applied, whereby shock attenuation is provided by compression of the shock absorber members and bending deflection of the sleeper members and the strut members, and whereby the degree of bending deflection of the strut members for a given force input can be preset during construction by selecting a desired spacing between the shock absorber members.

According to a second aspect of the invention, a prefabricated subflooring panel for modular assembly of the subflooring in an athletic playing surface includes a plurality of parallel, evenly spaced rows of strut assemblies which are adapted to be supported on an underlying surface, the strut assemblies each including a horizontal strut member and structure for supporting the strut member with respect to the underlying surface at a pair of spaced points; a plurality of elongate sleeper member, each of the sleeper members extending above one of the rows of strut assemblies and being supported by the strut members at a support location which is between the spaced points, the sleeper members having an upper surface to which a desired flooring material may be applied; and a plurality of elongate spacer members which are attached to the upper surfaces of the sleeper members, the spacer members being sized to extend beyond an outer edge of an outermost row of the strut assemblies by a predetermined distance to aid

in spacing the panel with respect to other panels when constructing an athletic playing surface.

According to a third aspect of the invention, a method of making an athletic playing surface includes

5 the steps of (a) providing a flat surface such as a floor; (b) providing a subflooring assembly including a plurality of strut assemblies each having a pair of spaced, resilient shock absorber members which are constructed and arranged to be supported on the flat

10 surface and an elongate strut member which is supported at spaced points by the shock absorber members, the strut assemblies being positioned in adjacent rows wherein each row is characterized by said strut members of adjacent strut assemblies being positioned in a

15 parallel and evenly spaced relationship; and a plurality of elongate sleeper members, each of the sleeper members extending above one of the rows of strut assemblies and being supported by the strut members in the row at a support location which is between the spaced points, the

20 sleeper members having an upper surface to which a desired flooring material may be applied; (c) preselecting the distance between the shock absorber members in the pairs; (d) laying the desired number of subflooring assemblies on the flat surface; and (e)

25 laying a flooring surface on the upper surfaces of the sleeper members, whereby an athletic floor is provided that will attenuate shocks to a degree which corresponds to the selected spacing of each pair of shock absorber members.

30 These and various other advantages and features of novelty which characterize the invention are pointed out with particularity in the claims annexed hereto and forming a part hereof. However, for a better understanding of the invention, its advantages, and the

35 objects obtained by its use, reference should be made to the drawings which form a further part hereof, and to the accompanying descriptive matter, in which there is

illustrated and described a preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

5 FIGURE 1 is a top plan view of a localized section of an athletic playing surface which is constructed according to a first, preferred embodiment of the invention;

10 FIGURE 2 is a fragmentary cross-sectional elevation view taken along lines 2-2 in FIGURE 1;

 FIGURE 3 is a perspective view of a component of the subflooring which is illustrated in FIGURES 1 and 2;

15 FIGURE 4 is a perspective view of a second embodiment of one component in the flooring assembly illustrated in FIGURES 1-3;

 FIGURE 5 is a perspective view of a third embodiment of the component;

20 FIGURE 6 is a perspective view of a fourth embodiment of the component;

 FIGURE 7 is a perspective view of a fifth embodiment of the component;

 FIGURE 8 is a perspective view of a sixth embodiment of the component;

25 FIGURE 9 is a fragmentary cross-sectional view illustrating a deflection-blocking arrangement according to one aspect of the embodiment illustrated in FIGURES 1-3;

30 FIGURE 10 is a top plan view of a prefabricated subflooring panel according to the embodiment illustrated in FIGURES 1-3; and

 FIGURE 11 is a perspective view of one component in the panel that is illustrated in FIGURE 10.

35 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

Referring now to the drawings, wherein like reference numerals designate corresponding structure

throughout the views, and referring in particular to FIGURES 1 and 2, a subflooring assembly 10 for an athletic playing surface 12 which consists of a plurality of hardwood strips 14 is supported by a hard, flat underlying surface 16, which in the illustrated embodiment is a concrete floor 18. Likewise, the invention could be supported on other types of surfaces, such as poured polyurethane floors, wooden floors or other commonly found floor materials. In the preferred embodiment, the hardwood strips 14 which constitute athletic playing surface 12 are tongue-and-grooved maple strips. It is to be understood, however, that alternative surfaces could likewise be employed, such as additional layers of plywood with an elastomeric coating thereon for example a running track. Those skilled in the art will appreciate the many different types of floor surfaces which are available.

