June 11, 1968 C. E. SHAFER 3,387,305

KNEE PROTECTOR

Filed Feb. 9, 1966

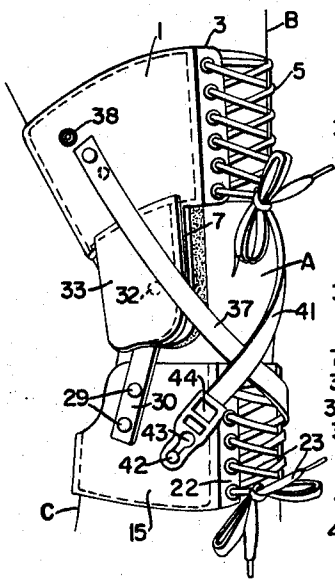


FIG. 1.

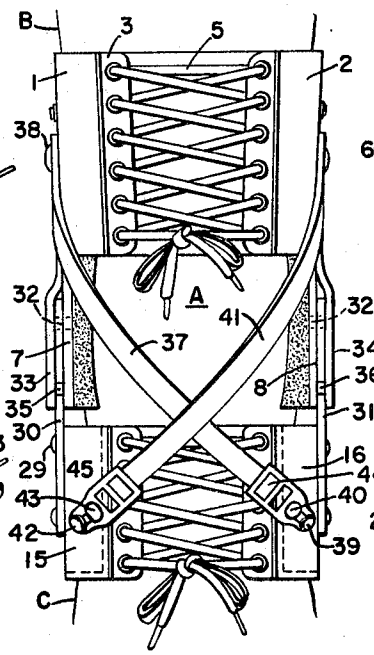


FIG. 2.

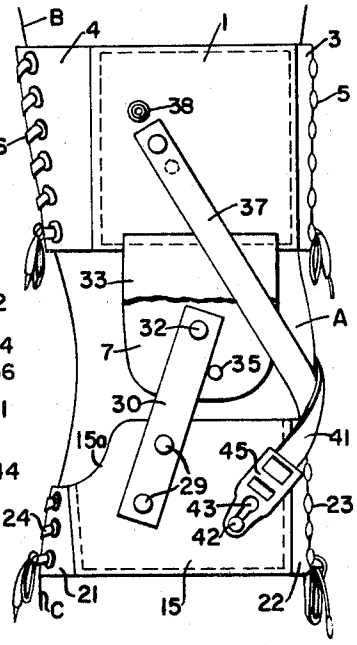


FIG. 3.

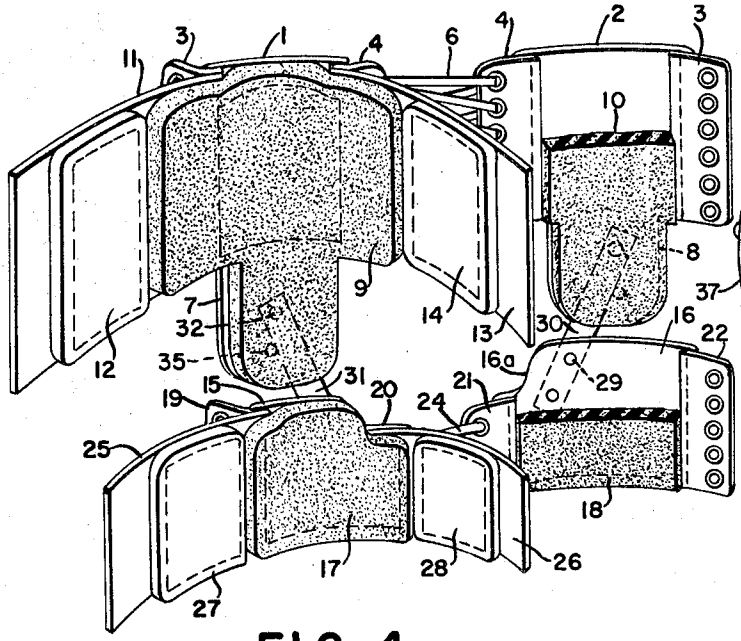


FIG. 4.

