May 26, 1970 G. KEENAN ET AL 3,513,842

PROTECTIVE DEVICE

Filed April 10, 1968

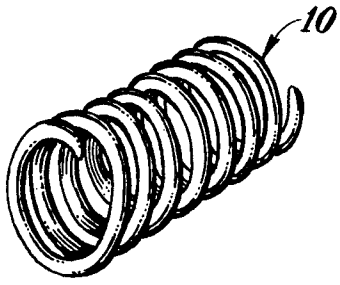


FIG. 1

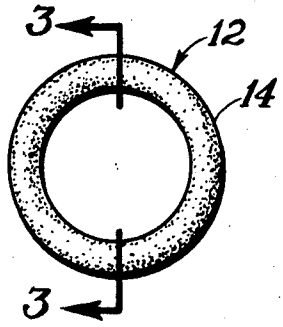


FIG. 2

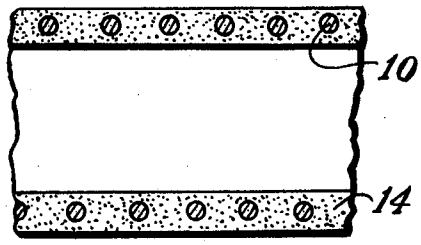


FIG. 3

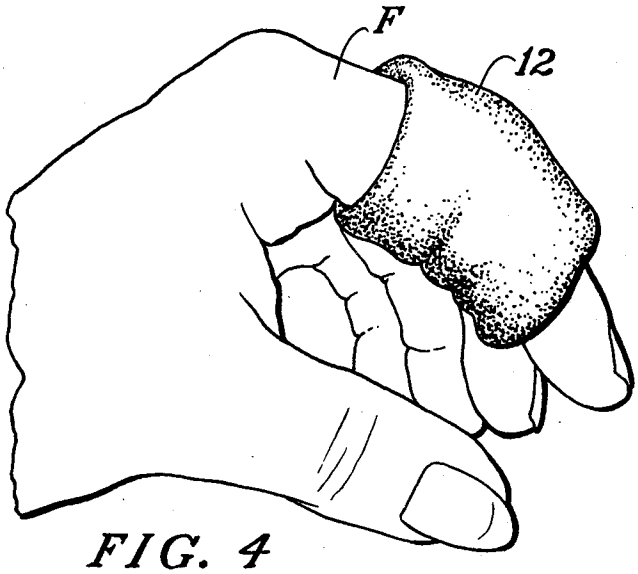


FIG. 4

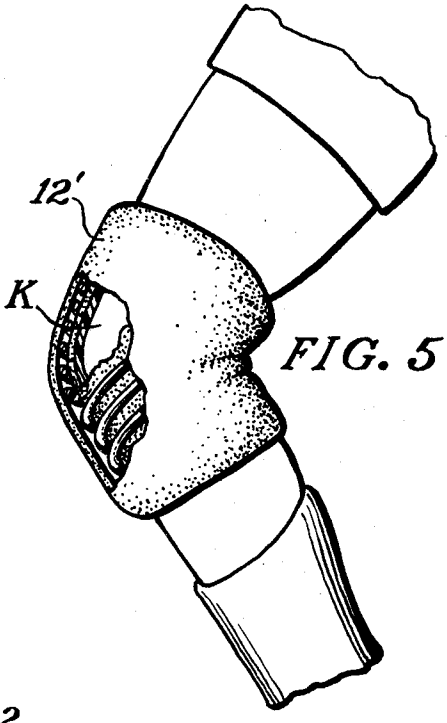


FIG. 5

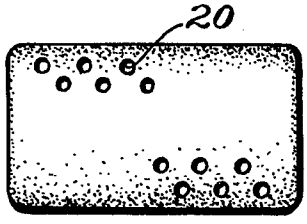


FIG. 6

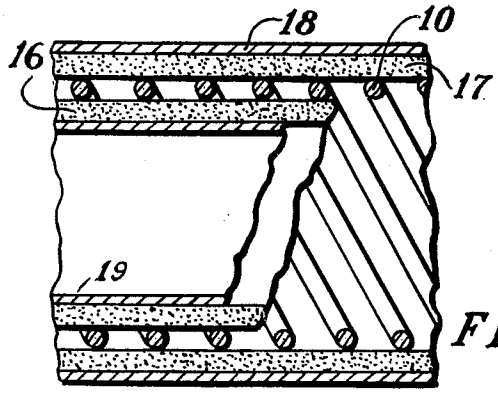


FIG. 7

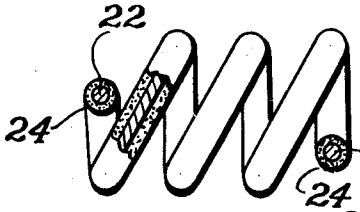


FIG. 8

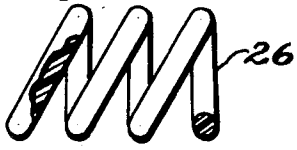


FIG. 9

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United States Patent Office 3,513,842 Patented May 26, 1970

3,513,842

PROTECTIVE DEVICE

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Filed Apr. 10, 1968, Ser. No. 720,080
Int. Cl. A61f
U.S. Cl. 128—157 10 Claims

ABSTRACT OF THE DISCLOSURE

A flexible protective guard for the protection of body members which employs a helical spring which is rigid in a radial direction but which can flex longitudinally to provide protection without immobilizing joints. The wire spring is cushioned to protect the member from the spring.

This invention relates to protective devices for body members and in particular to flexible devices suited for the protection of articulated members.

BACKGROUND OF THE INVENTION

Certain types of injuries result in sensitive body members which are subject to pain and irritation upon contact. In many cases injuries incapacitate the victim from all or part of his duties until healing is complete. The fear of pain, whether conscious or subconscious, often detrimentally affects the actions of athletes who have been injured resulting in poor performance or even complete non-participation in a given activity. Prior practice has been to immobilize the member involved as, for example, a finger, by taping the injured finger to a adjacent finger or by employing a rigid splint type device to prevent flexing of the finger. It has been noted that a person who has suffered a broken limb will be apprehensive during rehabilitation following removal of the cast.

