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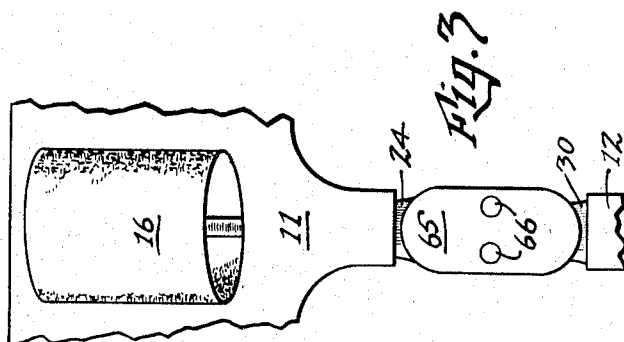
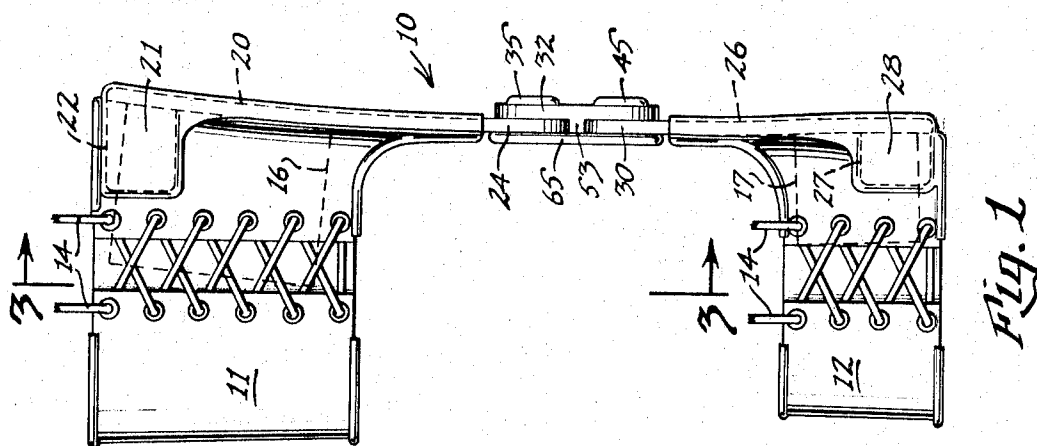
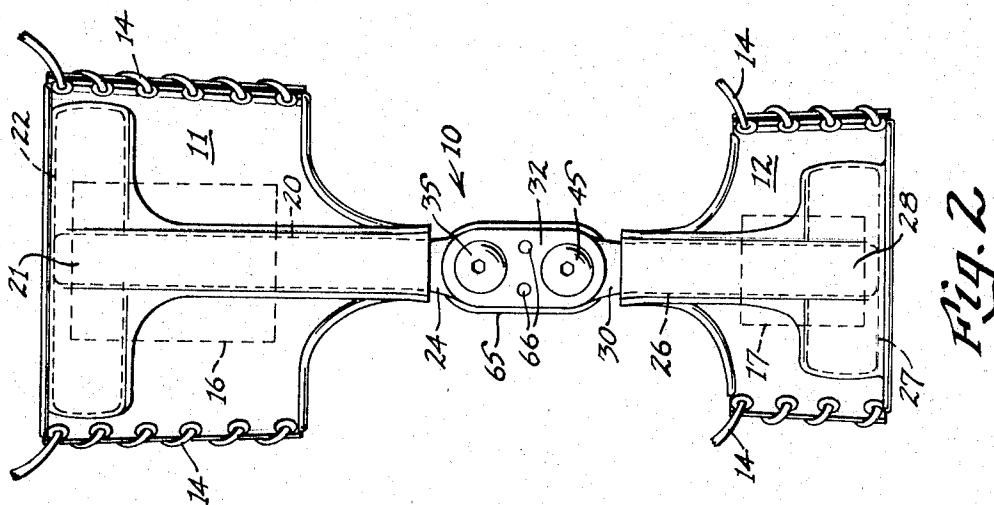
C. C. MCCLURE, JR

