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Nirschl

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[45] **Dec. 16, 1975**

[54] **MUSCULAR SUPPORT**

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[21] Appl. No.: **473,878**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 345,370, March 27, 1973, Pat. No. 3,877,426.

[52] **U.S. Cl.** ..... **128/165;** 128/80 R

[51] **Int. Cl.**[2] **A61F 13/00**

[58] **Field of Search** ..... 128/165, 166, 166.5, 167, 128/168, 169, 80 C, 80 R, 157, DIG. 15; 2/22, 24

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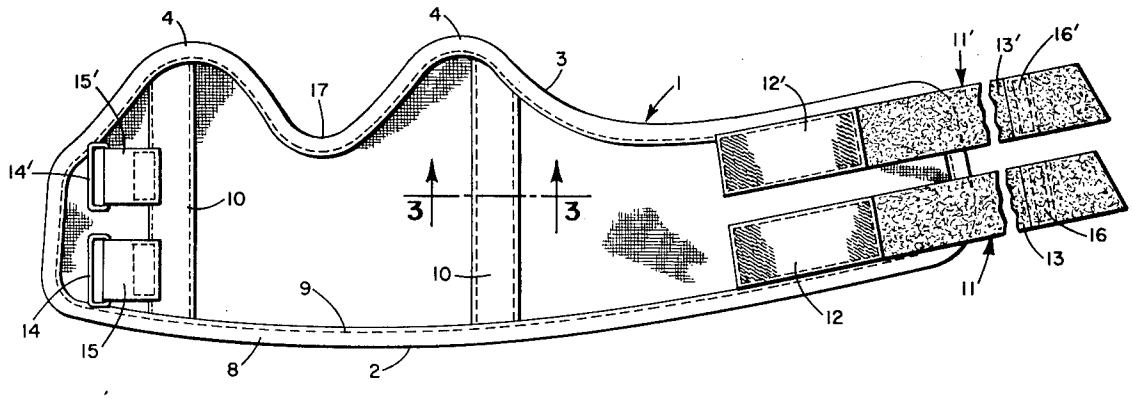
Primary Examiner—John D. Yasko

Attorney, Agent, or Firm—Schuyler, Birch, Swindler, McKie & Beckett

[57] **ABSTRACT**

A support for bracing the musculo-tendinous units in the lower extremities of humans especially around the knee and foot comprised of a flexible, curvilinear pad of substantial width especially adapted to be tightly wrapped about a muscle in such extremities without slippage and constructed of a two-layer laminate of cloth and foam rubber. The pad is easily tightened by means of a Velcro fastener strip attached thereon.