The use of the protective devices of this invention is so effective that the patient may freely engage in rigorous activity without fear of further injury. The devices may be employed as either a protective sterile covering or in some embodiments may be used in addition to the sterile covering. In the latter application ventilation holes are provided to permit healing while providing protection for irritation and contact. Major areas of application of the device, without intent to be limiting include use by athletes as a rehabilitation device in the case of broken bones and muscle injuries in lieu of conventional splints. The device may also be employed in protective equipment, such as shin guards, knee guards, thigh guards, forearm pads, digit protectors and padding gloves. A nonmetallic construction particularly suited for athletic use is disclosed.

The invention is also useful for the protection of stumps following surgery. It may also find use for the protection of digits where the user lacks sensitivity in the fingers, a conditions symptomatic of diseases such as Hansen's Disease and Raynaud's Disease, for example.

Accordingly, it is an object of this invention to provide a helical coil protective device.

It is a further object of this invention to provide an improved protective device for injured members.

A particular object of this invention is to provide a protective device employing resilient foam covered helical wire coil.

A further object of this invention is to provide a protective device comprising a helically wound cushioned wire.

A particular object of this invention is to provide a

flexible non-metallic body member protector suited for athletes.

It is an object of this invention to provide a protective device which is rigid in an axial direction but flexible relative to a longitudinal axis.