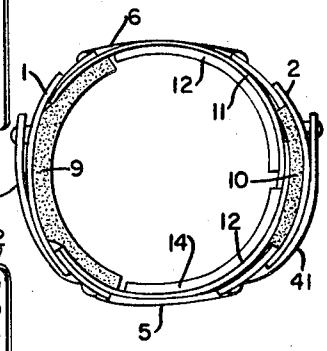


FIG. 5.

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KNEE PROTECTOR

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ABSTRACT OF THE DISCLOSURE

A knee protector comprising bands of rigid material adapted to encircle the leg above and below the knee, and a pair of inextensible straps having their ends secured to said respective bands, the straps freely crossing each other at a point just below the knee cap. The protector also includes a rigid portion extending downwardly from the upper band alongside the knee at each side.

This invention relates to knee-braces or protectors, and more particularly to devices of this kind designed to be worn by athletes, such as football players, to prevent injury to their knees.

An object of the invention is to provide equipment of this character which, while permitting normal flexure of the knee joint, will protect this joint from being damaged by lateral pressure or blows, and can be adjusted to regulate vertical as well as lateral pressure to prevent the joint from being forced apart.

Another object is to provide equipment of this nature embodying means to insure against hyper-extension of the knee joint.

A still further object of the invention is to devise a brace of this character which will prevent spreading of the knee joint and stretching of the medial collateral ligament which holds the knee capsule together.

I achieve these objects by applying to the user's leg both above and below the knee, encircling bands in the nature of pivotally connected rigid plates, and by providing a pair of inextensible straps adjustably secured to and extending from one band to the other and crossing each other adjacent the knee cap.

In order that the invention may be clearly understood, reference is had to the accompanying drawings, forming parts of this specification, and in which:

FIG. 1 is a perspective view of my improved brace as it appears when fitted to the leg of a wearer;

FIG. 2 is a front view thereof;

FIG. 3 is a side view thereof;

FIG. 4 is a perspective view of the brace in open condition, readily to be applied, parts being broken away; and

FIG. 5 is a plan view of the device as it appears in FIG. 2, parts being omitted.

Referring to the drawing in detail, the knee protector comprises an upper band, adapted to encircle the leg of the user above the knee, and a lower band, adapted to encircle the leg below the knee. As shown in the drawing, these bands are spaced apart vertically a sufficient distance to permit free flexing movement of the knee joint.

The upper band comprises a pair of rigid plates **1** and **2**, each curved to conform to the contour of the leg. These plates may be formed of light metal or other suitable material, but are preferably molded of plastic, of substantial thickness.

To the vertical oposing edges of thees two plates, are secured as by stitching, a pair of lacing strips **3**, at the front, and a pair of lacing strips **4** at the back, through the eyelets of which pass lacings **5** and **6**, respectively. It will thus be understood that these lacings constitute adjustable means for causing the band to grip the leg more or less tightly, as required.

The plates **1** and **2** are each formed with a rigid portion **7** and **8**, respectively, extending downwardly alongside the wearer's knee and having rounded lower edges, and on the inside, both thep lates and the downwardly extending portions are lined, as by cementing, with heavy cushions **9** and **10**, respectively, formed of foam rubber, or the like.

Attached to the side edges of the plate **1**, preferably by the same stitching as holds the eyelet strips **3** and **4**, are flexible extensions or flaps **11** and **13**, adapted to wrap around the leg, and to these flaps is secured suitable padding **12** and **14**, respectively.

The lower band also comprises a pair of rigid plates, designated **15** and **16**, likewise conformed more or less to the contour of the leg. The inside of these plates is lined with heavy cushions **17** and **18**, respectively, and to the side edges of the plate **15** are secured, as by stitching, eyelet strips **19** and **20**, and to the side edges of the plate **16**, eyelet strips **21** and **22**. Lacings **23** and **24** pass through the eyelets of strips **19** and **22** on the one hand and strips **20** and **21** on the other, and serve to adjustably bind the lower plates to the leg.

The top edge of these plates is cut away at the rear, as indicated at **16***a*, so as not to interfere with the bending of the knee. Attached to the side edges of the plate **15** are also flexible flaps **25** and **26**, preferably secured by the same stitching as holds the eyelet strips. To the inside of the flaps **25** and **26** are secured, as by cementing, suitable padding **27** and **28**, respectively. In FIG. 4 the cushions **10** and **18** are broken away to show the plates.