Looking to FIGURES 1-3, subflooring assembly 10 is constituted by a plurality of strut assemblies 20, each of which constitute an elongate strut member 22 which is supported at spaced points by a spaced pair of shock absorber members 24. Shock absorber members 24 are resilient and, preferably, are fabricated from an elastomeric substance such as polyurethane. In the most preferred embodiment, shock absorber members 24 are identical to the shock absorbers which are disclosed in U.S. Patent 4,879,857 to Peterson et al., the disclosure of which is hereby incorporated into this document by reference. Such shock absorber members 24 have a base portion 68 which contacts a bottom surface of strut member 22, and a domed portion 70 which contacts underlying surface 16, as can be most clearly seen in FIGURE 9.

Referring again to FIGURES 1-3, strut assemblies 20 are positioned in adjacent, staggered rows with adjacent strut assemblies 20 being positioned in a parallel and evenly spaced relationship. A sleeper

member 28 is secured to upper surfaces 26 of the strut members 22 within each row of strut assemblies 20, as can best be seen in FIGURES 1 and 3. Sleeper members 28 are elongate, and are supported by the respective strut members 22 at support locations which are between the spaced points at which the respective strut members 22 are supported by the resilient shock absorbing members 24. Each sleeper member 28 has a flat upper surface 30 to which the hardwood strips 14 are fastened to form athletic playing surface 12. Referring briefly to FIGURE 3, the combination of a sleeper member 28 and the strut assemblies 20 within a row is termed a rail 38. Fasteners 36 are used to secure sleeper member 28 to the respective strut members 22 within rail 38, as may be seen in FIGURE 3. In the preferred embodiment, fasteners 36 are one-inch staples, two of which are used to fasten sleeper member 28 to a strut member 22. Alternatively, an adhesive could be used in place of fasteners 36. The hardwood strips 14 are secured to the upper surface 30 of sleeper members 28 by flooring nails, staples, or by other equivalent fasteners.

In the most preferred embodiments, each strut member 22 is fabricated of 1/2-inch four-ply BC-grade plywood, and is cut to a dimension of approximately 3 inches in width by 13 inches in length. Sleeper members 28 are most preferably also fabricated of 1/2-inch four-ply BC-grade plywood and are cut to the dimensions of 2 inches in width by 8 feet in length. It is to be understood that any suitable dimensions could be employed.

During use, forces and shocks will be transmitted from playing surface 12 through the sleeper members 28 to the individual strut assemblies 20. Shocks which are transmitted to the individual strut assemblies 20 will be absorbed through a combination of a bending deflection of the strut member 22, and by compression of the pair of shock absorbing members 24

which support strut member 22. One of the salient advantages of a system constructed according to this aspect of the invention is that the resiliency of the assembly 10 can be preset during construction by
5 controlling the spacing between the shock absorbing members 24 in the strut assemblies 20. Referring briefly to FIGURE 3, a strut member 22 is supported by a first shock absorber member 32 and a second shock absorber member 34. In static terms, strut member 22 is
10 a simply supported beam between the shock absorber members 32, 34. Forces and shocks transmitted through sleeper member 28 will cause flexure of strut member 22 to a certain degree, depending upon the force and duration of the impact. If a particular athletic
15 facility requires a floor that is less resilient or "harder", the resiliency of subflooring assembly 10 can be reduced by mounting the shock absorber members 32, 34 more toward the center portion of elongate strut member 22. This will reduce the flexure of strut member 22 for
20 a given force input during operation. If a more resilient or "softer" playing surface is desired, shock absorber members 32, 34 would preferably be mounted to strut member 22 more toward the ends of strut member 22. The resiliency of a given floor can in this way be
25 varied across its surface. Shock absorber members 24 can be mounted to strut members 22 by adhesives, staples, or by other fastening techniques as may be desired.

Moreover, the improved subflooring assembly 10
30 according to the invention provides more localized shock attenuation than was possible in many prior art designs, because of the spaced, discontinuous nature of the strut assemblies 20. If strut assemblies 20 extended continuously beneath a playing surface 12, rather than
35 in their staggered, discontinuous pattern, shock inputs would be more readily transmitted to other areas of the playing surface 12.

