

FIG. 1

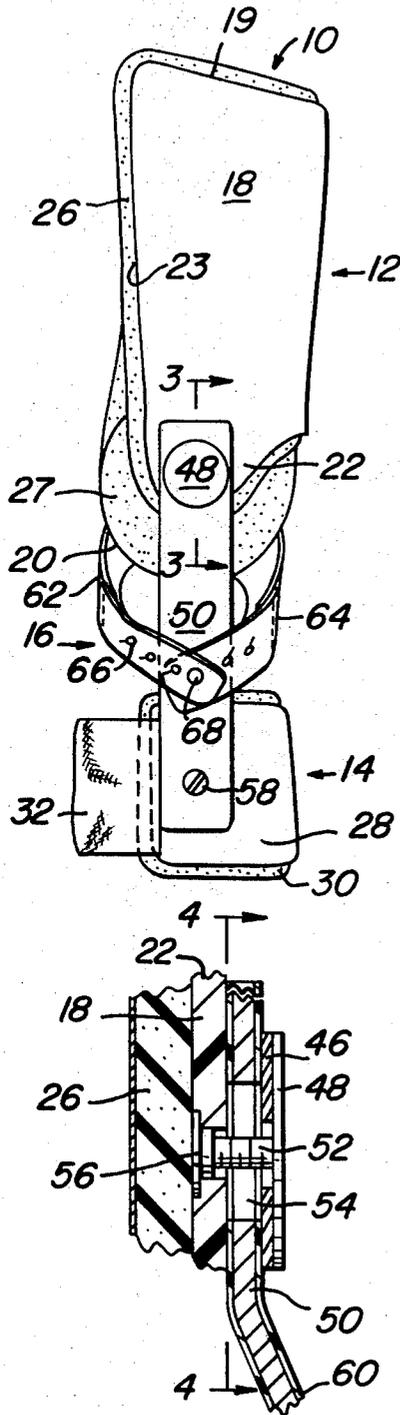


FIG. 3

FIG. 2

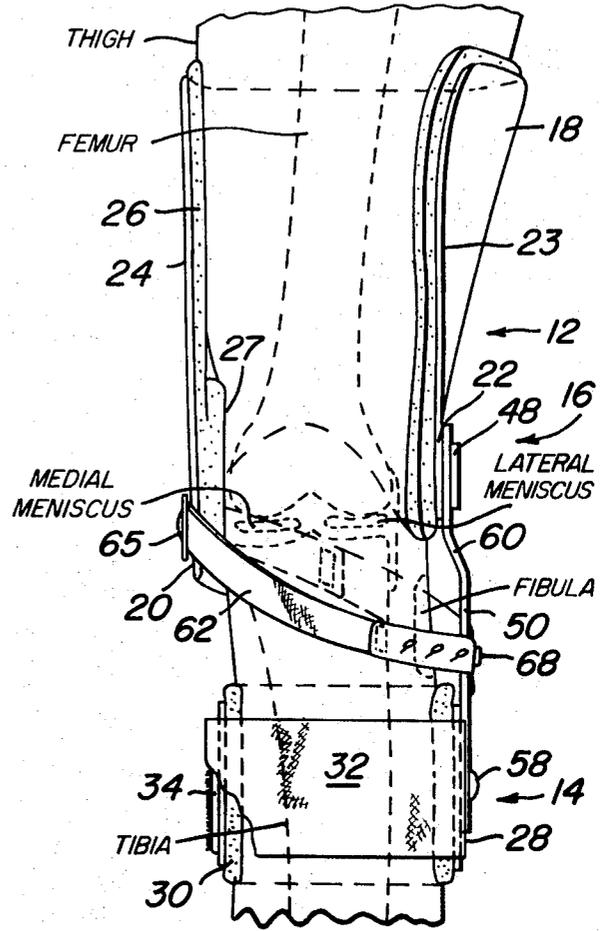
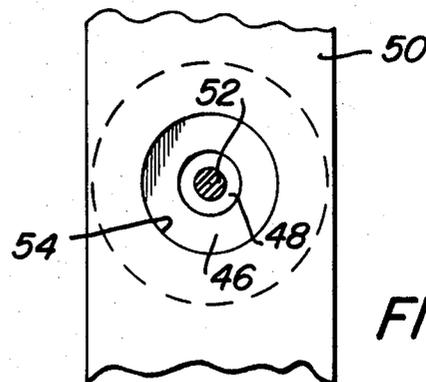


