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1,772,923	8/1930	Volz.....	2/22
1,931,524	10/1933	Becket	2/22
2,661,000	12/1953	Gazeley et al.	128/88
2,733,443	2/1956	Holder	2/22
2,959,168	11/1960	Shoor	2/22X
3,350,719	11/1967	McClure, Jr.....	128/80X
3,387,305	6/1968	Shafer	128/80X

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[54] **KNEE BRACE**
7 Claims, 9 Drawing Figs.

[52] **U.S. Cl.**..... **128/80,**
2/22

[51] **Int. Cl.**..... **A61f 3/00**

[50] **Field of Search**..... **128/80, 87,**
88, 89, 165; 2/22, 62; 3/2, 22; 287/28, 99, 14, 101

[56] **References Cited**
UNITED STATES PATENTS

2,460,895	2/1949	Meany.....	128/80
859,962	7/1907	Messersmith.....	128/88
901,592	10/1908	Clegg	54/82
1,466,487	8/1923	Shaffer.....	128/88
1,622,211	3/1927	Sheehan.....	2/22

ABSTRACT: A knee brace is disclosed which closely simulates the rocking-hinge joint motion and sliding motion of a knee. The knee brace is comprised of an upper rigid body and a lower rigid body, each having legs pivotably coupled together in a manner so that the legs may pivot relative to each other about an axis generally perpendicular to the zone of overlap and may slide relative to each other in all radial directions generally parallel to the zone of overlap. In one embodiment, the legs may also pivot toward and away from one another. The knee brace may be worn under the pants of the wearer who may run, walk, or sit down without giving any indication that he is wearing a knee brace.