The resiliency of the subflooring assembly 10 may further be preselected by varying the compressibility of the shock absorber members 24 prior to construction.

5 Referring to FIGURES 4-8, a variety of alternative preferred embodiments for the shock absorbing members 24 will now be discussed. FIGURE 4 illustrates a second embodiment 40 of a shock absorber which is shaped as a cylinder 42. FIGURE 5 discloses a
10 third embodiment 44 of a shock absorber which is embodied as a rectangular block 46. FIGURE 6 illustrates a fourth embodiment 48 which has an upper, rectangular slab-like portion 50 and a pair of depending legs 52, each of which are constructed as a rectangular
15 block with periodic rectangular holes defined therein. FIGURE 7 illustrates a fifth embodiment 56 which is constructed of a rectangular slab or block 58 and a lower, transversely positioned cylindrical portion 60. FIGURE 8 illustrates a sixth embodiment 62 which has an
20 upper slab or rectangular block-like portion 64 and a lower, truncated wedge-shaped portion 66. Although the disclosed embodiments for shock absorbing members 24 are the ones most preferable to the inventors at the time of execution of this document, it is to be understood that
25 other embodiments are possible and are equally within the purview of the invention. Preferably, the shock absorbing members 24 are formed of a resilient, polymeric material such as polyurethane, but could also be formed from other equivalent rubber-based or
30 polymeric elastomeric material. They have a preferred durometer rating within the range of 20-90.

Referring now to FIGURE 9, a novel arrangement 74 for blocking deflection of the subflooring assembly 10 in a localized area will now be discussed. In order
35 to prevent damage to subflooring assembly 10 which could otherwise result from the placement of heavy objects such as bleachers on athletic playing surface 12, a

blocking element 76 or elements can be secured in anticipated high-load locations to a lower surface 72 of strut members 22. Blocking elements 76 thus limit the deflection which is permitted between the strut member 5 22 and the underlying surface 16. This protects the strut members 22 and the shock absorber members 24 from damage in high load areas. The operational flexibility and simplicity of blocking arrangement 74 will readily be appreciated by athletic directors and other persons 10 who are familiar with the design of athletic floors in general.

Referring now to FIGURES 10 and 11, it will be seen that the subflooring assembly 10 according to the invention is preferably prefabricated into modular 15 subflooring panels 78 which, in the most preferred embodiments, is constituted by four rails 38, each rail including 12 strut assemblies 20. The rails 38 are held together by a plurality of spacer members 80 which are secured to the upper surfaces 30 of the sleeper members 20 28 so as to extend at right angles with respect to the sleeper members 28. As may be seen in FIGURE 10, there are most preferably three spacer members 80 on a panel 78. Most preferably, the spacer members 80 are fabricated from a 7/16-inch composite wooden material 25 that is commercially available as SPORTSBOARD from the Georgia Pacific Corp., or 3/4-inch five-ply CDX plywood and are 3 inches in width by 36 inches in length.

Certain novel aspects of the invention permit a subflooring panel 78 to be quickly and easily aligned 30 with an adjacent panel 78 during installation. A plurality of such panels 78 will be installed in abutting interlocking fashion to create a typical floor. Referring again to FIGURES 10 and 11, it will be seen that each spacer member 80 has an extended end portion 35 82 which extends beyond an outer edge 84 of the strut members 22 on an outermost rail 38 by a distance which corresponds to the spacing between a strut member 22 and

a sleeper member 28 on an adjacent rail 38 within panel 78. As a result, even spacing between the rails 38 in adjacent panels 78 is achieved by abutting extended end portion 82 against a second end portion 86 on an adjacent panel 78 during installation. As a further installation aid, extended end portions 82 of spacer members 80 are provided with a downwardly extending bumper element 88, as is shown in FIGURE 11. Bumper element 88 is designed to contact the sleeper member 28 on an adjacent panel, and/or the second end portion 86 of an adjacent spacer member 80. It should be understood that the panel members 78 could be laid out in a staggered pattern, in which case the bumper elements 88 would contact only the sleeper members 28 of an adjacent panel and not the second end portion 86.

