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Froimson

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[54] **THERAPEUTIC SUPPORT DEVICE**

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[51] **Int. Cl.** **A61f 13/00**

[58] **Field of Search** ..... 128/165, 169, 87, DIG. 15, 128/157, 327; 273/189 A, 189 R

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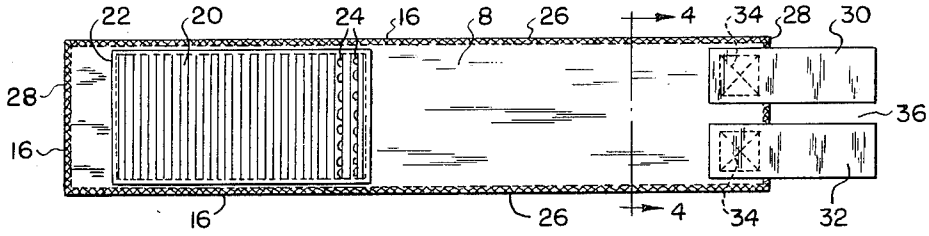
[57] **ABSTRACT**

A theropeutic support device of the type to be worn by a user, such as a tennis player, on his arm for relief of the pain resulting from the pathological lesion commonly referred to as "tennis elbow." The device includes a flexible, elongated band-like body formed from a substantially inelastic material for disposition around the proximal forearm below the elbow, and having a selectively adjustable fastener system to hold the opposed ends of the body in secured overlapping relation to provide a closed adjustable loop encompassing the forearm in the installed position thereof.

3 Claims, 4 Drawing Figures



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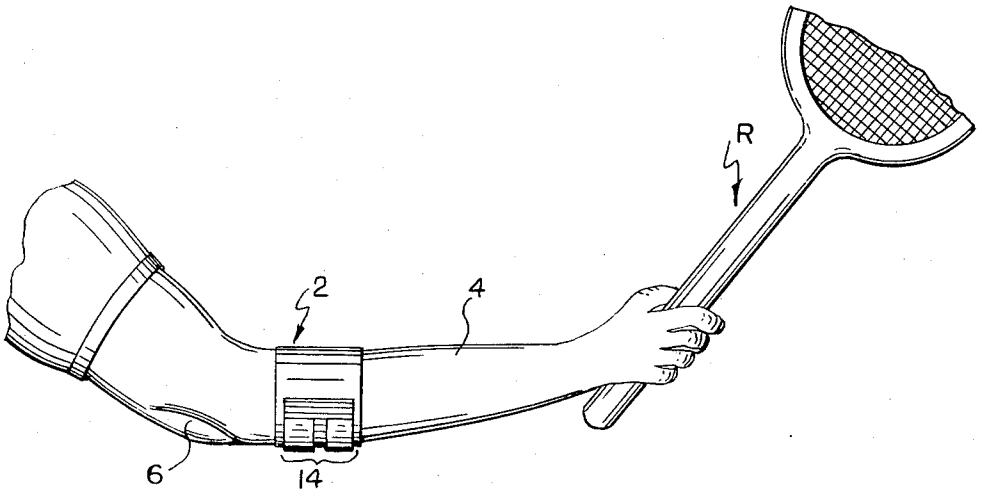