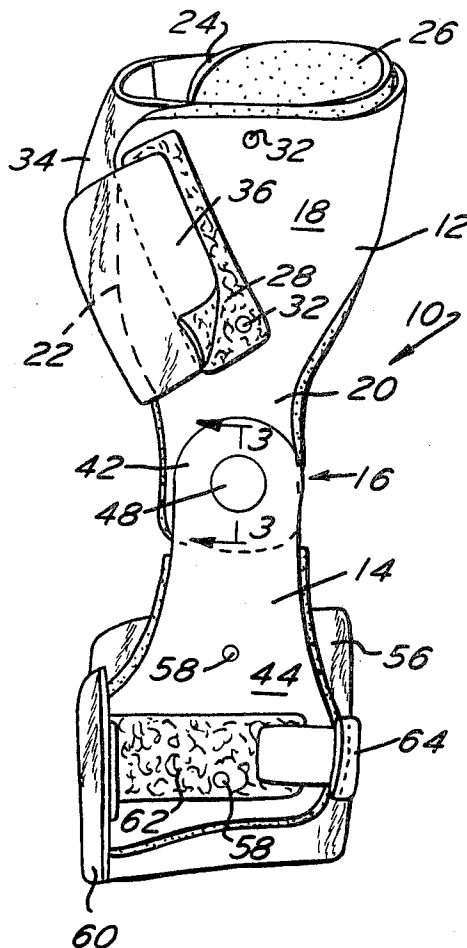


FIG. 1

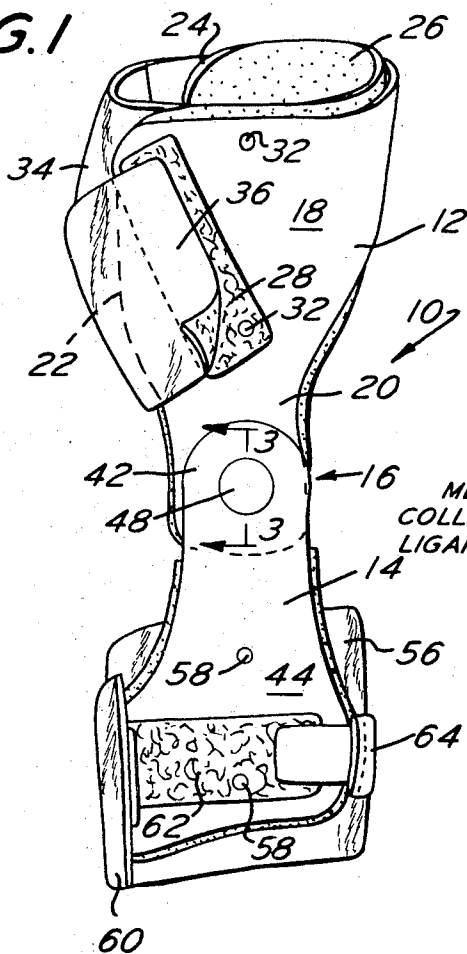


FIG. 2

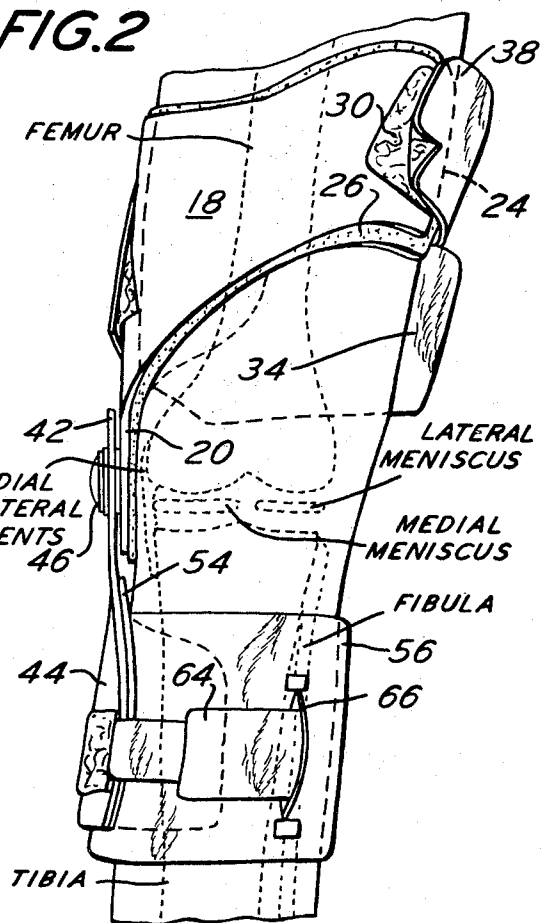


FIG. 3

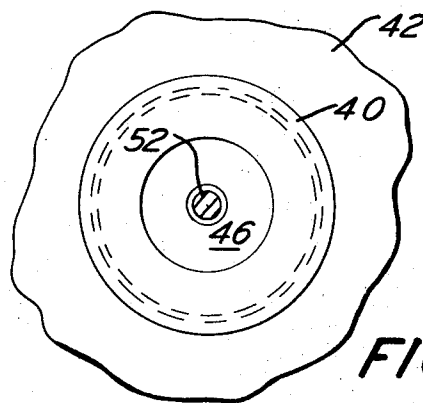
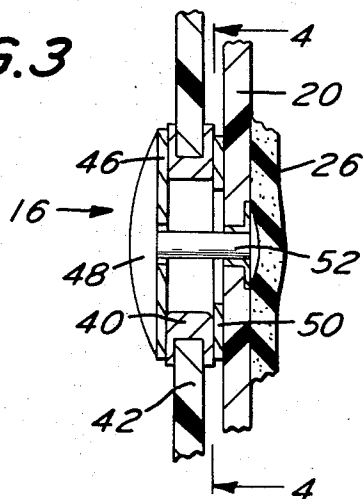