To aid in the installation of panels 78 in the direction which is perpendicular from that described above, it will be noted that sleeper members 28 have end portions 90, 92 which extend on one end of panel 78 beyond the last strut members 94. Specifically, a sleeper on a first rail 38 extends beyond a last strut member, which is not visible in FIGURE 10 due to the presence of spacer member 80. An end portion 92 of an adjacent rail 38 protrudes beyond a last strut member 94 and beyond the end portion 90 of the first rail 38, due to the nature of the interlocking relationship between the rails. Viewing the opposite side of panel 78, it will become evident that the first extended end portion 90 is constructed to abut a corresponding sleeper member 98 on an adjacent panel 78 at a first plane 96 which passes through the strut member 98. Similarly, the second extended end portion of the adjacent rail 38 will abut a corresponding sleeper member 28 on adjacent panel 78 at a plane 100 which passes through a last strut member 102 on the corresponding rail 38. Since the end portions 90, 92 will overlay the strut members 98, 102 on the adjacent panel 78, shocks will be absorbed

uniformly over the entire subflooring with no deviations due to the interlocking of the panels 78.

It is to be understood, however, that even though numerous characteristics and advantages of the present invention have been set forth in the foregoing description, together with details of the structure and function of the invention, the disclosure is illustrative only, and changes may be made in detail, especially in matters of material, shape, size and arrangement of parts within the principles of the invention to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.

WHAT IS CLAIMED IS:

1. A subflooring assembly (10) for an athletic playing floor (14) having a plurality of intermediate layers of material and spaced, resilient shock absorber members (24) supporting said floor on a hard underlying surface (16) characterized in that a plurality of strut assemblies (20) form a first of said layers with elongate strut members (22) supported at spaced points by said shock absorber members, adjacent rows of said strut assemblies being positioned in a parallel and evenly spaced relationship, a second of said layers being formed by elongate sleeper members (28) each of which extends above one of said rows of strut assemblies and is supported by said strut assemblies in said row at a support location which is between said spaced points, said sleeper members having an upper surface (26) to which a desired material comprising said floor may be applied, whereby shock attenuation is provided by compression of said shock absorber members and bending deflection of said sleeper members and said strut members, and whereby the degree of bending deflection of said strut members for a given force input can be preset during construction by selecting a desired spacing between said shock absorber members.
2. An assembly according to claim 1, wherein said shock absorber members (24) have a base portion (68) contacting said strut member and a second, domed portion (70) for contacting the underlying surface.
3. An assembly according to claim 1 including at least one blocking element (76) to prevent deflection positioned between a lower surface of one of said strut members and the underlying surface.

4. An assembly according to claim 1 including a plurality of elongate spacer members (80) which are attached to said upper surfaces (30) of said sleeper members (28), said spacer members being sized to extend
5 beyond an outer edge of an outermost row of said strut assemblies (20) by a predetermined distance to aid in spacing said panel with respect to other assemblies (10) when constructing an athletic playing surface.
- 10 5. A subflooring assembly according to claim 4, wherein said spacer members each include a downwardly extending bumper element (88) in said portion which extends beyond said outer edge.
- 15 6. A subflooring assembly according to claim 5, wherein adjacent rows of said strut members (22) are staggered with respect to each other to form an interlocking pattern, and said bumper element (88) is constructed and arranged to contact a sleeper member
20 (28) of an adjacent subflooring assembly during initial construction of an athletic playing surface.
7. A subflooring assembly according to claim 4, wherein said sleeper members (28) are extended beyond
25 last strut members (22) on at least one end of said assembly so as to contact corresponding sleeper members on an adjacent assembly.
8. A subflooring assembly according to claim 7,
30 wherein said extended portions of said sleeper members are constructed to engage the sleeper members of an adjacent assembly at a plane which passes through a last strut member on the adjacent assembly.
- 35 9. A method of making an athletic playing surface, comprising:

- (a) providing a flat surface (16) such as a floor;
- (b) providing a subflooring assembly (10) including a plurality of strut assemblies (20) each having a pair of spaced, resilient shock absorber members (24) which are constructed and arranged to be supported on the flat surface and an elongate strut member (22) which is supported at spaced points by said shock absorber members (24), said strut assemblies being positioned in adjacent rows wherein each row is characterized by said strut members of adjacent strut assemblies being positioned in a parallel and evenly spaced relationship; and a plurality of elongate sleeper members (80), each of said sleeper members extending above one of said rows of strut assemblies and being supported by said strut members in said row at a support location which is between said spaced points, said sleeper members having an upper surface (30) to which a desired flooring material may be applied;
- (c) preselecting the distance between said shock absorber members (24) in said pairs;
- (d) laying the desired number of subflooring assemblies (10) on the flat surface; and
- (e) laying a flooring surface on said upper surfaces of said sleeper members, whereby an athletic floor is provided that will attenuate shocks to a degree which corresponds to the selected spacing of each pair of shock absorber members.