FIG.1

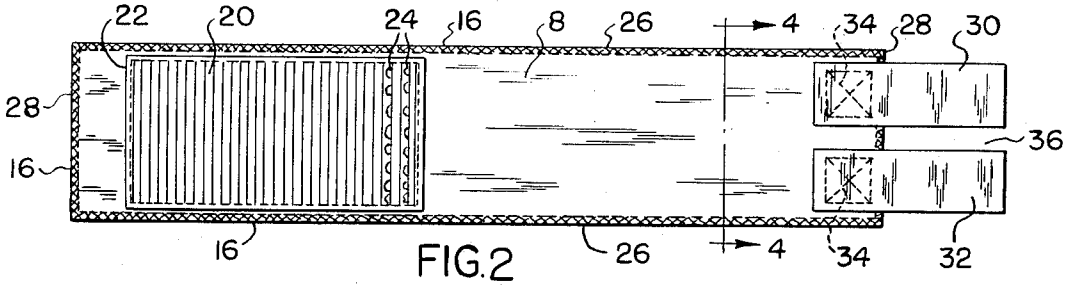

FIG.2

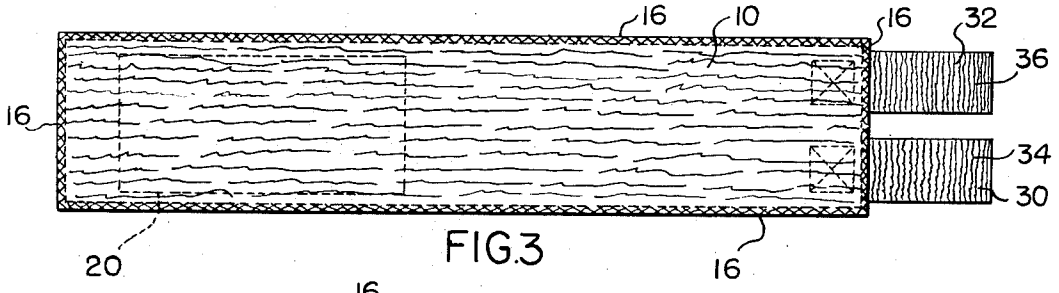

FIG.3

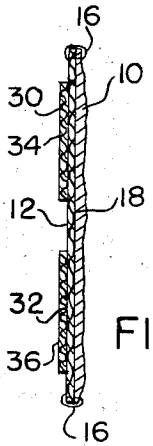

FIG.4

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THERAPEUTIC SUPPORT DEVICE

BACKGROUND OF THE INVENTION

The present invention relates generally to a theropeutic support device, particularly to an elbow support device for providing relief of elbow pain, and especially the pathological lesion known as "tennis elbow."

A common injury, particularly to tennis players, is a painful inflammation at the elbow. It is believed that the inflammation results from the stretching of a tendon which has its point of origin on the elbow. Such tendon is technically known as the common extensor origin of the lateral humeral epicondyle. The injury may occur for a variety of reasons. One such reason is due to the shock placed upon such tendon by improper stroking of the ball. Such shock occurs because it is difficult for every tennis player to master the necessary technique for continually stroking the ball correctly. Moreover, even the experienced and expert player in a game as fast as tennis often finds it necessary to hit the ball while off balance and/or in an awkward position, thereby being unable to strike the ball in the proper manner to minimize such shock.

In the past, treatment of tennis elbow has included rest, cock-up splints, and elbow braces to allow the injured tendon and associated muscles to heal. Where the injury is too severe, it has been necessary to resort to surgical methods such as fasciotomy, muscle stripping, or tendon lengthening.

The surgical method of curing the problem is usually considered to be a last resort as it is expensive and results in a permanent modification of the arm muscle structure. The cock-up splints and the elbow braces have also been unsatisfactory. They are expensive, cumbersome, and unnatural. Such splints and braces are designed to prevent the arm from straightening. By this means they alleviate the tension on the elbow tendon technically known as the common extensor origin on the lateral humeral epicondyle. The aforesaid splints and braces are cumbersome and difficult to apply and have the disadvantage that the arm cannot be extended. The full extension of the arm is the natural and best way of playing tennis. As a result, the wearer of the brace has to develop a new and unnatural stroke.

SUMMARY OF THE INVENTION

A flexible but non-elastic band for circumscribing the forearm adjacent the elbow is provided. The band is of a predetermined width range to cooperate in obtaining the desired spreading of the resistive pressure while mitigating wrinkling or skewing of the device; the band is also of a predetermined adjustable length range to provide the necessary tightness. In the preferred form, the band is held in place by a fastener which facilitates the even distribution of the pressure and in obtaining the desired tightness. In the preferred form, the band is a laminate with the inner surface being of a foam rubber padding to assist in preventing slippage.

By the foregoing arrangement, a band is provided which operates to resist the expansion of the forearm which is normally caused by the maximum contraction of the wrist and finger flexors and extensors at the moment of impact. The device has the advantage of not continually and unduly compressing the forearm muscles during the non-impact periods while preventing excessive expansion of such muscles at the critical moment of impact to achieve the desired result. As a result, the device achieves its purpose without stopping the circulation or causing discomfort to the wearer.