FIG. 4



INVENTORS
 MAURICE ROSMAN
 ANTHONY CALABRESE
 BY *Seidel & Standa*
 ATTORNEYS

FIG. 5

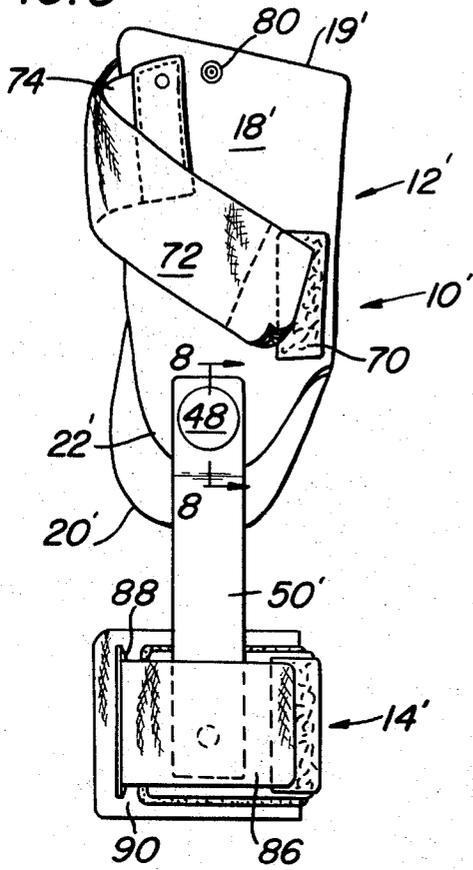


FIG. 6

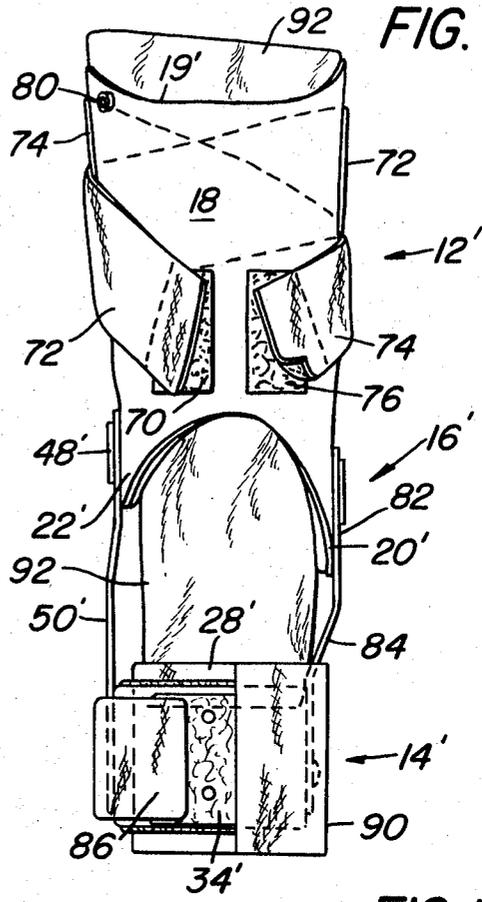


FIG. 7

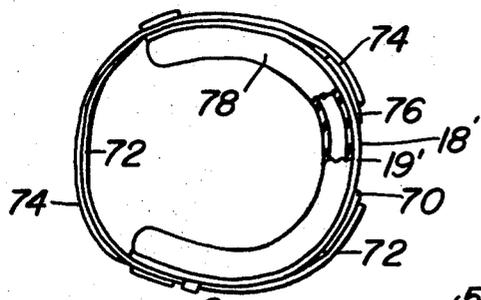


FIG. 10

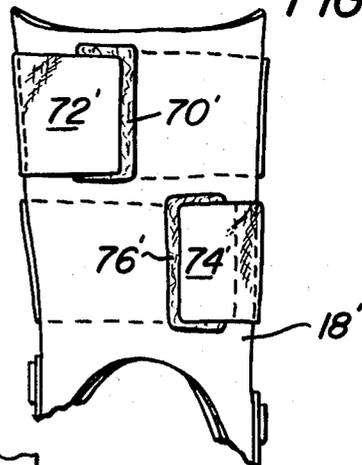


FIG. 8

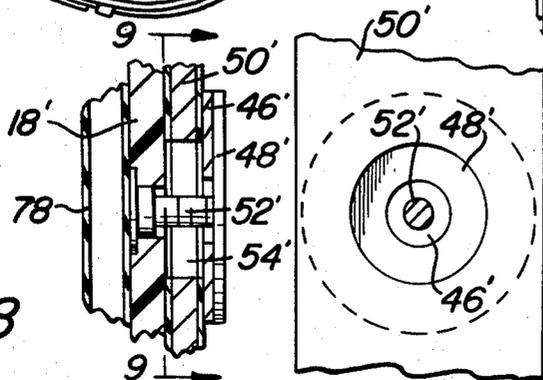
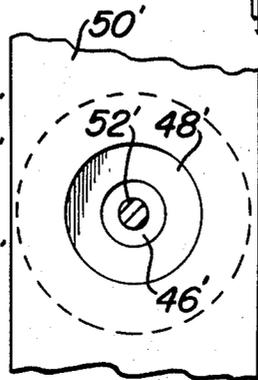


FIG. 9



INVENTORS
 MAURICE ROSMAN
 ANTHONY CALABRESE
 BY *Seidel & Standa*
 ATTORNEYS

KNEE BRACE

This invention relates to a knee brace, and more particularly, to a knee brace which provides for an improved mobility factor while providing protection for an injured knee from lateral forces. The knee brace of the present invention may be utilized by persons who have suffered from a blow which has pushed the patella to one side without any blocking or cutting effect or persons who have torn cartilages or ligaments. Such conditions are frequently received by athletic persons such as football players.

The torn ligaments or cartilages are generally received on the interior of the knee as a result of a blow from the exterior of the knee at the knee joint. A normal knee joint as perceived by the present inventors contemplates a combination of rocking, sliding and a pivotable movement between the thigh and calf portions of a leg. The knee brace of the present invention has been designed in a manner so as to permit such movement while at the same time provided protection along the interior or medial portion of the knee joint in the area of the medial meniscus and the collateral ligaments of the knee. In doing so, the knee brace has been designed in a manner so as to be lightweight and capable of being worn under a pants leg in a manner which is comfortable while at the same time permitting the wearer to run, walk or sit down.

The knee brace is comprised of rigid upper and lower body portions preferably made from a lightweight rigid material such as nylon or polyurethane. The body portions may be reinforced by including fiberglass or other materials therein. The body portions partially encircle the thigh and calf. The remainder of the thigh and calf are encircled by flexible elastomeric material supported by the body portions. The lateral side of the body portions are pivotably connected to a bar.

It is an object of the present invention to provide a novel knee brace.

It is another object of the present invention to provide an improved knee brace which has a mobility factor which closely resembles that of a knee joint.

It is another object of the present invention to provide a novel knee brace having rigid body portions pivotably coupled together on their lateral side in a manner so that the body portions may pivot with respect to an axis generally perpendicular to the zone of overlap and slide relative to one another in a direction generally parallel to the zone of overlap.

It is another object of the present invention to provide a novel knee brace having upper and lower body portions which may slide, rock, and pivot relative to each other.

It is another object of the present invention to provide a novel knee brace which is light in weight, inexpensive, and will permit the wearer to walk, run and sit down while wearing the same.