FIG. 4

FIG. 9



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FIG. 5

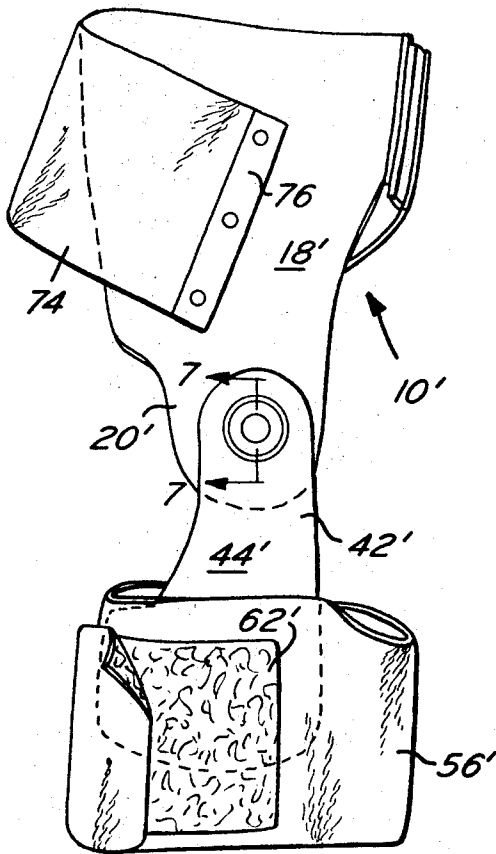


FIG. 6

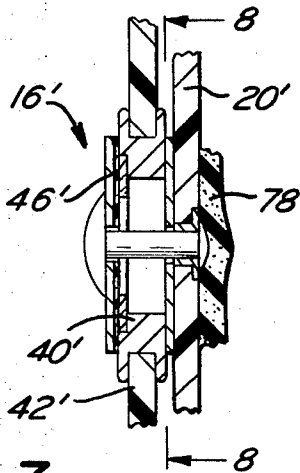
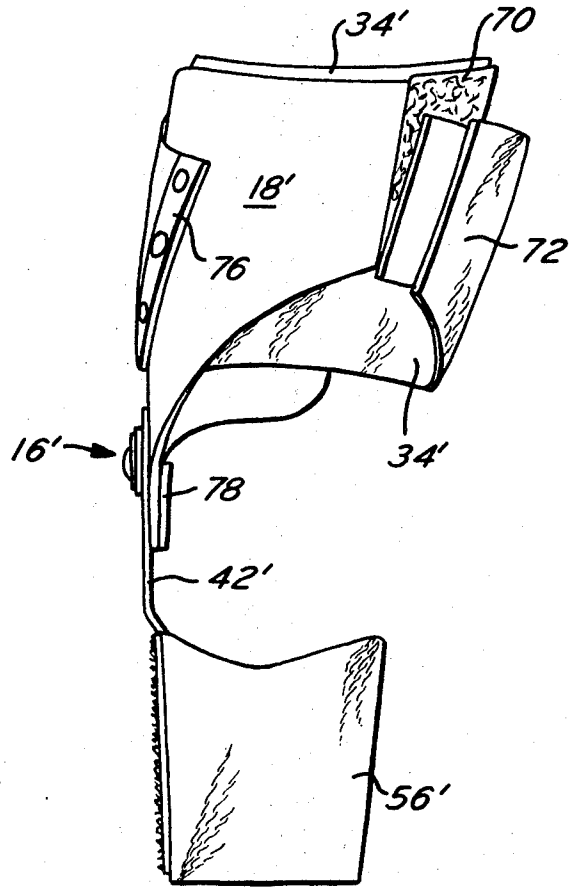
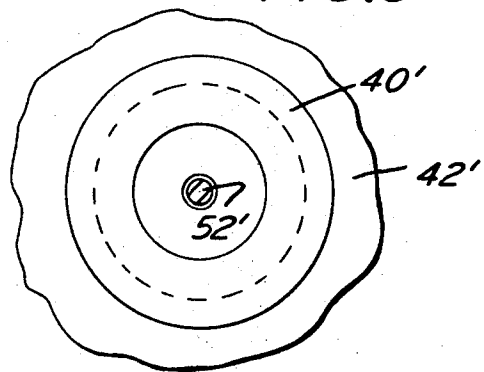


FIG. 7

FIG. 8



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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 area. 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 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 provide 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 fiber glass 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.