The foregoing device is light in weight, comfortable, easy to apply and remove, and does not encumber the wearer or interfere with the normal elbow motion necessary for a normal tennis stroke. The device is constructed and arranged to apply a minimum and comfortable pressure during ordinary exertion, but acts to apply strong counter-pressure at the moment of impact. By this arrangement, the device can remain in position on the forearm during strenuous activity while continually alleviating pain resulting from play. In addition, one size support fits all patients thereby providing ease of dispensing and prescribing. In severe cases, the use of the forearm band relieves the pressure while the arm is also being treated with local anesthetic and steroid injections into the tender tissues distal to the lateral epicondyle.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a fragmentary, generally side elevation view of the theropeutic support device made in accordance with the present invention, and is illustrated as applied to the forearm of a tennis player;

FIG. **2** is a top plan view of the top, or outer surface of the device;

FIG. **3** is a plan view of the bottom, or inner surface of the device; and

FIG. **4** is a cross-sectional view taken along the plane of line **4—4** of FIG. **2.**

DESCRIPTION OF THE PREFERRED EMBODIMENT

The theropeutic support device made in accordance with the present invention, illustrated generally at **2,** is best shown in FIG. **1** disposed in encompassing relation around the forearm **4** of a tennis player immediately below the elbow **6.** In general, the device **2** includes an elongated web-like body **8** constructed in accordance with a predetermined width-and-length range. Preferably, the body **8** is of a laminated construction (FIG. **4**) having an inner layer **10** made of a flexible, friction gripping and cushion-like material which may be fixedly secured to an outer layer **12** made from a flexible, inelastic material. The body **8** includes a selectively adjustable fastener means, designated generally as **14,** constructed to hold the opposed ends of the body in secured overlapping relation to provide a closed, adjustable loop encompassing the forearm **4** in the installed position thereof.

In accordance with the invention, the body **8** of the device **2** is preferably of a substantially inextensible, yet flexible construction. In the form shown, the outer layer **12** is preferably made of a high strength, inelastic material which has minimum elongation or stretchability in any direction when subjected to load. Preferably, the material is made from a non-woven fabric, such as muslin with a duck substrate, or a canvas material or the like. For example, in the present invention it has been found that such material for the outer layer has a elongation or stretchability which does not exceed a length increase of three-eighths inch upon application of an axial load of **10** pounds or does not exceed a length increase of **1/2** inch upon an axial load of **20** pounds. Being of a non-woven construction, the fabric material for the outer layer provides the desired flexi-

bility to enable the body **8** to be readily wrapped in encompassing relation around the forearm.

In the invention, it has been found important that the width of the body **8** of a predetermined dimension for optimum results. Preferably, the body **8** has a widthwise dimension in a range between 2 inches to 3 inches with the preferred dimension being 2-½ inches. Moreover, it has been found that when the device has a lesser widthwise dimension, it does not give the desired distribution of support pressure for the forearm, and that a greater width results in a loose fit so as not to achieve the objects of the present invention.

In accordance with the invention, it is desired that the pressure applied to the forearm muscle be more of a restrictive pressure, resisting undue expansion of the muscle, rather than a compressive pressure. Since such resistive pressure occurs only when the ball is actually being struck, the pressure is not sufficient to cut-off the circulation or cause discomfort to the user. Thus, it is in accordance with the invention for the body **8** to be adjustably secured in position so as to apply minimum pressure upon the forearm muscle during the time when it is relaxed. The forearm muscle is in such a relaxed condition during much of a tennis game, since only a small portion of the total time of a tennis match is involved in the actual contact with the ball. Moreover, such time of contact is very short in duration. Accordingly, this minimum pressure is supplied, in part, by use of a friction or non-slip gripping material which provides a frictional contact between the inner layer **10** and the surface of the forearm to assist in holding the body **8** in position rather than relying on securement by extreme compression. In the invention it has been found that a preferred material for the inner layer **10** be made from a flexible, elastomeric material having friction gripping and cushion-like characteristics, such as foam rubber.

In the invention, the inner **10** and outer **12** layers are preferably secured to one another so as to prevent relative movement therebetween and to prevent any wrinkling between the component layers. Accordingly, the layers may be secured together by an outer stitching, as at **16,** disposed around the outer periphery thereof. In addition, the confronting opposed surfaces of the inner and outer layers may be bonded to one another, as at **18,** so as to provide a laminate-like construction. Preferably, the layers may be bonded together by a suitable adhesive material which is compatible with the material of the inner foam layer and which provides a bonded securement to the outer layer **12.**

In the invention, though the body **8** could be wrapped with more than one revolution about the forearm, it is preferred that only one revolution or wrap be utilized. In any event, it is important that the pressure exerted by the wrapped body be such so as not to apply excessive pressure to the forearm during the period of its relative relaxation. Accordingly, it is an important aspect of the invention that the fastening system, as at **14,** be employed to provide adjustability, not only to fit a variety of arms, but to permit each user to adjust the device for his own personal comfort. Moreover, such fastening system must not only permit rapid application, but also should maintain general uniformity of pressure upon the forearm.