Other objects will appear hereinafter.

For the purpose of illustrating the invention, there are shown in the drawings forms which are presently preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentalities shown.

FIG. 1 is a side elevation view of one embodiment of the knee brace of the present invention.

FIG. 2 is a rear elevation view showing the knee brace on a person's knee.

FIG. 3 is a sectional view taken along the line 3-3 in FIG. 1.

FIG. 4 is a sectional view taken along the line 4-4 in FIG. 3.

FIG. 5 is a side elevation view similar to FIG. 1 but illustrating another embodiment of the present invention.

FIG. 6 is a view similar to FIG. 2 but illustrating the front of the embodiment of the present invention shown in FIG. 5.

FIG. 7 is a top plan view.

FIG. 8 is a sectional view taken along the line 8-8 in FIG. 5.

FIG. 9 is a sectional view taken along the line 9-9 in FIG. 8.

FIG. 10 is an elevation view of a modification of the upper body portion shown in FIG. 5.

Referring to the drawing in detail, wherein like numerals indicate like elements, there is illustrated a first embodiment of the present invention wherein the knee brace is designated

generally as 10. The knee brace 10 comprises an upper half designated generally as 12 and a lower half designated generally as 14, coupled together by a hinge means designated generally as 16.

The upper half 12 includes an upper body portion 18 having a downwardly extending medial leg 20 adapted to extend along the interior cartilage and ligaments of a knee joint and a shorter lateral leg 22. The body portion 18 is made from a rigid tough polymeric plastic material and may be internally reinforced with materials such as glass filaments. The body portion 18 is adapted to encircle a substantial portion of a thigh above the knee joint. Thus, the body 18 is adapted to extend around approximately 270° of the front and sides of the thigh and has rear edges which are designated as 23 and 24. When worn, the gap between the edges 22 and 24 will extend from the postera-medial to postera lateral portion of the thigh and be bridged with adhesive tape or straps as described below.

The body portion 18 may be provided with a rubber or felt lining 26 covered with leather. Lining 26 has a doughnut-shaped portion 27 adjacent the medial meniscus. A strip of elastic or tape material may be joined intermediate its ends to the body portion 18 in any convenient manner such as by rivets. Velcro portions may be fixedly secured to the body portion 18 for cooperation with the ends of said tape material to hold the body portion 18 in position on the thigh.

The lower half 14 includes a body portion 28 made from the same material as body portion 18. Body portion 28 is generally C-shaped for embracing the front of the calf with the medial portion slightly longer than the lateral portion. A lining 30, similar to lining 26, is provided on body portion 28. A tape 32 bridges the ends of body portion 28 and is releasably connected to Velcro portion 34.

The hinge means 16 includes a rivet having a head 48 and a shank 52. The head 48 is plastic coated and overlies a washer 46 which overlies the upper end of a plastic-coated connecting bar 50. The shank 52 extends through a hole in the washer 46, through a hole 54 in a bar 50, through a hole in the leg 22 and terminates in an enlarged head 56 between the leg 22 and the lining 26. The coating on bar 50 and head 48 may be made from a self-lubricating material such as Teflon, nylon or a rubberized plastic.

It will be noted that the diameter of the hole 54 is substantially larger than the diameter of the shank 52 on the rivet. See FIG. 3. The leg 22 and bar 50 may slide relative to each other in all radial directions generally parallel to the zone of overlap. In a working embodiment of the knee brace, the amount of radial movement is one-quarter inch. In addition, the shank 52 may be made long enough to enable the leg 22 to rock to a limited extent relative to bar 50. The combination of rocking and sliding as well as the pivotable movement between the upper and lower halves 12 and 14 more closely approximates the mobility factor of the knee joint. At the same time, the doughnut 27 overlies the interior cartilage and ligaments of the knee joint so as to provide protection for the same and prevent the patella from sliding inwardly. This feature provides the maximum protection for the medial structures of the knee.

