

Jan. 5, 1971

J. P. VIGLIONE
PROTECTIVE DEVICE

3,551,912

Filed Feb. 26, 1969

2 Sheets-Sheet 1



INVENTOR.

Joseph P. Viglione

BY

Paul + Paul

ATTORNEYS.

Jan. 5, 1971

J. P. VIGLIONE
PROTECTIVE DEVICE

3,551,912

Filed Feb. 26, 1969

2 Sheets-Sheet 2

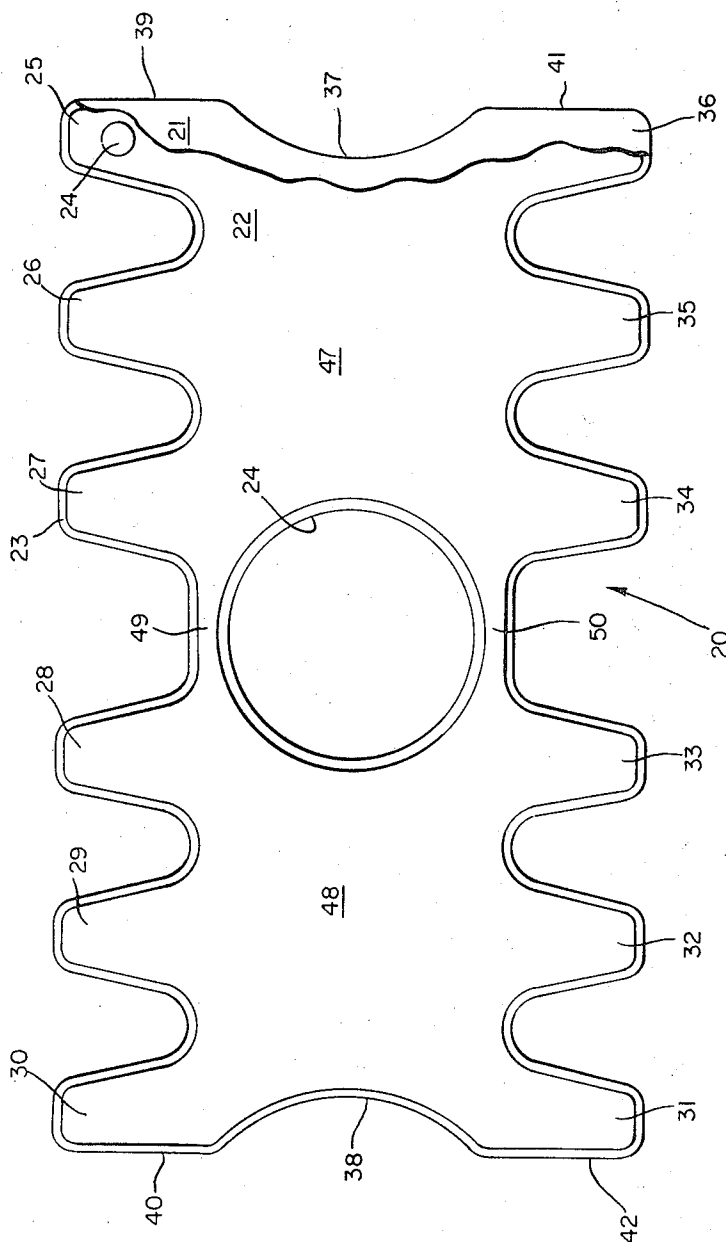


Fig. 4

INVENTOR.

Joseph P. Viglione

BY

Paul + Paul

ATTORNEYS.

1

3,551,912

PROTECTIVE DEVICE

Joseph P. Viglione, 715 Scott St.,
Stroudsburg, Pa. 18360

Filed Feb. 26, 1969, Ser. No. 802,436

Int. Cl. A41d 13/06

U.S. Cl. 2—24

7 Claims

ABSTRACT OF THE DISCLOSURE

A protective device for a body joint, having fluid filled cushion areas positioned at either side of the joint and passages connecting said areas for the flow of fluid from one such area to the other upon impact.

BRIEF SUMMARY

This invention relates to devices for protecting athletes in contact sports from injury due to impact.

The devices of this invention are designed to cushion vulnerable parts of the body by dissipating blows received thereon. Dissipation is accomplished by transfer and distribution of force through the fluid system of the protective device.