These and other features, objects and advantages of the invention will, in part, be pointed out with particularly and will, in part, become obvious from the following more detailed description of the invention taken in conjunction with the accompanying drawing, which forms an integral part thereof.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a pictorial view of a supporting spring forming part of the structure;

FIG. 2 is an end view of the protective device;

FIG. 3 is a section taken along lines 3—3 of FIG. 2;

FIG. 4 is a pictorial showing of the device as applied to a finger;

FIG. 5 is a pictorial showing of the device partially broken away, as applied to a section of the knee joint;

FIG. 6 is a plan view of the device showing an embodiment provided with apertures for the circulation of air;

FIG. 7 is a cross sectional view of an alternative embodiment of the device having a nonstick liner;

FIG. 8 is a pictorial showing of a protective device with portions broken away to expose the interior;

FIG. 9 is a view taken in elevation and partially broken away of another embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 shows a helical wire coil **10**. By way of example, the dimension of this coil for the protection of an average male digit finger would be 0.5" in diameter and would use a carbon steel wire having a diameter of 0.008" and helically wound with a pitch of 50°–80°. For a typical male knee the dimensions would, of course, vary, and, by way of example, would be 4" in diameter at one end and 5" in diameter at the other end. For the knee guard application the coil may be formed of a wire having a diameter of 0.06" and helically wound with a pitch of 50°–80°. The coil would then be encapsulated in a foam material **14** as, for example, polyurethane foam, so that a soft resilient coating results. The end view of the finished member **12** comprising wire **10** encapsulated in foam **14** is shown in FIG. 2. As may be seen by reference to FIG. 3, the wire **10** is completely covered by the foam **14**.

In FIG. 4 there is shown a digit F protected by member **12**. It will be noted that the finger is bent in the usual fashion without interference from the device.

In FIG. 5 there is shown a knee K protected by a larger size device **12'**. Encapsulation may be carried out by any of the well known casting or impregnation techniques. It could also be made on a continuous basis by forming the wire and running it off a mandrel while simultaneously coating the wire. Such techniques may be readily adapted from the wire making industries.

In FIG. 7 an alternative method of assembly is shown wherein the wire **10** is covered coaxially by an inner sleeve of polyurethane foam or other suitable shock absorbing material **16** and an outer layer **17**. If desired, an additional sleeve of waterproof material **18** may be provided. This sleeve may be applied in the form of a tube or the article may be dipped into a suitable material, such as plastisol.

Where the device is to be used over a dressing, it is preferred that ventilation holes **20** be provided, as shown in FIG. 6.

It is also envisioned that the device may be made simply and inexpensively by forming the resilient shock absorbing coating **24** directly by the wire as an extrusion process. The resulting article is shown in FIG. 8 where the wire **22** is coated with the resilient insulator **24**. This latter construction has a distinctive advantage in that it permits winding of custom made protective units from a limited number of stock size coated wires.

There is an objection on the part of sports authorities to the presence of metal members in guard devices. Accordingly, there is provided a synthetic resin coil **26** as shown in FIG. 9. Polycarbonate is a suitable resin for this purpose. Another suitable material is a glass fiber bundle with resin bonded strands. Epoxy resin is one of the resins customarily employed for bonding glass fibers. The synthetic resin coil may be covered with a shock absorbent resilient layer by any of the methods discussed hereinabove.

The coil member acts as a beam in deflection but is rigid relative to axial forces.

Having thus disclosed the best embodiment of the invention presently contemplated, it is to be understood that various changes and modifications may be made by those skilled in the art without departing from the spirit of the invention.

What we claim as new and desire to secure by Letters Patent is:

1. A device for the protection of a body member comprising:

(a) a helical coil beam surrounding a longitudinal axis, said beam being yieldable to bending movements relative to the axis but rigid to axial forces relative to the axis; and

(b) a resilient padding layer covering said coil.

2. The device of claim **1** wherein said coil is formed of a metal.

3. The device of claim **1** wherein said coil is formed of a synthetic resin.

4. The device of claim **3** wherein said resin is polycarbonate.

5. The device of claim **1** wherein said coil is wound of a stiff core member coaxially surrounded by a resilient resin foam.

6. The device of claim **1** wherein said coil is a helically tapered coil.

7. The device of claim **1** provided with air passages.

8. The device of claim **1** having an inner liner nonadhesive to human tissue.

9. The device of claim **1** wherein said coil is encapsulated in a resilient synthetic resin material.

10. The device of claim **1** wherein said synthetic material is polyurethane foam.

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ADELE M. EAGER, Primary Examiner

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