The lower end of bar 50 is pivotably connected to body portion 28 by pin or rivet 58 with no play. As shown more clearly in FIG. 2, the upper and lower ends of bar 50 are offset and connected by angled portion 60 so as to prevent contact with the fibular head. A pair of straps 62 and 64 are secured to the medial leg 20 on upper body portion 18 by clamp 65. Each strap has holes 66 through which a pin 68 on bar 50 may extend. Lateral forces applied to upper body portion 18 are resisted by these straps since they are coupled to bar 50 on the opposite side of the knee brace.

In view of the above description and the illustrations in the drawing, a more detailed explanation of the manner of using the knee brace 10 of the present invention is not deemed necessary since it will be readily apparent to those skilled in the art.

In FIGS. 5—9, there is illustrated another embodiment of the present invention designated generally as 10'. The knee brace 10' is identical with the knee brace 10 except as will be made clear hereinafter. Accordingly, corresponding elements are provided with corresponding primed numerals.

A velcro portion 70 is secured to the front of upper body portion 18'. A strap 72 has one end secured to body portion 18' and angles downwardly so that its free end may attach to Velcro portion 70. A strap 74 has one end secured to body portion 18' and angles downwardly so that its free end may attach to Velcro portion 76.

The body portion 18' may have a rubber lining comparable to lining 26. A bladder 78 inflatable through valve 80 is provided along the inner surface of body portion 18'. It will be noted that the upper edges 19 and 19' of the body portions 18' and 18, respectively, slope forwardly. Like the body 18, the body portion 18' tapers in an upward direction so that the diameter of the body portion adjacent the hinge means 16' is less than it is at the upper edge of the body portion. These dimensions conform generally to the shape of a thigh. Valve 80 is of the type conventionally used in a basketball.

The hinge means 16' includes a bar 50' on the lateral side and a similar bar 82 in the medial side. Bar 82 is identical with bars 50 and 50' but has a slightly greater angled portion 84.

Elastic tape 32' is coupled to the body portion 28' at the middle thereof. One end 86 of tape 32' extends through a slit 88 in the other end 90. The ends 86 and 90 then extend around the body portion 28' so as to be releasably and adjustably coupled to the Velcro portion 34' which is secured to the front of body portion 28'. In doing so, ends 86 and 90 overlies the lower ends of bars 50' and 82. See FIG. 6.

In each embodiment, the upper half may pivot with respect to the lower half through an arc of at least 270°. In each embodiment the elastic tape material on the upper body encircles the entire thigh so that the knee brace can be applied tightly notwithstanding any minor variations between the shape of the thigh and the shape of the upper body portions 18 and 18'. The mobility of the knee braces and their lightweight make them comfortable to wear. The significance of their weight will be apparent from the fact that operative embodiments as disclosed herein weigh only one pound.

Body portions 28 and 28' are each swiveled to its bar 50, 50', 82 by a rivet so that the lower body portion may be self-accommodating to the calf. The body portions 18, 18', 28, 28' may be made from a reinforced polycarbonate such as Lexan, nylon, polyurethane, etc. Lexan is a trademark for a commercially available thermoplastic carbonate-linked polymer produced by reacting bisphenol A and phosgene.

In knee brace 10, the laterally positioned bar 50 has a pulling effect on the medially positioned doughnut portion 27, effected by way of the straps 62 and 64, to pull portion 27 against the medial surface of the knee with a circular contact area and without applying pressure on the medial knee. In knee brace 10', movement of the leg causes the bladder 78 to deform in shape and conform to the space between the body portion 18' and the thigh. The bladder 78 is generally of uniform cross section when the leg is straight. As the leg is bent at the knee, the cross section of the bladder 78 increases at the knee adjacent the lower edge of the body portion 18' and becomes thinner at the upper edge of the body portion 18'. Bladder 78 may be provided on body portion 18.