10. A method according to claim 9, wherein the step of preselecting the distance between said shock absorber members (24) in said pairs further includes varying the spacing between said shock absorber members from one of said pairs to another to allow the athletic playing surface to have different characteristics across its surface.

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FIG. 1

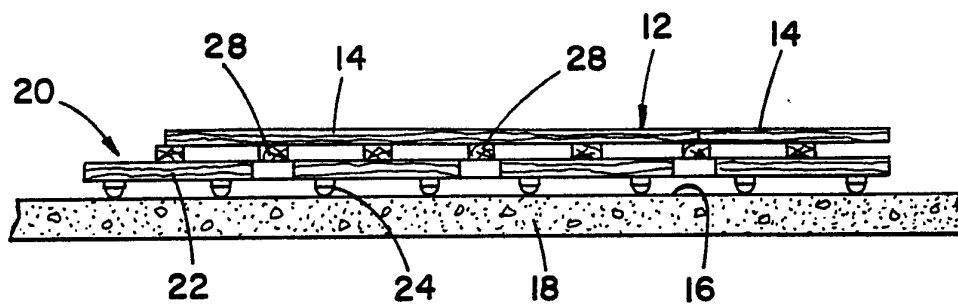
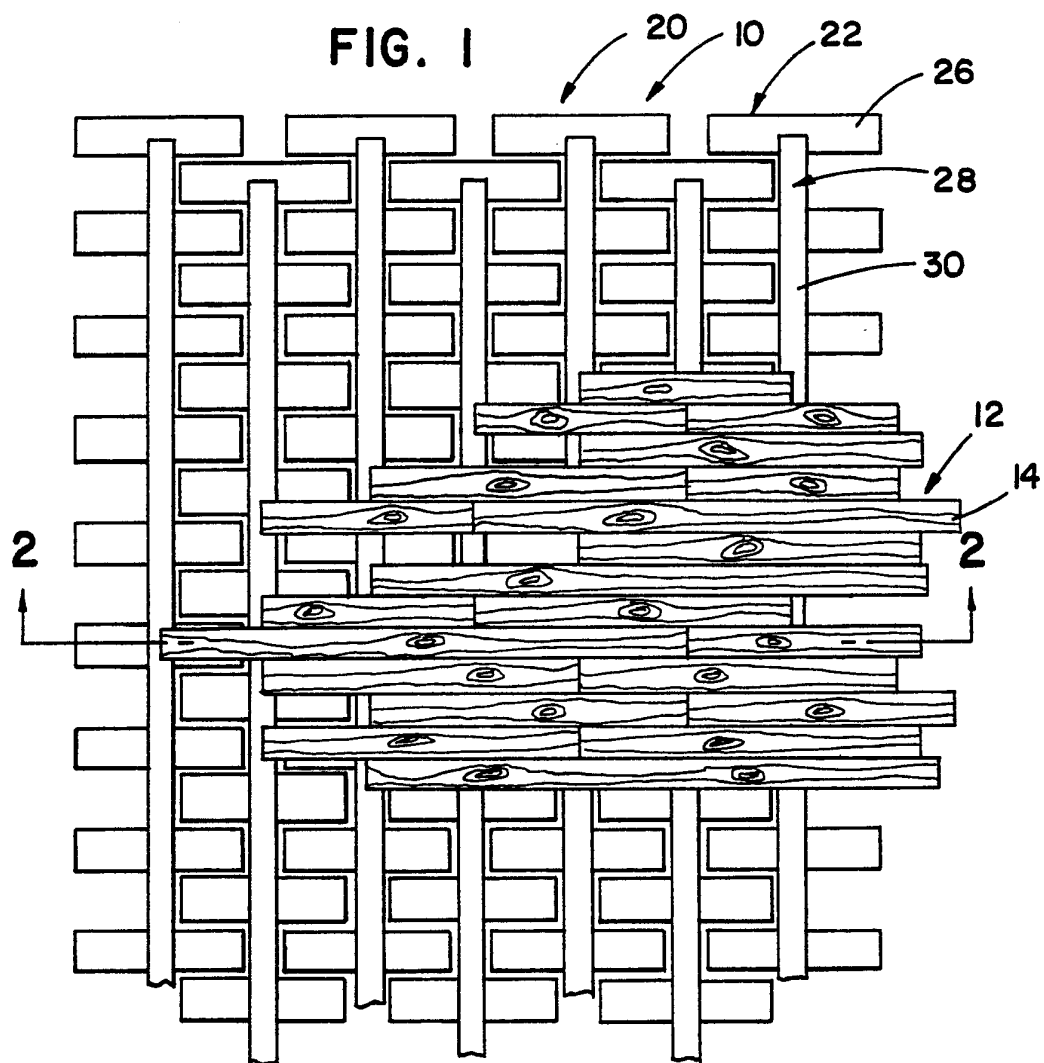