3,350,719

KNEE BRACE

Filed Sept. 20, 1965

2 Sheets-Sheet 1



INVENTOR:
CHRISTOPHER C. McCURE, JR.
BY *Harrington A. Lackey*
ATTORNEY

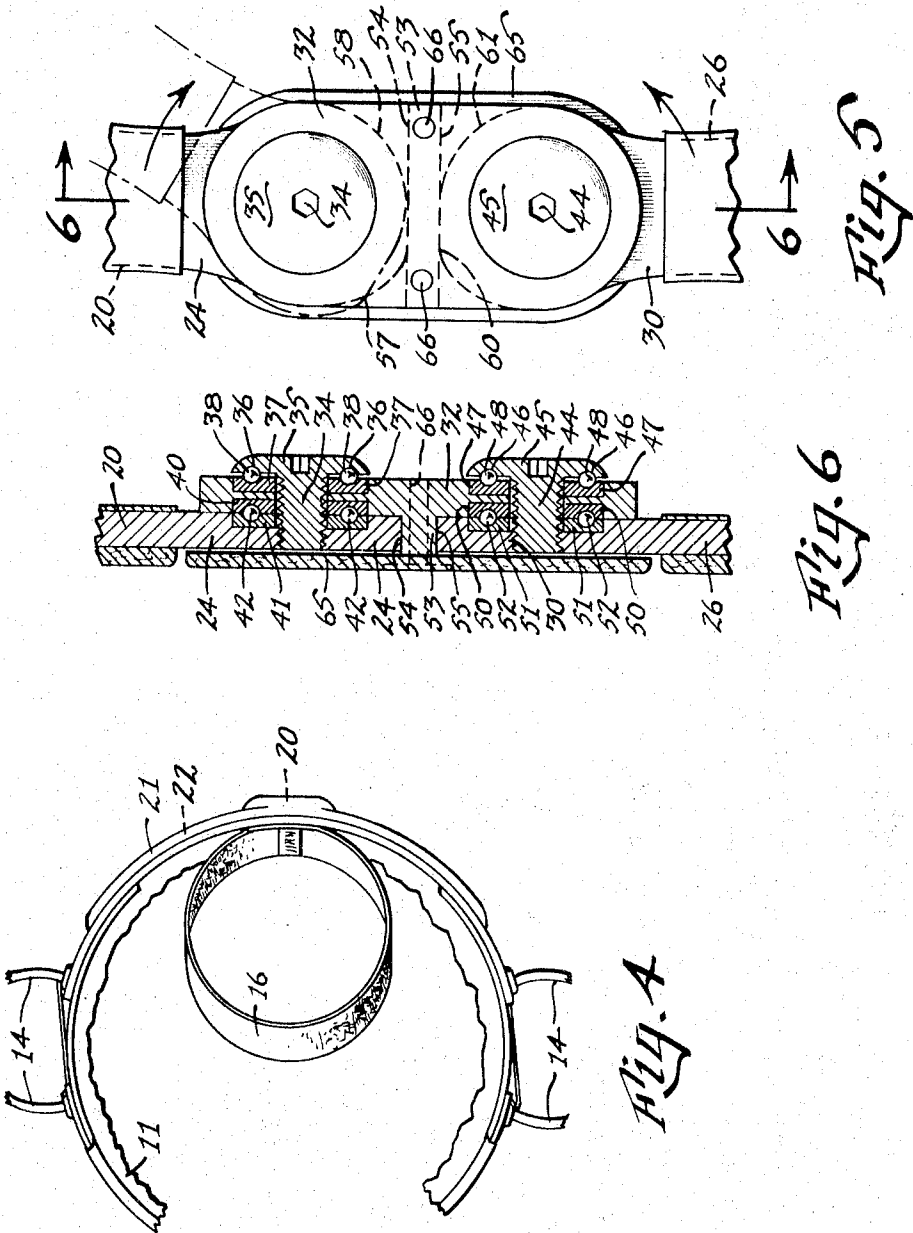
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2 Sheets-Sheet 2



INVENTOR:
CHRISTOPHER C. McCLURE, JR.
BY *Harrington A. Lackey*
ATTORNEY

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KNEE BRACE

Christopher C. McClure, Jr., 1903 Hayes St.,
Nashville, Tenn. 37203

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ABSTRACT OF THE DISCLOSURE

A knee brace having a single upper bar and a single lower bar and a link bar pivotally joined at each end to the respective lower end of the upper bar and upper end of the lower bar on the outside thereof, and an upper cuff and a lower cuff for securing, respectively, the upper and lower brace bars to the outside of the thigh and calf, respectively, of a wearer.

This invention relates to a knee brace, and more particularly to a protective knee brace for the prevention of injury to the knee.

Heretofore, knee braces have been primarily designed and used for the correction of injuries and disease to the knee. Moreover, prior knee braces have employed brace members on both sides of the knee, and have comprised upper and lower brace members, the ends of which are connected in the region of the knee by a single pivotal joint or hinge.

It is therefore an object of this invention to provide a knee brace for protecting the knee from injury, and at the same time, to provide maximum freedom of knee action.

Another object of this invention is to provide a knee brace having articulated brace members which will afford lateral stability to the knee, without sacrificing true knee action.

A further object of this invention is to provide a protective knee brace having an upper brace member secured to the thigh and a lower brace member secured below the knee, both brace members being connected by a double hinge member.