The knee brace 10' is designed to provide protection against injuries while providing for maximum mobility of the wearer. Knee brace 10' is designed to provide for protection the wearer has already received a moderate or severe sprain to the ligament and due to its double-bar construction will result in lesser mobility as compared with knee brace 10. In each embodiment, the medial leg 20 or 20' is longer than the lateral leg 22 or 22'. The bladder 78 is preferably used on a knee brace such as knee brace 10' designed to be utilized by a wearer who has already received an injury since the bladder provides for further protection due to the cushioning effect obtained thereby. The knee brace 10 and 10' are preferably

applied over a cotton stocking 92 which extends from above edge 19, 19' to the lower half 14, 14'.

In FIG. 10, the body 18' has been modified so as to relocate the position of the Velcro portions 70' and 76'. These Velcro portions are disposed so that the straps 72' and 74' may extend directly across the gap at the back of the body portion 18' instead of crisscrossing as shown in FIGS. 5 and 6. Otherwise, the embodiment of FIG. 10 is identical with that illustrated in FIGS. 5—9.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and hereinafter, lining 26 and/or bladder 78 may be referred to as a cushion means.

We claim:

1. A knee brace comprising, a stiff upper portion to encircle a substantial portion of the thigh, means for holding said upper portion on the thigh, said upper portion having at least opposed inwardly and outwardly positioned sections when worn on a knee, said inwardly positioned section depending below said outwardly positioned section to define a leg that will be along the medial cartilage or ligament of the knee joint, cushion means on the inner surface of said upper portion, a stiff lower portion to encircle a substantial portion of the calf, means for holding said lower portion on the calf, said lower portion having at least opposed inwardly and outwardly positioned sections, an elongated bar having one end pivotally connected to said outer section of said lower portion and having its other end connected adjacent the lower end of said outer section of said upper portion for sliding and pivotal movement relative thereto, means on said elongated bar adjacent said stiff lower portion for engaging flexible strap means, and flexible strap means fixed to said inwardly positioned section of the upper portion and being releasably connected to said strap engaging means.

2. A device as defined in claim 1 wherein, said cushion means includes a doughnut-shaped portion adjacent said inwardly positioned leg to lie against the knee joint, said strap means and said doughnut-shaped portion cooperating to provide lateral support for said knee joint.

3. A device as defined in claim 1 wherein, said elongated bar has a section extending downwardly from said upper portion then a portion angled downwardly and outwardly away from said knee joint and finally a portion connected to said angled portion and extending downwardly toward said lower portion.

4. A knee brace comprising a stiff upper portion to encircle a substantial portion of the thigh, means for holding said upper portion on the thigh, said upper portion having at least opposed inwardly and outwardly positioned sections when worn on a knee, said inwardly positioned section depending below said outwardly positioned section to define a leg that will be along the medial cartilage or ligaments of the knee joint, cushion means on the inner surface of said upper portion, a stiff lower portion to encircle a substantial portion of the calf, means for holding said lower portion on the calf, said lower portion having at least opposed inwardly and outwardly positioned sections, an elongated bar having one end pivotally connected to said outer section of said lower portion and having its other end connected adjacent the lower end of said outer section of said upper portion for sliding and pivotal movement relative thereto, a second elongated bar having one end pivotally connected to said upper portion of said depending leg at a point substantially opposite the lower end of said outer section of said upper portion and having its other end pivotally connected to said inner section of said lower portion so that said first and second elongated bars cooperate to support said knee joint against lateral displacement.

5. A device as defined in claim 4 wherein, said cushion means includes a doughnut-shaped portion adjacent said inwardly positioned leg to lie against the knee joint, said strap means and said doughnut-shaped portion cooperating to provide lateral support for said knee joint.

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6. A device as defined in claim 4 wherein, said cushion means is an inflatable bladder, a valve supported by said upper portion for enabling said bladder to be inflated and said bladder extends to at least the lower edge of said upper portion.

7. A device as defined in claim 5 wherein, said first elongated bar depends downwardly from said upper portion, then

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outwardly away from said knee joint and again downwardly toward said lower portion, and said second elongated bar depends downwardly from said upper portion, then inwardly toward said knee joint and again downwardly toward said lower portion.

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