As will be set forth in detail below, I have chosen to illustrate my invention in the form of a device for protecting the knee joint. However, those skilled in the art will observe that the invention is readily adaptable to protect other vulnerable parts of the body.

It is generally agreed that protective devices currently in use do not effectively prevent, and in many cases do little to mitigate, impact injuries during sports participation. For example, football, hockey and lacrosse players wear a variety of helmets and pads of semi-resilient material, such as foam rubber. See, for example, U.S. Pat. 2,188,718. However, the continuing high rate of injury in those sports makes it clear that existing devices do not afford sufficient protection.

A protective device for sports use should enlarge the area over which the force is applied to dissipate the magnitude of force per unit area. The device should also translate the originally unilateral direction of the force against one side of the body portion into a balanced forced situation, wherein an equal and opposite force acts on the other side of such body portion. In addition, the energy of the impact should, as far as possible, be absorbed in causing deformation of the protective device, rather than the underlying body portion.

Thus, the object of this invention is to provide a shock absorbing protective device capable of protecting body portions against impact injury.

A more specific object is to provide a shock absorbing impact device for protection against impact received during sports participation, including a fluid containing device designed to evenly distribute the energy of the impact.

Another specific object is to provide a hydraulic protective device for an athlete's knee joint which includes a fluid containing impact absorbing cushion area on either side of the knee joint designed so that an impact force against one side is distributed to the impact absorbing cushion area on the other side to provide an equal force acting against the original impact force.

I attain the foregoing objectives by providing a hydraulic impact absorbing device which is positioned about the body portion to be protected.

The impact device contains a fluid system designed so that upon impact of a force of short duration (which is typical in sports) against one side of a body portion, the pressure thus created is not entirely localized against such side, but instead is instantly distributed substantially evenly throughout the system to create an equal and opposite

2

force acting against the other side of the body portion. Accordingly, since the force is not continuous but of finite value and duration, the force per unit area declines with distribution.

If desired, a moderately compressible fluid may be used in the system, i.e., a fluid which is more compressible than water, but less compressible than gas. In such a case, a portion of the impact energy is also absorbed in compressing the fluid.

DESCRIPTION OF THE DRAWINGS

The present invention is illustrated in connection with a knee joint protection device, and a preferred embodiment thereof is described below and in the drawings, wherein:

FIG. 1 is a perspective view, taken from the side of the leg, showing the device for protecting the knee joint.

FIG. 2 is a perspective view of the device shown in FIG. 1, taken from a position more to the rear of the knee joint.

FIG. 3 is a sectional view, taken along lines III—III of FIG. 1.

FIG. 4 is a perspective view of the fluid containing cushion in flattened condition.

FIGS. 1 and 2 illustrate a portion of an athlete's leg 10 at the center of which is the knee 11. The femur 12, tibia 13, and the patella 14 are shown in dotted lines. The knee joint is generally indicated as 15. The fibula and the ligaments and cartilage associated with the joint are omitted for clarity.

The protective device 20 is hollow, fluidtight and flexible. Preferably, the device comprises inner and outer heavy gauge plastic sheets 21, 22, the mating edges of which are hermetically bonded, as by well known heat sealing procedures, to form a marginal edge 23. A suitable valve 24 is provided for the introduction of a fluid F such as ethylene glycol into the chamber within the walls 21, 22 of the device.

Material 21, 22 should be soft and flexible, but substantially non-stretchable. It should have high strength and tear and abrasion resistance to withstand the stress and impact forces incident to contact sports, such as football. Twelve gauge vinyl plastic may be used, for example, but other materials having the desired characteristics are also acceptable.

For manufacturing purposes, the sheets 20, 21 may be cut from initially square pieces of material about 11 x 11 inches according to the pattern illustrated in FIG. 4 to form a central hole 24 for the knee cap, six upper pods 25—30 and six lower pods 31—36. Arcuate portions are removed from the sides to form inwardly extending arcuate side edges 37 and 38 intermediate substantially straight edges 39, 40 and 41, 42 at the top and bottom of the sides. The opposing peripheral edges of the sheets 21, 22 are then bonded, as described.