9 Claims, 6 Drawing Figures



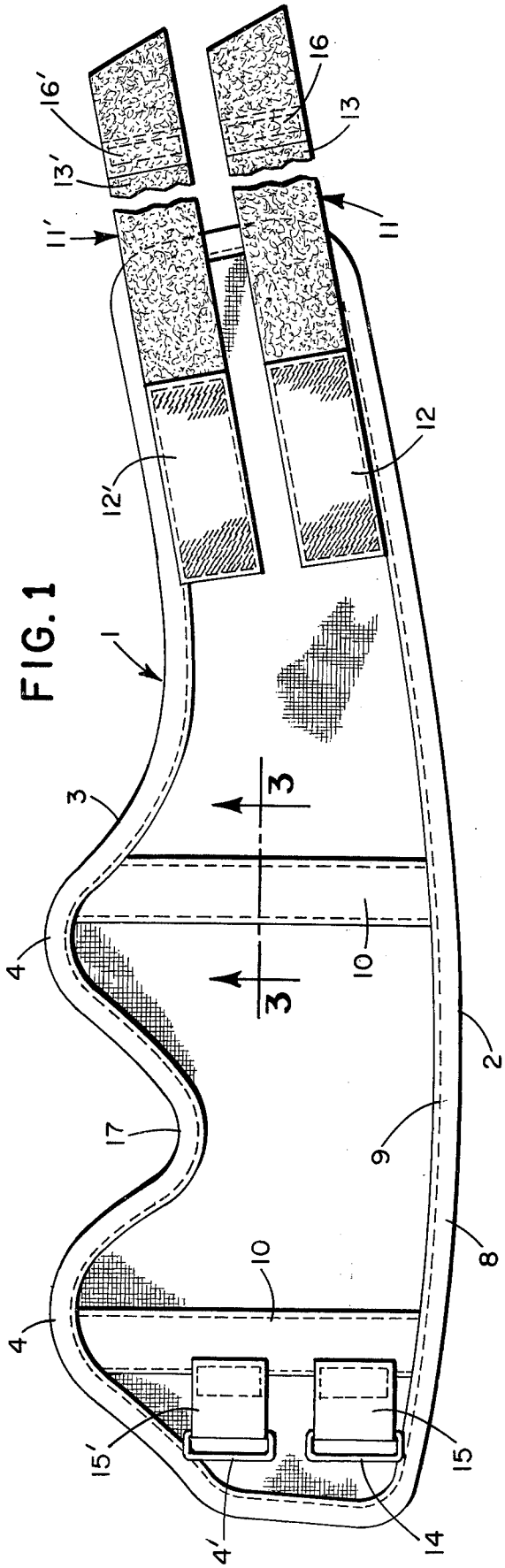

16'
16
13'
13
11'
11
12'
12
1
3
3
3
4
10
2
17
9
8
4
10
15'
15
14'
14

FIG. 1

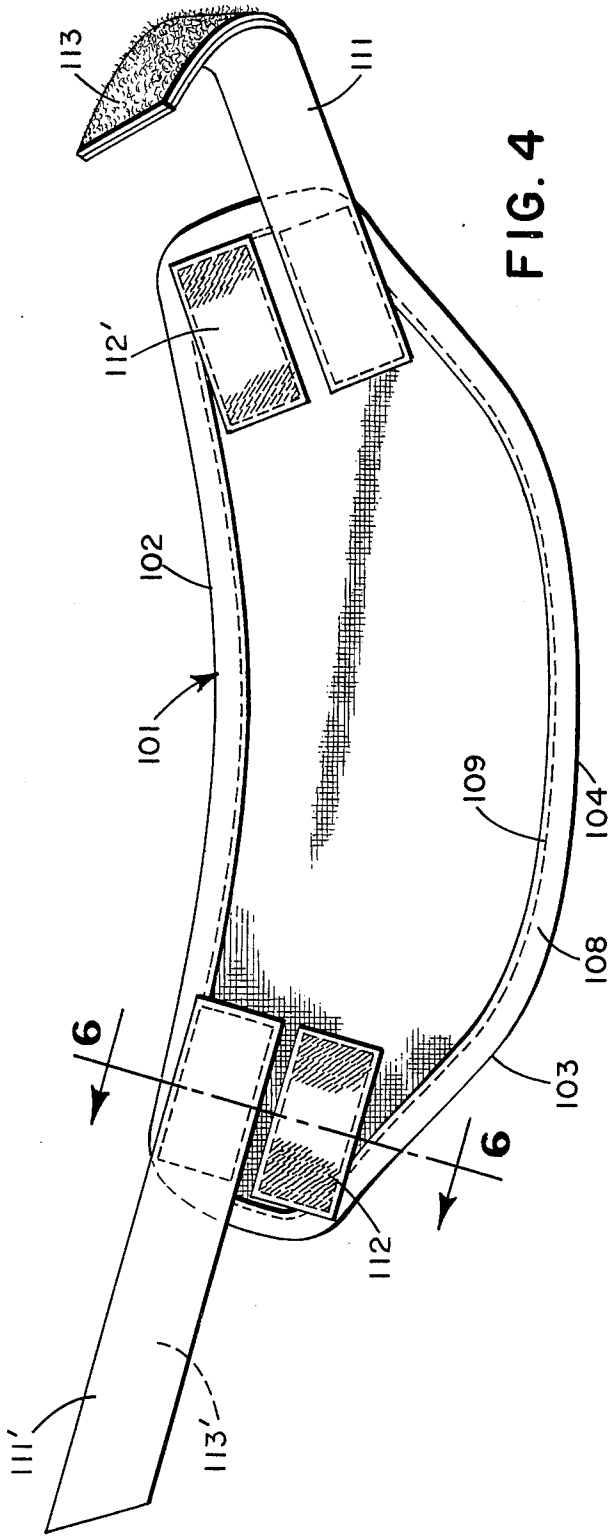

113
111
112'
102
101
109
104
108
6
6
103
112
111'
113'