Further objects of the invention will be apparent from the following description taken in conjunction with the drawings, wherein:

FIG. 1 is a front elevation of the invention as used on the left leg of the wearer;

FIG. 2 is a left side elevation of the invention disclosed in FIG. 1;

FIG. 3 is a section taken along the line 3-3 of FIG. 1;

FIG. 4 is a fragmentary top plan view of the invention;

FIG. 5 is an enlarged fragmentary left side elevation of the double hinged connection; and

FIG. 6 is a section taken along the line 6-6 of FIG. 5.

Referring now to the drawings in more detail, the knee brace 10 includes an upper or thigh cuff 11 and a lower or calf cuff 12. These cuffs 11 and 12 may be made of leather, or any other suitable flexible material for wrapping around the leg of the wearer above and below the knee. The cuffs 11 and 12 disclosed in the drawings comprise two halves provided with eyelets secured together by the lacing 14. As additional protection and comfort to the leg of the wearer, a knitted elastic sleeve 16 may be secured in the upper cuff 11 for fitting around the thigh, and a similar knitted sleeve 17 may be provided in the lower cuff 12 to fit around the lower portion of the leg below the knee.

A substantially flat upper brace bar 20 is protectively secured within a padded covering 21, made of leather or plastic, along the outside of the upper cuff 11. The upper portion of the brace bar 20 is fixed to a transverse arcuate reinforcing bar 22 also secured to the outside of

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the cuff 11 by the protective covering 21. The upper brace bar 20 depends from the upper cuff 11 and terminates in an enlarged circular lower end 24.

In a similar manner, a substantially flat lower brace bar 26, having a transverse arcuate reinforcing bar 27, is secured to the outside of the lower cuff 12 by a padded covering 28. Both coverings 21 and 28 may be secured to their respective cuffs 11 and 12 by any convenient means, such as stitching, adhesives or fusion. The lower brace bar 26 projects upwardly from the cuff 12 in substantially the same plane as the upper brace bar 20, and terminates in an enlarged circular upper end 30.

A link bar 32 is mounted to overlap the outside surfaces of the upper bar 20 and the lower bar 26. An upper pivot pin 34 extends through a mating opening in the upper end of the link bar 32 and threadedly engages, or is otherwise fixed into, the lower end 24 of the upper brace bar 20, so that the center of the circular lower end 24 is coaxial with the axis of the pivot pin 34. As best disclosed in FIG. 6, the upper pivot pin 34 may be provided with a head or cap 35 having an inner annular groove 36 opposing an annular raceway 37 inset in the outer surface of the upper end of link bar 32 for supporting ball bearings 38. In a similar manner, inset annular raceways 40 and 41 may be provided in opposing surfaces on the inside of the link bar 32 and the outside of the lower end 24 of the upper brace bar 20 for receiving ball bearings 42.

In a similar manner, a lower pivot pin 44 having a head 45 is provided with an annular groove 46 opposing an inset annular raceway 47 in the outer surface of the link bar 32 to receive the ball bearings 48. The pivot pin 44 extends rotatably through a mating opening of the link bar 32 and is secured in threaded engagement with the upper end 30 of the lower brace bar 26. The annular raceway 50 inset in the inner surface of the link bar 32 and the annular raceway 51 inset in the outer surface of the upper end 30 of the lower brace bar 26 are adapted to receive the ball bearings 52. The pivot pins 34 and 44 provide a double hinge joint connecting the upper brace bar 20 and the lower brace bar 26 through the link bar 32.

Extending inwardly from and transversely of the link bar 32 is a ledge 53 having an upper surface 54 and a lower surface 55. The ledge 53 is adapted to extend into the space between the lower end 24 and the upper end 30. The lower end 24 is provided with an eccentric portion or stop segment portion 57, which is flat and extends outwardly from the intersection of the longitudinal axis of the upper brace bar 20 with the circular portion 58, with gradually increasing radii. The distance between the upper surface 54 and the center of the lower end 24 is approximately equal to the radius of the circular portion 58, so that the circular portion 58 may clear or easily ride over the upper surface 54 as the brace bar 20 is pivoted about the pivot pin 34. However, when the brace bar 20 is longitudinally aligned with the link bar 32, the stop portion 57 engages the upper surface 54 to prevent any further rotation in a counter-clockwise direction, as disclosed in FIG. 5.

In a similar manner, the upper end 30 is provided with a stop portion or segment 60 which is also flat and gradually increases radially from the circular portion 61 from a point on the longitudinal axis of the brace bar 26 to perform the same function as the stop portion 57. The stop portions 57 and 60 are so positioned on their respective ends 24 and 30, that the pivotal movements of the brace bars 20 and 26 are limited when they have been rotated to a longitudinally aligned position simulating the thigh and calf of the leg when they are aligned in standing position. However, the pivotal movement of

the brace bars 20 and 26 in the opposite direction is limited only by the flexural limits of the knee.