The device 20 may be applied to the knee in the position shown in FIGS. 1 and 2 by adhesive tape. However, it may be preferable to provide the device with suitable support means, such as upper and lower bands of elastic material 43, 44, to assist in maintaining the device in proper position. As shown in FIG. 2, the opposing ends of the bands 43, 44, which preferably are at the rear of the knee, may be provided with zippers 45, 46 to facilitate the application and removal of the device.

When properly positioned as shown in FIGS. 1 and 2, the design of device 20 is such that large cushion-like pouches 47, 48 cover the respective sides of the knee in which most of the fluid is concentrated when the device is filled. Fluid pressure changes within the interior may travel from one side of the device 20 to the other through passages 49, 50 above and below the hole 24.

When the wearer receives a blow against one of the cushion pouches 47, 48 on one side of the knee, the force of impact pushes the adjacent walls 20, 21 of the device closer together. This, in turn, increases the pressure of the fluid in the area affected. However, the pressure is immediately distributed equally throughout the remainder of the system. Thus, for example, the pressure of a blow against pouch 47 is distributed into the pods 25-27 and 34-36, through passages 49, 50, into the pods 28-30, 31-33 and pouch 48 at the other side of the knee.

The increased hydraulic pressure in that portion of the system opposite the side against which the blow was received, e.g. within pods 28-30, 31-33 and pouch 48 in the above example, renders the same more rigid and thus more resistant to the bending force of the blow. Thus, the pouch 48 and its related pods push back against the force of the blow with an equal and opposite force and act like a brace against alateral displacement of the knee joint.

The pods 25-35, it should be noted, serve two very useful functions. First, they greatly increase the area of the fluid system, providing more space for the dissipation of impact forces, but without restricting mobility. Second, they act as sensors, for detection and protection against blows received around the periphery of the knee.

In the foregoing manner, blows against the side of the knee which ordinarily would tear the ligaments and cartilage associated with the knee joint are reduced in destructive power by the device 20, since the force of the blow is absorbed and equally distributed by the fluid cushion surrounding the joint and because the joint is restricted from moving laterally with the blow by means of the increased rigidity of the device on the side opposite the blow.

It is to be clearly understood that the terms and expressions used herein are employed as terms of description, and not of limitation, and that there is not intention in using such terms and expressions to exclude any equivalents of the devices or methods described. It is also to be clearly understood that what is specifically shown and described herein represents a preferred embodiment only of the invention, and that various changes and equivalents may be resorted to without departing from the principles of the invention or the scope of the claims hereof. Accordingly, it is intended to claim the present invention broadly, as well as specifically, as indicated in the appended claims.

I claim:

1. A knee brace comprising:

(a) a body member adapted to be secured about the knee joint, said body member having hollow cushion portions at the opposing sides of the knee joint forming means for containing a fluid, and

(b) said body member also having passage means between said hollow cushion portions for the transmission of fluid pressure from the portion at one side of the joint to the portion at the other side, whereby the pressure of a blow on one of said portions is transmitted hydraulically through the passage means and increases the rigidity of other cushion portion to support the joint against damaging lateral displacement caused by the blow.

2. The invention of claim 1 wherein the brace also includes support means connected to said cushion portions for maintaining the brace in position about the knee joint.

3. The invention of claim 2 wherein the support means comprises a band of fabric having elastic qualities.

4. The invention of claim 3 wherein the fabric band includes opposing end edges and means for connecting said edges.

5. The invention of claim 1 wherein the brace includes valve means for the selective introduction and discharge of fluid.

6. The invention of claim 1 wherein the cushion portions comprise vinyl plastic.

7. The invention of claim 1 wherein the brace also includes elongated hollow pods operatively connected to said cushion portions.

References Cited

UNITED STATES PATENTS

1,117,168	11/1914	Crowley	2-24
2,188,718	1/1940	Jung	2-24
2,774,152	12/1956	Alber	2-22X
2,830,585	4/1958	Weiss	2-22UX
3,074,400	1/1963	Schulman	2-24UX
3,186,404	6/1965	Gardner	128-402X
3,189,919	6/1965	Chase	2-22X
3,407,406	10/1968	Werner et al.	36-2.5X
3,454,963	7/1969	Palladino	2-24

ALFRED R. GUEST, Primary Examiner