FIG. 4

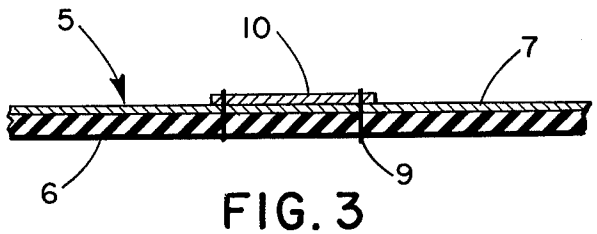


FIG. 3

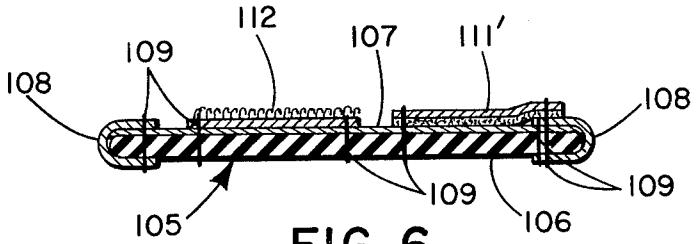


FIG. 6

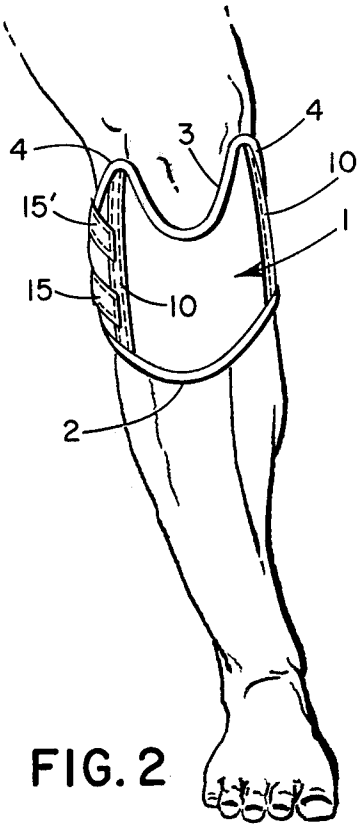


FIG. 2

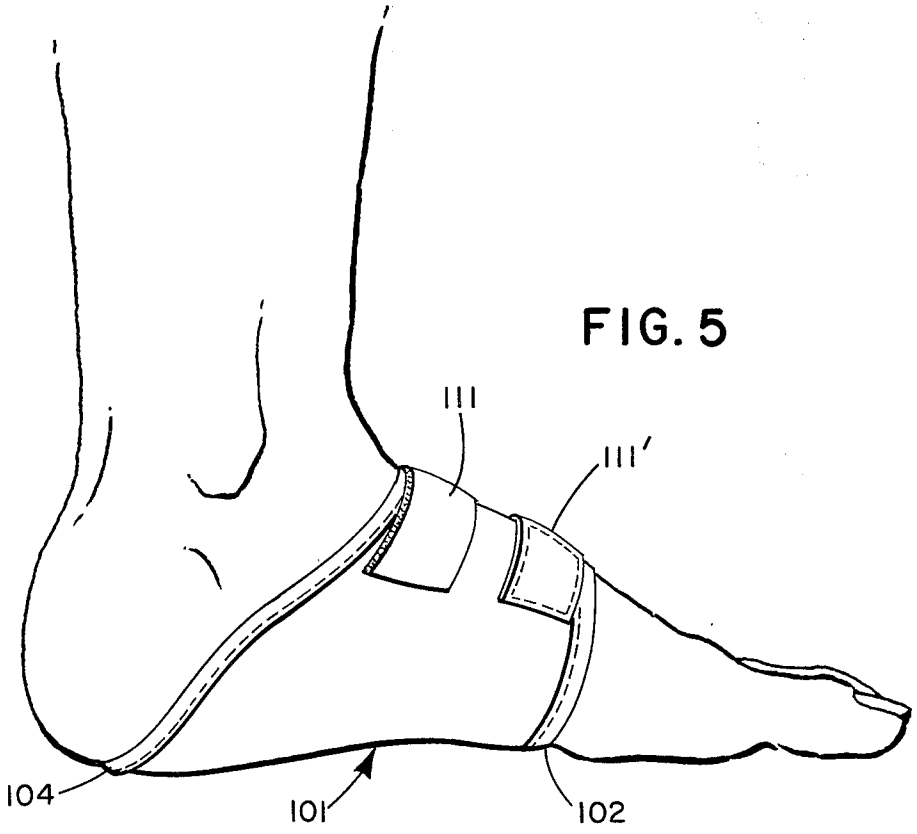


FIG. 5

MUSCULAR SUPPORT

PRIOR APPLICATIONS

This application is a continuation-in-part of application Ser. No. 345,370 filed Mar. 27, 1973 now U.S. Pat. No. 3,877,426.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention pertains to a support for bracing the musculo-tendinous units in the lower extremities of humans. In particular, various embodiments of this invention relate to supports for preventing and relieving injuries to the muscles and tendons of the foot and of the knee, by applying external circumferential pressure over a wide area of the musculo-tendinous unit to thereby relieve the tension normally exerted by the muscle.

2. Description of the Prior Art

Tennis is rapidly becoming one of the most popular sports, since it can be played by people of all ages, both indoors and outdoors, during the day or at night under lights. With the advent of the popularity of tennis, especially among people of various ages and various muscular ability, has come an increasing incidence of muscular injuries to the elbow, the foot and the knee. These injuries include "tennis elbow," dislocation or subluxation of the patella, tendinitis of the posterior tibial and peroneal musculo-tendinous units, chronic flat-footedness and arch strain, and an increased incidence of heel spurs. The primary symptom of these injuries is a chronic inflammation of the attachment of muscle-tendon groups to the associated bones.

It is believed that the aforestated injuries occur because the normal arrangement of the muscles and their attachments to the associated bone structure predisposes individuals to injury during the movements associated with strenuous physical exercise, such as during a tennis match. These strenuous exertions create great pressure against the attachment of the muscle mass, subjecting it to repetitive and chronic strain with the subsequent formation of non-elastic scar tissue. This scar tissue often tears again and tends to become re-inflamed. The situation is compounded by the lack of appropriate muscle-tendon strength and endurance to withstand the forces which are placed against it (so characteristic of the occasional athlete who rarely trains for sports activity).