FIG. 2

2/3

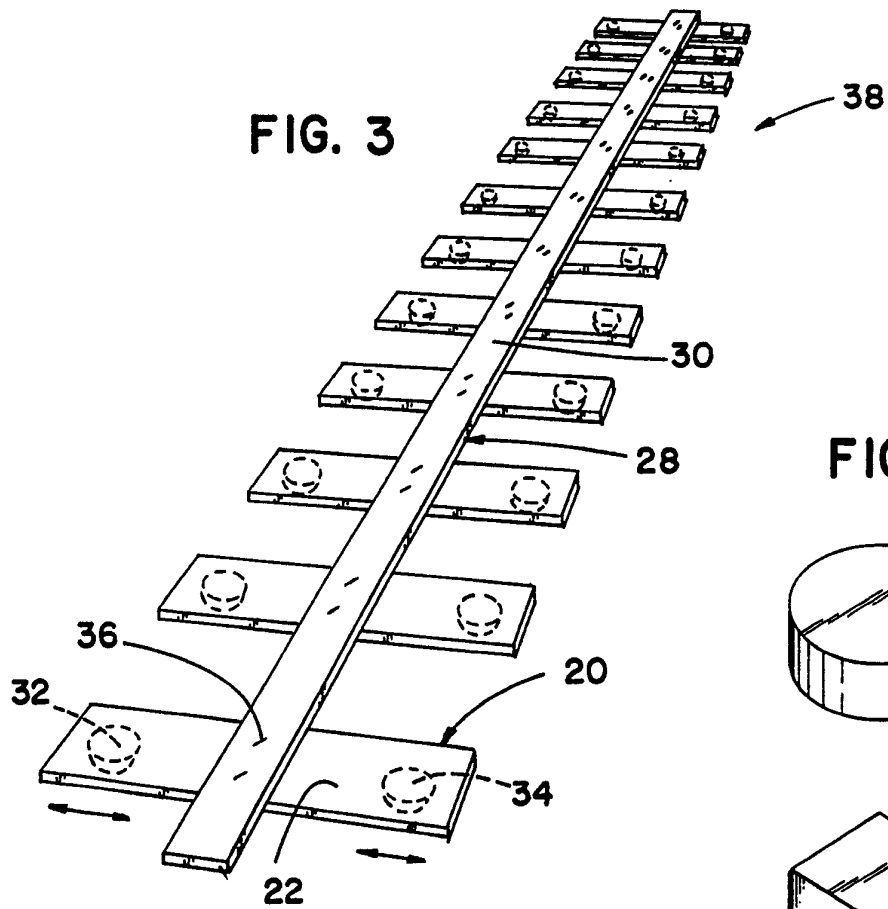


FIG. 4

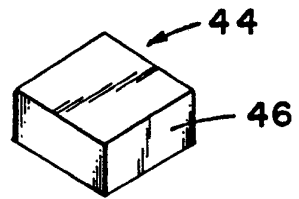
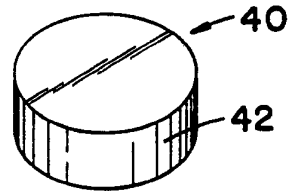