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 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 side elevation view similar to FIG. 1 but with the knee brace rotated 90°.

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 another embodiment of the present invention.

FIG. 7 is a sectional view taken along the line 7-7 in FIG. 5.

FIG. 8 is a sectional view taken along the line 8-8 in FIG. 7.

FIG. 9 is a sectional view of a portion of a leg in accordance with another embodiment.

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 a body 18 having a downwardly extending leg 20 adapted to extend along the interior cartilage and ligaments of a knee joint. The body 18 is made from a rigid tough polymeric plastic material and may be internally reinforced with materials such as glass filaments. The body 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 thigh and have front edges which are designated as 22 and 24. When worn, the gap between the edges 22 and 24 will extend from the anterolateral to posterolateral portion of the thigh.

The body 18 may be provided with a rubber lining 26. A strip of elastic material 34 is joined intermediate its ends to the body 18 in any convenient manner such as by rivets 32. One end 36 of material 34 is removably and adjustably connected to the body 18 at mating Velcro portions. One Velcro portion designated 28 is fixedly secured along the interior portion of the body 18 as shown more clearly in FIG. 1. The material 34 is preferably a heavy gauge material having a thickness of approximately one-sixteenth of an inch.

The end 38 of the material 34 is adapted to cooperate with Velcro portion 30 on the body 18 adjacent front edge 24. The construction and arrangement for the material 34 is designed so as to enable the wearer to apply the knee brace without any external assistance and to enable him to adjust the tightness to suit his comfort and facilitate bridging the gap between the front edges 22 and 24 on the body 18. It will be noted that the Velcro portions 28 and 30 are disposed at an acute angle with portion 30 being at an elevation which is above the elevation of portion 28. As a result thereof, the material 34 will have its ends crisscrossing each other directly above and lateral to the knee cap.

The lower half 14 includes a body 44 made from the same material as body 18. Body 44 has an upwardly extending leg 42 which overlaps the terminal end of leg 20. A grommet is provided within a hole in the leg 42 at the zone of overlap. A washer 46 overlies the adjacent surface on grommet 40.

The hinge means 16 includes a rivet having a head 48 and a shank 52. The head 48 overlies a substantial portion of the washer 46. The shank 52 extends through a hole in the washer 46, through the hole defined by the inner periphery of the grommet 40, through a hole in a washer 50, through a hole in the leg 20 and terminates in an enlarged head between the leg 20 and the rubber lining 26. Washers 46 and 50 are preferably made from a self-lubricating material such as Teflon.

It will be noted that the diameter of the inner periphery of the grommet 40 is substantially larger than the diameter of the shank 52 on the rivet. See FIG. 4. The legs 20 and 44 may slide relative to each other in all radial directions generally parallel to the zone of overlap as indicated by the arrows in FIG. 4. In a working embodiment of the knee brace, the amount of movement in the directions is one-fourth inch in each direction. In addition, the shank 52 may be made long enough to enable the leg 42 to rock to a limited extent as indicated by the arrows in FIG. 3. 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 legs 20 and 44 overlie 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 body 44 on the lower half 14 encircles a substantial portion of the calf, such as a distance of approximately 120 arcuate degrees. The remainder of the calf is encircled by a material 56 corresponding to the material 34. Material 56 is secured intermediate its ends to the body 44 by rivets 58. The rivets 58 will extend through the rubber lining 54 on the body 44. One end of the material 56 is adjustably and releasably coupled to the body 44 at the Velcro portion 62. The other end of the material 56 includes a tongue 64 extending through a slot 66 in the material 56 and likewise is releasably and adjustably coupled to the Velcro portion 62.