For the most part, the problem occurs because of an inherent weakness in the structure, design or mechanical relationship of the muscles, tendons, or ligaments in the knee and foot which subject these members to increased forces in a specific area, thus placing an inordinate strain on the tissues.

Treatment for such injuries has been primarily medical in nature ranging from surgery or localized injection of cortisone to simple rest.

It has been found that the pain of such injuries can be relieved, and the injury itself often prevented, by placing pressure about the muscles of an extremity. The pressure on such muscles serves to relieve the internal tension thereon by providing a counter-force against which the muscle can push.

A number of bandage-like devices, generally elastic in nature, have been developed which can be placed about the foot or the knee. Such devices have suffered

from several disadvantages. For example, some elastic devices have tended to restrict circulation in the limbs; and the elastic characteristics of such bandages have failed to provide sufficient counter-force pressure to effectively disseminate the concentration of forces. Other devices designed to exert pressure about the muscle have the serious disadvantage of limiting mobility of the bodily member and the joints associated therewith. Still other such devices do not stay in place on an extremity and are too narrow to properly disseminate forces placed on the muscles.

OBJECTS OF THE INVENTION

This invention has as an object a muscular support which can be tightly wrapped about a muscle with a substantially uniform pressure over a sufficiently wide area of the muscle to maximize the dissemination of forces placed thereon.

As another object, this invention provides a muscular support of substantial width that resists slippage from the extremity during vigorous athletic motion such as that occurring during a game of tennis.

As a further object, this invention provides a muscular support for the foot or knee which does not impair the mobility of the wearer.

As yet another object, this invention provides a strong pad of rugged, long-wearing characteristics, which maintains its appearance and utility over prolonged use.

My copending application Ser. No. 345,370 filed Mar. 27, 1973, describes and claims a device especially suitable for wrapping about the muscle of the forearm to prevent tennis elbow. This application is directed toward devices especially suitable for preventing or treating foot and arch strain, foot tendinitis, and knee injuries.