FIG. 5

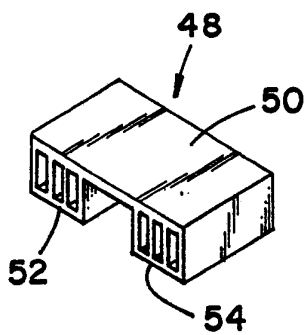


FIG. 6

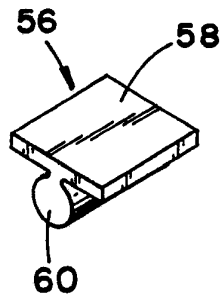


FIG. 7

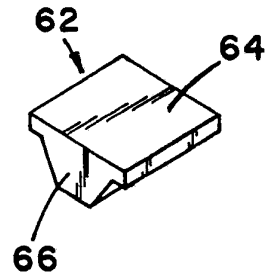


FIG. 8

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FIG. 9

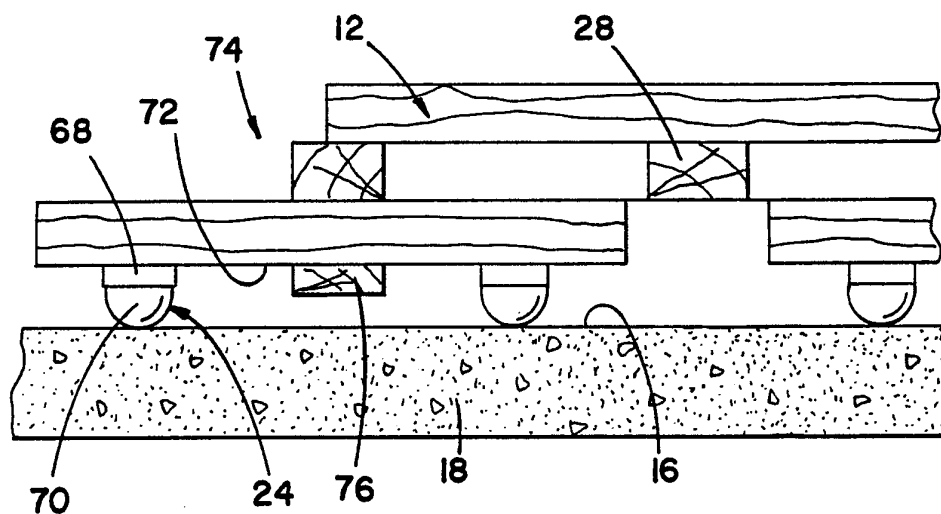
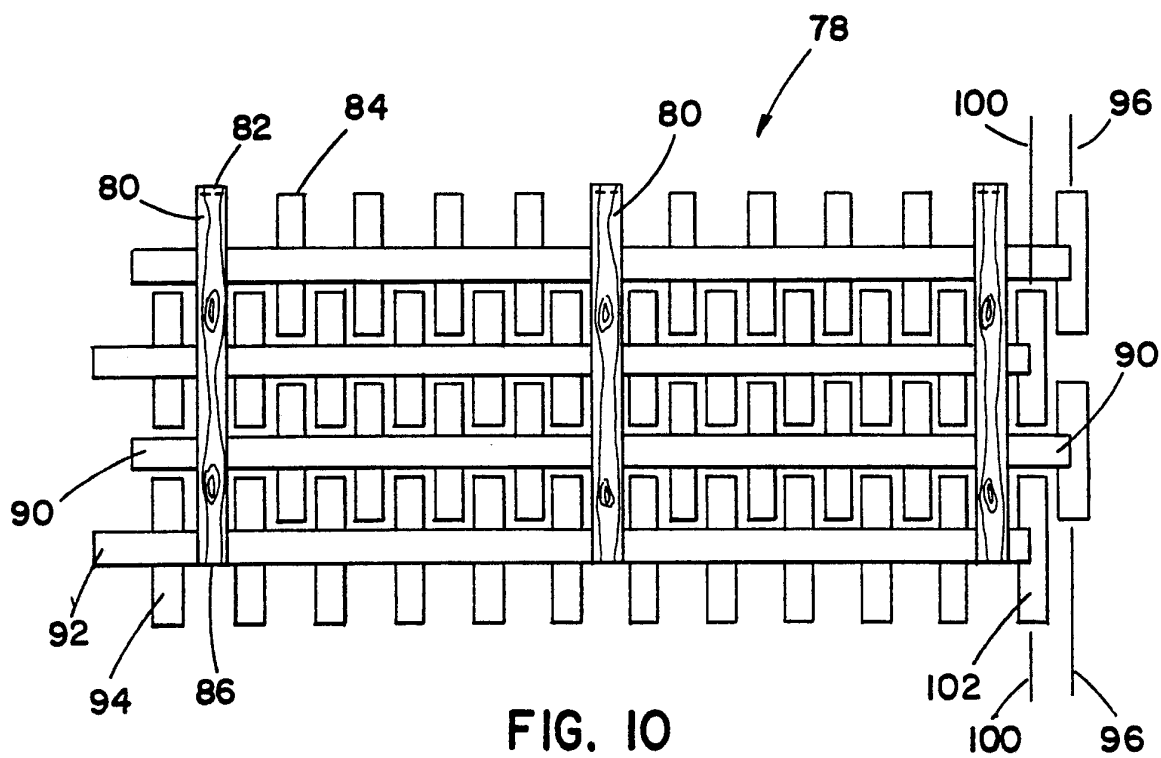
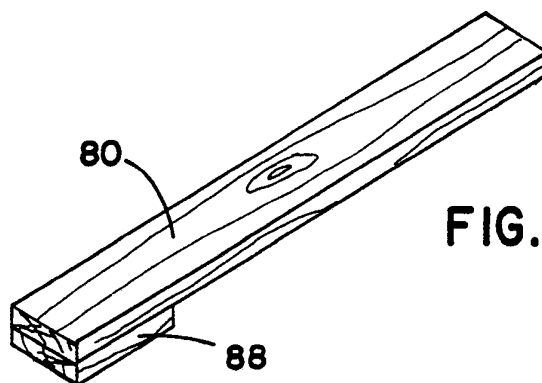