The insides of the brace bars 20 and 26 are padded by the cuffs 11 and 12, by the cuff extensions, and by the coverings 21 and 28. Moreover, the insides of the lower ends 24 and 30 are covered by a soft leather pad 65 which is secured to the ledge 53 by pins or rivets 66.

The knee brace 10 is preferably used by athletes, such as football players, in order to protect their knees against pulled ligaments and torn cartilages, which are frequently caused by blows against the sides of the knees and by twisting.

For these purposes, it has been found that a single brace bar 20 secured above the knee and a single brace bar 26 secured below the knee, and double-hinged to the outside of the knee are more than ample to afford the necessary protection. By eliminating the inside brace bars, the side of each knee is protected from injury from the brace bar on the inside of the opposite knee, and there is greater freedom of knee action for running.

The double hinge action provided by the knee brace 10 in which the pivot pins 34 and 44 are approximately laterally aligned with the pivotal portions of the end of the femur and the end of the tibia, respectively, affords a very accurate approximation of the true knee action. In the human knee, the end of the femur and the end of the tibia terminate in cartilages, which are separated by a joint space and lubricated, and secured by ligaments. These joint ends and joint space are covered or enclosed by an articular capsule. Thus, in this knee brace, the upper brace bar 20 simulates the action of the femur and the lower brace bar 26 simulates the action of the tibia. The link bar 32 spans the joint space and is connected to each brace bar 20 and 26 by separate pivot pins 34 and 44 in order to simulate the double-hinge action of the knee.

The stop portions 57 and 60 on their respective ends 24 and 30 further simulate the upright pivotal limit of the knee and leg.

The knee brace 10 may be worn by loosening the laces 14 and inserting the leg through the sleeves 16 and 17 until the sleeve 16 is fitted on the thigh slightly above the knee, and the sleeve 17 is fitted around the portion of the leg below the knee. The link bar 32 is located opposite the knee so that the pivot pins 34 and 44 are substantially laterally aligned with the corresponding joint ends of the femur and the tibia. The cuffs 11 and 12 are then secured about their corresponding sleeves 16 and 17 by means of tightening and tying the laces 14. The brace bars 20 and 26 are so mounted that they extend along the outside of the leg. The knee brace 10 may be removed from the leg by merely reversing the steps for putting on the knee brace.

This knee brace is such an improvement over prior devices, that it has already proved highly satisfactory in reducing injuries to the knee by football players wearing the device. Moreover, the device 10 so closely approximates true knee action, that a runner wearing the knee brace has been clocked in running the 100-yard dash in the same time as he runs the 100-yard dash without the knee brace.

It will therefore be apparent to those skilled in the art that various changes may be made in the invention without departing from the spirit and scope thereof, and therefore the invention is not limited by that which is shown in the drawings and described in the specification, but only as indicated in the appended claims.

What is claimed is:

1. A knee brace comprising:

- (a) a single flat upper brace bar having an inside and an outside, and a lower end and a free upper end,
 - (b) a single flat lower brace bar having an inside and an outside, and an upper end and a free lower end,
 - (c) a flat link bar having first and second ends,
 - (d) an upper pin pivotally connecting the first end of said link bar against the outside of the lower end of said upper brace bar,
 - (e) a lower pivot pin pivotally connecting the second end of said link bar against the outside of the upper end of said lower brace bar, so that said upper and lower brace bars will pivot in substantially the same plane and said link bar overlaps the outside only of both said brace bars,
 - (f) stop means on the inside of said link bar between said brace bars to limit the pivotal movement of said brace bars in one direction to an angle of approximately 180° apart,
 - (g) said upper end of said upper brace bar comprising an arcuate transverse bar, concave inward, and terminating in free extremities,
 - (h) an upper cuff fixed to said upper brace bar and said upper transverse bar, said upper cuff being adapted to be secured about the thigh of a wearer so that said upper brace bar fits on the outside of said thigh,
 - (i) said lower end of said lower brace bar comprising an arcuate transverse bar, concave inward, and terminating in free extremities,
 - (j) a lower cuff fixed to said lower brace bar and said lower transverse bar, said lower cuff being adapted to be secured about the calf of a wearer so that said lower brace bar fits on the outside of said calf.
2. The invention according to claim 1 in which no portion of said stop means of or said link bar project inwardly beyond the inside flat surfaces of said upper and lower brace bars, and further comprising a substantially flat padded member secured to said link bar and covering the insides of the lower end of said upper brace bar, and the upper end of said lower brace bar.

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JORDAN FRANKLIN, *Primary Examiner*.

60 J. R. BOLER, *Assistant Examiner*.