SUMMARY OF THE INVENTION

These and other objects of the invention are achieved by a muscular support device comprising a substantially curvilinear, elongated pad having one long edge arcuately shaped and of a predetermined length measured longitudinally of said elongated pad, and having an opposed long edge with a portion thereof non-parallel to and extending away from said arcuately shaped long edge and of a predetermined length measured longitudinally of said elongated pad such that said support device will be of generally conical shape when wrapped about the muscle of said bodily limb or member. The pad is flexible in all directions and comprises a laminate having an inner layer of resilient foamed material and an outer layer of substantially inelastic flexible sheet. One end of the pad has a Velcro fastener strip attached to the outer surface of the outer layer whereby the pad can be fastened around the bodily limb or member.

The elongated pad of the device of this invention, of curvilinear shape, substantial width and dimensioned to render it generally conical when wrapped about the subject muscle, is configured to facilitate the exertion of an even counter-force pressure over a broad area of such muscle during the contraction thereof, without significantly impairing the mobility of the bodily limb or member associated therewith. Thus, an accurately fitting wide support device is obtained which provides for maximum dissemination of forces over a broad muscular area.

In certain embodiments the pad has a binding strip of elastic cloth around the edges of such pad, the binding

strip being attached to the laminate by stitching to the foam side of such laminate. Also, in certain embodiments, the pad is adapted for application to the human foot with pressure applied to the upper instep and to the bottom surface of the foot between the ball and the heel thereof.

In other embodiments the elongated pad includes a pair spaced projections along one of the long edges thereof such that the pad may be applied to the leg between the knee and the ankle with such projections applying pressure to the portions of the leg adjacent to the lateral edges of the kneecap.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and advantages of the invention, which will become apparent to those skilled in the art, are referenced to the following drawings in which:

FIG. **1** is a plan view of the outer surface of one embodiment of the muscular support device of the invention;

FIG. **2** is a perspective view of the muscular support device of FIG. **1** in position, tightly wrapped about the leg;

FIG. **3** is a sectional view along line **3—3** of FIG. **1**;

FIG. **4** is a plan view of the outer portion of a second embodiment of the muscular support device of the invention;

FIG. **5** is a perspective view of the muscular support device of FIG. **4** in position, tightly wrapped about the foot;

FIG. **6** is a sectional view along line **6—6** of FIG. **4.**

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

FIGS. **1, 2,** and **3** and FIGS. **4, 5** and **6** illustrate two embodiments of the muscular support pad of this invention adapted for use about the knee and the foot, respectively.

As best seen in FIGS. **1, 2** and **3,** the muscular support of one embodiment of this invention comprises a substantially curvilinear, elongated pad **1** having one convexly arcuately shaped long edge **2** and having an opposing long edge **3** with a portion thereof non-parallel to edge **2** and forming two flat projections **4** of the pad **1** extending away from such convexly arcuately shaped long edge **2.** The convexly arcuately shaped long edge **2** is of a greater length, measured longitudinally of the elongated pad **1,** than the opposing long edge **3** such that the muscular support will assume a generally conical shape when wrapped about the leg, as illustrated in FIG. **2.** This configuration provides for support by the exertion of an even pressure around the leg and on the inferior oval margins of the kneecap, extending over a wide area but without significantly impairing the mobility of the knee. Additionally, the conical configuration of the wrapped device aids in preventing downward slippage and displacement of the device during athletic exertion.

Pad **1** comprises a laminate **5** having a polymeric foam bottom layer **6,** which is preferably foam rubber of about one-eighth inch to one-fourth inch thickness, and a flexible but relatively inelastic sheet upper layer **7,** which is preferably cotton duck cloth. When the pad is wrapped about the leg, such bottom layer **6** and top layer **7** will become the inner and outer layers respectively of the support device. A suitable laminate of foam rubber and cotton is commercially available from PROTEK-TOE PRODUCTS, of Union, New Jersey. It is possible to use other foams than foam rubber, but the foam should be selected so that it is highly resilient, has similar "fight back" properties so it tends to resist compression, and has a coefficient of friction sufficiently similar to that of foam rubber, whereby it resists slipping even when the skin underneath the support device begins to sweat. Preferably, the surface of the foam rubber is smooth-appearing and the pore size of the foam at the surface is very tiny, giving the outer surface of the foam a skin-like appearance.