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—8, 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 stitched to one end of the material 34' so as to define a pocket. One end portion of the body 18' extends into the pocket. The material 34' encircles the inner periphery of the body 18' and has a free end portion 72 releasably and adjustably coupled to the Velcro portion 70. In addition, a strip of elastomeric material 74, similar to material 34, has one end 76 riveted to the body 18'. The other end of the material 74 is releasably and adjustably coupled to the material 34' intermediate the front edges on the body 18'.

The body 18' does not have a rubber lining comparable to lining 26. Instead, a cushion or pad 78 is provided along the inner surface of leg 20'. It will be noted that the upper edges of the body 18' are generally in the same plane. Like the body 18, the body 18' tapers in an upward direction so that the diameter of the body adjacent the hinge means 16' is less than it is at the upper edge of the body. These dimensions conform generally to the shape of a thigh.

The hinge means 16' utilizes a flat grommet 40' and a flat washer 46' so that the legs 20' and 42' may only pivot and slide but may not rock relative to each other. Thus, the relationship between the diameter of the shank 52' and the inner periphery of the grommet 40' is the same as that described above.

The elastic material 56' which is releasably coupled to the body 44' is doubled back on itself and partially stitched so as to define a pocket. The body 44' extends into the pocket. The free end of the material 56' is releasably and adjustably coupled to the Velcro portion 62' which is stitched to one of the layers of the material 56'.

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 Flexible elastic 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 bodies 18 and 18'. The mobility of the knee braces and their light weight make them comfortable to wear. The significance of their weight will be apparent from the fact that operative embodiments as disclosed herein weigh only 1 pound.

In either embodiment, the lower leg, such as leg 42, may be a plastic coated rigid metal leg 70 as shown in FIG. 9. Also, the body, such as body 44, may be swiveled to its leg by a rivet so that the lower body may be self-accommodating to the calf. The body on the halves may be made from a 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.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof and, accordingly, reference should be made to the appended claims, rather than to the foregoing specification as indicating the scope of the invention.

We claim:

1. A knee brace comprising a stiff upper body for encircling a substantial portion of the thigh, said upper body having a downwardly extending leg adapted to extend along the medial cartilage or ligaments of the knee joint, a stiff lower body for encircling a substantial portion of a calf, said lower body having an upwardly extending leg which overlies said upper leg, hinge means joining said legs so that the legs may slide in all radial directions generally parallel to their zone of overlap and pivot with respect to each other about an axis generally perpendicular to their zone of overlap, said hinge means including a grommet on one leg, a rivetlike member having a shank extending through the grommet, the inner diameter of the grommet being at least twice the diameter of the shank.

2. A knee brace in accordance with claim 1 wherein said upper and lower bodies are made from a rigid polymeric plastic material, and a free end of each strip of flexible material being releasably coupled at an area juxtaposed to a surface of said bodies.

3. A knee brace in accordance with claim 1 wherein said upwardly extending leg is metal coated with a polymeric plastic.

4. A knee brace in accordance with claim 1 wherein one of said bodies has an end disposed within a pocket on the flexible material associated therewith.

5. A knee brace in accordance with claim 1 including a rubber lining on each body, and each of said strips of flexible material being elastomeric, and said bodies being made from a polycarbonate.

6. A knee brace in accordance with claim 4 wherein each body has a portion disposed within a pocket on each strip of flexible material for ease of assembly and replacement of the strips of material.

7. A knee brace comprising an upper body for encircling at least a substantial portion of a thigh, said upper body having a connecting portion adapted to extend along the medial cartilage or ligaments of the knee joint, a lower body for encircling at least a substantial portion of a calf, said lower body having a connecting portion which overlies said upper body connecting portion, hinge means joining said connecting portions so that they may slide in all radial directions generally parallel to their zone of overlap and pivot with respect to each other about an axis generally perpendicular to their zone of overlap, said hinge means including a grommet on one connecting portion, a pin having its shank extending through the grommet, the inner diameter of the grommet being at least twice the diameter of the shank so that the connecting portions may slide in all radial directions until said shank contacts the inner surface of said grommet, and said connecting portions being pivotable about the longitudinal axis of said pin.

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