In the invention, it has been found that a Velcro type fastener system having predetermined dimensions and incorporated on the body **8** of the device is preferable. Velcro is a trademark of Nelcro S.A. Such fastener system is based upon the concept of an intermeshing relation between loop-like projections on one member that are adapted for interlocking engagement within a fibrous, mat-like material.

As best seen in FIGS. **2** and **3,** the fastener system **14** of the present invention includes an elongated base member **20** fixedly secured by stitching **22** adjacent one end of the body **8** and on the side adjacent the outer layer **12** thereof. As shown, the base **20** includes a series of spaced parallel rows of loop-like projections **24** made integral with the base and extending outwardly therefrom. By this arrangement, the loop-like projections **24** are of a generally U-shaped construction with the distal end of the loop extending in a direction away from the base **20.** Preferably, the base **20** has a length of approximately 5 inches and a width of 2 inches. The base is preferably of an elongated, polygonal, such as rectangular, construction extending parallel to and in a lengthwise direction with respect to the longitudinal central axis of the body **8.** Preferably, the base is disposed inwardly of the opposed side edges **26** of the base a distance of approximately one-fourth inch, and is spaced inwardly adjacent one of the respective ends **28** of the body **8** a distance of approximately 1 inch.

At the opposite end **28** of the body **8,** a pair of elongated straps **30** and **32** are provided to extend laterally outwardly from the body **8.** In the form shown, the straps **30** and **32** are fixedly secured by suitable stitching, as in **34,** adjacent the end of the body **8** on the side adjacent the outer layer **12,** and are preferably disposed in generally parallel relationship with respect to one another and with respect to the longitudinal central axis of the body **8.** Each of the strap-like members **30** and **32** includes a fibrous, mat-like material **34** and **36** (FIG. **3**) disposed on the side adjacent the inner layer **10** of the body **8.** By this arrangement, the loop-like projections **24** of the base **20** are received in interlocking meshing engagement with the fibrous, mat-like material **34** and **36** provided on the respective straps **30** and **32** for holding the body in closed overlapping relation around the forearm **4** in the installed position, as best seen in FIG. **1.**

Preferably, the straps **30** and **32** have a width of approximately 1 inch and a length of approximately 3 inches. The straps **30** and **32** are disposed in overlapping relation to an extent of approximately 1 inch with respect to the body **8** in relation to the end edge **28** so that they extend laterally outwardly from the edge **28** a distance of approximately 2 inches. By this arrangement, there is avoided any loose edges which would provide undesirable flapping due to the wind velocity created by movement of the forearm during the striking of the ball. Such flapping would provide a source of annoyance to the user. In addition, any loose flapping surfaces would possibly cause a loosening or wrinkling of the body **8** and, hence, might interfere with the quality of the forearm swing. Moreover, swing. a game such as tennis, it is desirable to have minimum distractions as the game requires the utmost concentration. The type of fastener system described has been found to provide the additional advantage in that it is not only quick and easy to install, providing for rapid adjustment, but it also distributes the fastening pressure evenly, thereby further increasing the anti-skew characteristic of the device. This is extremely important since the device

does not rely upon compression for holding same in place during the period of relaxation of the forearm. It is to be recognized that in periods when the forearm is relaxed, it may still be in motion. For example, when a player is running in a direction toward the ball he is necessarily gripping the Racket (FIG. 1) tightly to prepare for his stroke. Moreover, during a tennis match, many times a player is running to be in a given position and is not even preparing to strike the ball. At such time, again, the arm would be in motion as part of the retention of balance in running. During such periods of motion, it is necessary that the device not slip or become wrinkled, thereby lessening or destroying the effectiveness thereof.

In the invention, the body **8** has been constructed to have a length sufficient to accommodate almost all forearm sizes. Preferably, the body has a length of between 8 inches to 15 inches with 8-½ inches to 14-½ inches being preferred. This taken in conjunction with the adjustable fastener system **14** provides the desired support for practically any size forearm and provides the maximum elongation of three-eighths inch to one-half inch for the minimum and maximum length sizes, respectively, as aforesaid.