The laminate **5** is preferably bordered by binding strip **8,** which is an elasticized fabric. The binding strip can be eliminated, but at a sacrifice in the overall wear properties and appearance of the support. The elastic binding strip is sewn on, as are all other attachments to the pad, by stitching **9** which is sewn through the foam rubber side. By sewing through the foam rubber side is meant stitching with the foam rubber side in the upper position, the stitches **9** causing the foam rubber **6** to compress. The stitches, therefore, are indented below the surface that is in contact with the skin, thereby lessening the danger of skin irritation due to abrasion caused by raised stitching.

To one end of the pad **1** is attached a pair of flexible Velcro or equivalent fastener strips **11** and **11'**. Each fastener strip has hooked portions **12** and **12'** and loop portions **13** and **13'**. The other end of the pad has two rigid metal rings **14** and **14'** attached to the flexible outer sheet layer **7** by looped cloth ribbons **15** and **15'**. The support is kept firmly about the leg and the muscles by threading the free loop ends **13** and **13'** of Velcro fastener strips **11** and **11'** through the underside of rigid metal rings **14** and **14'** and reversedly back for attachment to the hook ends **12** and **12'** of the Velcro fastener strips. Conveniently, the free ends **13** and **13'** of the Velcro fastener strips can be looped back upon themselves and stitched, thereby forming raised portions or catches **16** and **16'**. These raised portions **16** and **16'** permit the user to form a circular, loosely engaged support through which he can insert his leg prior to final positioning of the support device and tightening of the Velcro fasteners.

As shown more clearly in FIG. **2,** the projections **4** of this knee support accommodate the inferior oval margins of the patella, or kneecap, with the reinforcing members **10,** which may conveniently be substantially rigid strips of nylon or other synthetic resin, providing additional stabilizing strength. The muscular support of this configuration thus may be clinically beneficial in both treating and preventing such problems as dislocation or subluxation of the patella, condromalacia patellae and patellar tendinitis, or jumper's knee, as well as Osgood-Schlatter's tibial epiphysitis. The use of a non-elastic material for the outer surface **7** of the support will serve to minimize circulatory blockage, such as is present with the use of elastic wrappings and supports. Additionally, as indicated in FIG. **2,** the configuration of this knee support, with the spaced projections **4** on either side of the kneecap, leaves the kneecap free and permits the knee joint to retain its mobility, thus permitting more freedom of movement and avoiding hinderance of the athletic activities of the wearer. It has been found that convenient dimensions for this knee brace are in the range of 3½ to 5 inches for the minimum dimensions between the base **17** of the projections **4** and the convexly arcuately shaped long edge **2** and in the range of 8½ to 15½ inches measured linearly longitudinally of the brace.

Another embodiment of the muscular support of this invention is illustrated in FIGS. **4, 5** and **6.** As shown in FIG. **5,** this embodiment is particularly suitable for providing support to the plantar fascia, the bottom surface of the foot, between the ball and the heel. Insofar as the structure of this second embodiment is similar to the above-described embodiment for use adjacent the knee, like components are numbered alike in hundred and unit series, respectively.

In this second embodiment, especially adapted for application to the foot, the curvilinear elongated pad **101** has a concavely arcuately shaped long edge **102** and an opposing long edge **103** with a portion thereof non-parallel to edge **102** and forming a single, broad, flat projection **104** of the pad **101** extending away from the concavely arcuately shaped long edge **102.** In this embodiment the concavely arcuately shaped long edge **102** is shorter, measured longitudinally of elongated pad **101,** than the opposing long edge **103** such that wrapping the support about the foot, as illustrated in FIG. **5,** will cause the support to assume a generally conical shape having substantial width. Such configuration facilitates application to the foot such that pressure may be applied over a broad area at the upper instep and along the plantar, or bottom surface of the foot between the ball of the foot and the heel without impairing mobility. Convenient overall dimensions for this foot brace have been found to be in the range of 3½ to 4½ inches for the maximum width thereof measured between opposing long edges **102** and **103,** and in the range of 7½ to 11½ inches measured linearly longitudinally of the brace.

In this second embodiment the hook portions **112** and **112'** of the Velcro fastener strips **111** and **111'** are separated from the loop portions **113** and **113',** with one hook portion **112** and one loop portion **113'** disposed at one end of the elongated pad **101** and the mating loop portion **113** and hook portion **112'** disposed at the opposite end thereof. By virtue of this arrangement, in which the rigid metal rings of the above embodiment are eliminated, the wearer may wrap the support about the foot and tighten it by pulling across the foot on loop portions **113** and **113'** prior to engaging them to their respective hook portions **112** and **112'.** While this is a convenient arrangement of the fasteners, other arrangements, such as a broad single fastener, would also be suitable.