Fastened rigidly to each of the lower plates **15** and **16**, as by means of rivets **29**, is an upwardly extending arm **30**, **31**, respectively, which arms are pivotally connected at their upper ends, as by means of pivot **32**, to the downwardly extending portions **7** and **8** of the upper plates **1** and **2**. Preferably, a protecting cover **33**, **34** overlies these pivots.

Fixed stop pins **35** and **36** are carried by the downwardly extending portions **7** and **8**, in a position to engage the edges of arms **30** and **31**, respectively, to limit their swinging movement about the pivots **32**. In this way, hyper-extension of the knee joint is prevented. The pivots **32** are, of course, substantially in transverse alignment with the knee joint.

Inextensible straps **37** and **41** have their upper ends attached to the upper plates **1** and **2**, respectively, as by means of any desired one of a plurality of snap fasteners **38**. These straps extend downwardly at an angle and cross each other at a point just below the knee cap of the wearer, as clearly shown in FIGS. 1, 2 and 3. It will be noted that these straps are completely free and unconfined at their crossing point, thus permitting full flexing of the knee. The lower ends of these straps are fitted into adjustable buckle members **44** and **45**, respectively. The buckle member **44** is formed with a keyhole slot **40**, and the buckle member **45** is formed with a keyhole slot **43**, these slots being adapted to engage headed studs **39** and **42**, respectively, carried respectively by the lower plates **16** and **15**.

From the foregoing, it will be seen that the rigid, padded extensions **7** and **8** project downwardly from the upper plates **1** and **2**, and bear closely against the knee at each side, thus protecting the knee from being injured by lateral pressures or blows.

Normally the weight of the body exerts vertical pressure on the knee joint, but when a player is tackled and falls, this vertical pressure is suddenly removed. The function of the crossed straps, anchored to rigid bands above and below the knee, is to press the knee capsule together, both laterally and longitudinally, to prevent it from spreading or being forced apart.

These cross straps may be adjusted either by using selectively any desired one of the snap fasteners 38, or by means of the adjustable buckle members 44 and 45, or both, thus regulating as desired the pressures exerted by these straps. By shortening or tightening the straps, the parts of the knee joint are pressed more securely together.

I regard as the most important features of the invention the use of rigid anchoring bands, immovably fixed to the leg above and below the knee, together with the inextensible straps secured at their ends to these rigid bands and crossing each other at a point adjacent the knee cap.

What I claim is:

1. A knee protector to prevent injury to the knee of the wearer while allowing substantially free normal movement of the knee comprising, in combination, an upper band constructed to encircle and be fixed to the leg immediately above the knee, a lower band constructed to encircle and be fixed to the leg immediately below the knee, and means interconnecting said upper band and lower band for pivotal movement about and aligned with the knee joint of the wearer, said means including a pair of inextensible straps adjustably secured at their opposite ends to said respective bands, said straps each extending diagonally across the leg of the wearer and exerting vertical and lateral pressure on the knee joint of the wearer to prevent spreading of the knee joint and stretching of the medial collateral ligament which holds the knee capsule together, said straps crossing each other at a point just below the knee joint of the wearer and being free and unconfined at their crossing point to allow normal flexure of the knee joint while preventing injury thereto.

2. A knee protector according to claim 1, in which said bands are both constructed of substantially rigid material.

3. A knee protector in accordance with claim 2, in which each band comprises a pair of rigid plates, each

curved to fit the contour of the leg, and in which means are provided for adjustably securing the adjacent edges of said plates together to cause them to grip the leg.

4. A knee protector comprising an upper band constructed to encircle the leg above the knee, a lower band constructed to encircle the leg below the knee, said bands both being constructed of substantially rigid material, a pair of inextensible straps adjustably secured at their opposite ends to said respective bands, said straps crossing each other at a point just below the knee cap of the wearer and being free and unconfined at their crossing point; said upper band having a rigid portion at each side extending downwardly alongside the wearer's knee, and a pair of arms, one at each side, each pivotally connected at one end with one of the downwardly extending portions of said upper band, and rigidly connected at its other end with said lower band, to prevent hyper-extension of the knee.

5. A knee protector in accordance with claim 4, in which a stop pin is carried by the downwardly extending portion of said upper band in a position to engage one of said arms at a point below the pivot thereof, to limit the pivotal movement of said arm.

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