FIG. 11



INTERNATIONAL SEARCH REPORT

PCT/US 91/06320

International Application No

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)⁶

According to International Patent Classification (IPC) or to both National Classification and IPC
 Int.Cl. 5 A63C19/00; E04F15/22

II. FIELDS SEARCHED

Minimum Documentation Searched⁷

Classification System	Classification Symbols
Int.Cl. 5	A63C ; E04F ; E01C

Documentation Searched other than Minimum Documentation
 to the Extent that such Documents are Included in the Fields Searched⁸

III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹

Category ¹⁰	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
Y	GB,A,578 294 (LARSEN) 18 July 1946 see page 2, line 63 - line 88 see page 2, line 129 - page 3, line 4; figures ---	1-3,9
Y	WO,A,8 902 017 (HAMBERGER INDUSTRIEWERKE GMBH) 9 March 1989 see abstract; claims 6-8; figures ---	1-3,9
Y	US,A,4 879 857 (PETERSON ET AL.) 14 November 1989 cited in the application see abstract; figures ---	2
A	GB,A,2 161 514 (CONSTRUCTIONS METALLIQUES & CARROSSERIES CAIRE CLAUDE) 15 January 1986 see abstract; figure 4 --- -/--	4

¹⁰ Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

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"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search

26 NOVEMBER 1991

Date of Mailing of this International Search Report

11. 12. 91

International Searching Authority

EUROPEAN PATENT OFFICE

Signature of Authorized Officer

JONES M.

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
Y	CH,A,366 380 (BEMBE-PARKETT-FABRIK JUCKER & CO. KG) 15 February 1963 see claims; figures ---	1,3
Y	DE,A,2 614 551 (SEIS) 13 October 1977 see page 6, last paragraph - page 7, paragraph 1; figure see page 8, paragraph 2 - paragraph 3 ---	1,3
A	DE,A,1 659 828 (FRANKENTHALER TURNGERÄTEFABRIK M. AUGENTHALER VORM. PFEIFER) 23 April 1970 see claim; figures 1-2 ---	1,9
A	US,A,2 823 427 (KUHLMAN) 18 February 1958 see column 2, line 34 - line 40; figures 2,4,7 ---	1,3

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.**

US 9106320
SA 51194

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information. 26/11/91

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GB-A-578294		None	
WO-A-8902017	09-03-89	DE-A- 3729163 DE-U- 8717823 EP-A- 0404770	16-03-89 10-05-90 02-01-91
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DE-A-2614551	13-10-77	None	
DE-A-1659828	23-04-70	None	
US-A-2823427		None	