In the embodiment shown, the inner layer **10** has a thickness arranged between one thirty-secondth inch and one-sixteenth inch, and the outer layer **12** has a thickness arranged between one thirty-secondth inch and one-sixteenths inch with the overall thickness of the body **8** being between one-sixteenth inch and three-sixteenths inch, and with the preferred overall thickness being one-eighth inch.

In a typical application, the body **8** of the device **2** is simply wrapped about the forearm **4** immediately below the bend of the arm at the elbow **6,** as best seen in FIG. **1.** The device should be applied sufficiently forward on the forearm so that it does not cut into the flexed bicep muscle on the upper arm when the forearm is bent to its maximum upward limit.

In the invention, the lengthwise dimension of the body **8** is adjusted by wrapping the same partway around the forearm, and holding it in this partially wrapped position, as by placing the forearm against the front of the users body. Then with the thumb, for example, placed upon the base **20** of the fastener system **14,** the fingers can separately move the other end of the body with the strap **30** and **32** into tight overlapping engagement with the opposite end of the body **8,** thereby to slightly compress the muscle underlying the body of the device. When this position is achieved, the strap **30** and **32** may then be pressed by the fingers of the right hand, for example, into the base **20** so as to mesh the projections **24** in interlocking holding engagement within the fibrous mat-like material **34** and **36** of the respective straps, thereby securing the device in position with the desired amount of tightness. During play, the device is secured in encompassing relation comfortably on the forearm. Then, during the periods when the ball is actually being stroked, the device sufficiently resists the expansion of the forearm to apply the desired counter or resistive pressure thereto. As a result, the undesired stretching of the lateral humeral epicondyle is prevented.

By the foregoing arrangement, and accompanying drawings it will be seen that the present invention provides a therapeutic support device wherein the symptoms of "tennis elbow" can be controlled in a high percentage of patients by by its use on the proximal forearm. This limits full contraction of the wrist extensor muscles. Moreover, the device reduces tension on the tendon fibers originating from the lateral epicondyle. The use of the device in accordance with the invention replaces taping and re-taping with adhesive tape and effectively lessens the need for surgery, hastening recovery, and permitting earlier return to athletic and work without recurrence of pain.

I claim:

1. A proximal forearm therapeutic support band for alleviating the symptoms of the pathological lesion known as "tennis elbow" by applying restrictive pressure against expansion of the proximal forearm upon contraction of the musculature thereof, said support band comprising,

a flexible, essentially inelastic body adapted to be secured around the proximal forearm immediately below the elbow in the general relaxed condition thereof,

said body being substantially rectangularly shaped and having opposed side and end edges with a length between about 8 to 15 inches and a width between about 2 to 3 inches.

said body being of a laminate-like construction including an inner layer made of elastomeric, friction material for providing a friction surface for holding said body against movement when disposed around said forearm, and an outer layer made of essentially inelastic, fibrous material disposed in engaged superimposed relation with said inner layer,

said inner and outer layers being secured to each other throughout their confronting surfaces to provide said laminate-like construction,

said laminate-like construction of said body, as provided by said outer layer, having a maximum elongation between three-eighths to one-half inch when subjected to an axial load of between 10 lbs. to 20 lbs. per unit of length for controllably limiting radial expansion of the resistive force caused by tightening of the forearm muscle so as to prevent full contraction of the wrist tensor muscles during use thereof, and

selectively adjustable fastener means disposed on the said body for securing said body in an adjustable loop along said forearm including a base member secured to said outer layer on the surface opposite said inner layer and disposed adjacent one end of said outer layer, said base member including a plurality of tooth-like projections, and at least one strap-like member secured to said outer layer on the surface opposite said inner layer and disosed adjacent the opposed end of said outer layer, said strap-like member including a mat-like fibrous layer for interlocking engagement with the projections on said base member to hold said body in encompassing relation around said forearm in the secured position of said fastener means.

2. A proximal forearm support band in accordance with claim **1,** wherein

said inner and outer layers are secured to one another throughout their respective peripheries by means of stitching so as to secure the opposed side and end edges thereof in abutting, non-overlapping relationship, with the layers bonded together intermediate of said stitching.

3. A proximal forearm support device in accordance with claim 2, wherein

said base member is spaced inwardly of the associated end of the outer layer,

said strap-like member extends in generally parallel relation to the longitudinal central axis of said body and overlaps said body at one end and extends outwardly from the associated end of the outer layer at its opposed end.

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