When the brace of this second embodiment is firmly fastened about the foot, as shown in FIG. **5,** it may thus provide a pressure against the contracting musculo-tendinous units, as well as the plantar fascia, and thus disseminate any excessive concentration of forces at and about the ankle and foot during athletic exertion. Similarly to the previously disclosed embodiment of the support, this second embodiment is configured to avoid immobilizing the ankle joint of the wearer and thus avoids hinderance of the wearer's athletic activities while still providing musculotendinous, fascial and ligamentous support over a broad area.

While two embodiments of the support of this invention, especially suited for the disclosed specialized applications, have been disclosed with particularity above, numerous modifications of the same within the scope of the invention will be readily apparent to those skilled in the art. For example, various other arrangements and numbers of Velcro fasteners may readily be substituted for those disclosed herein, as may be belts and buckles and other fastening devices. Additionally, various configurational modifications of the support pad of this device to facilitate application of the invention to various musculo-tendinous units of the body especially the ankle, mid-leg, thigh, medial epicondyle of elbow, upper and mid-arm, and wrist, will occur to those skilled in the art and are considered also to be encompassed by this invention. Thus, the scope of the invention of this muscular support, which is suitable for the treatment and prevention of injury to muscles in many parts of the body and associated with many different types of activities, is to be limited solely by the claims appended hereto.

What is claimed is:

1. A support device capable of being wrapped about and surrounding the muscle of a bodily limb or member without extensive overlap and capable of applying circumferential pressure to a wide area of said muscle to thereby relieve internal tension of the muscle, comprising a substantially curvilinear, elongated pad having one long edge convexly arcuately shaped and having an opposing long edge with a portion thereof forming a pair of spaced, flat projections of said pad extending away from said convexly arcuately shaped long edge, said opposing long edge being of a predetermined length measured longitudinally of said elongated pad such that such support device will be of generally conical shape when wrapped about the muscle of said bodily limb or member, said pad being flexible in all directions and comprising a laminate having an inner layer of resilient foamed material bonded to an outer layer of substantially inelastic flexible sheet and having fastening means for securing said support device tightly about said muscle.

2. The support device of claim **1** wherein said resilient foamed material is foamed rubber.

3. The support device of claim **1** wherein said substantially inelastic flexible sheet is a woven fabric.

4. The support device of claim **1** wherein said fastening means comprise a plurality of Velcro fastener strips attached to the outer surface of said outer layer.

5. The support device according to claim **1** wherein said fastening means comprise at least one Velcro fastener strip attached to the outer surface of said outer layer at each end of said elongated pad.

6. The support device of claim **1** wherein said fastening means comprise in combination a plurality of Velcro fastener strips attached to the outer surface of said outer layer at one end of said elongated pad and at the other end of said pad a corresponding plurality of rings attached to the outer surface of said outer layer, said Velcro fastener strips having a loop section and a hook section, one of each said sections of said Velcro strips partially overlapping said pad and the other of each said sections constituting a free end, whereby said pad can be fastened around the limb or member by threading each said free end of said strips through a corresponding said ring and reversedly drawing said free end for attachment to said overlapping section.

7. The support device of claim **1** further comprising a plurality of reinforcing members attached to said pad with at least one said reinforcing member extending between the edge of each said projection and said arcuately shaped edge.

8. The support device of claim **7** wherein said reinforcing members comprise relatively stiff elongated strips of a substantially rigid synthetic resin.

9. A method of preventing overload on selected muscles and tendons of the portion of a human leg between

the knee and ankle comprising the application of circumferential pressure to a wide area of the quadriceps, patella and the patellar tendon by wrapping about said leg portion a substantially curvilinear, elongated pad having one long edge arcuately shaped and of a predetermined length measured longitudinally of said elongated pad, and having an opposing long edge with a portion thereof forming a pair of spaced flat projections of said pad extending away from said arcuately shaped long edge, said opposing long edge being of a predetermined length measured longitudinally of said elongated pad such that said support device will be of a generally conical shape when wrapped about said leg and said pressure will be applied by said projection to the portions of said leg adjacent the lateral edges of the kneecap.

* * * * *