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(54) **APPARATUS FOR USE IN EXERCISING**

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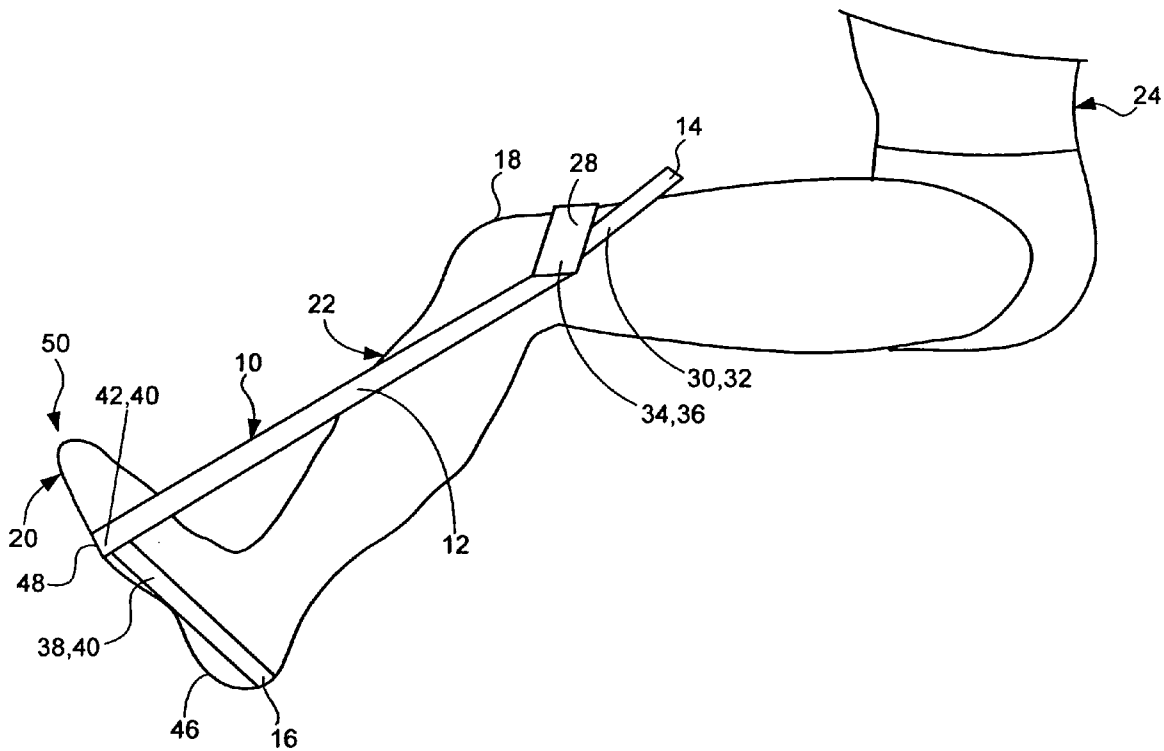
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(57) **ABSTRACT**

**Related U.S. Application Data**

(63) Continuation-in-part of application No. 10/482,808, filed on Jan. 5, 2004, filed as 371 of international application No. PCT/AU02/00895, filed on Jul. 5, 2002.

Apparatus for use in exercising, including means for engaging the foot of one leg of a user of the apparatus, wherein the means for engaging is adapted to retard movement of the foot as the foot moves from a first position towards a second position.



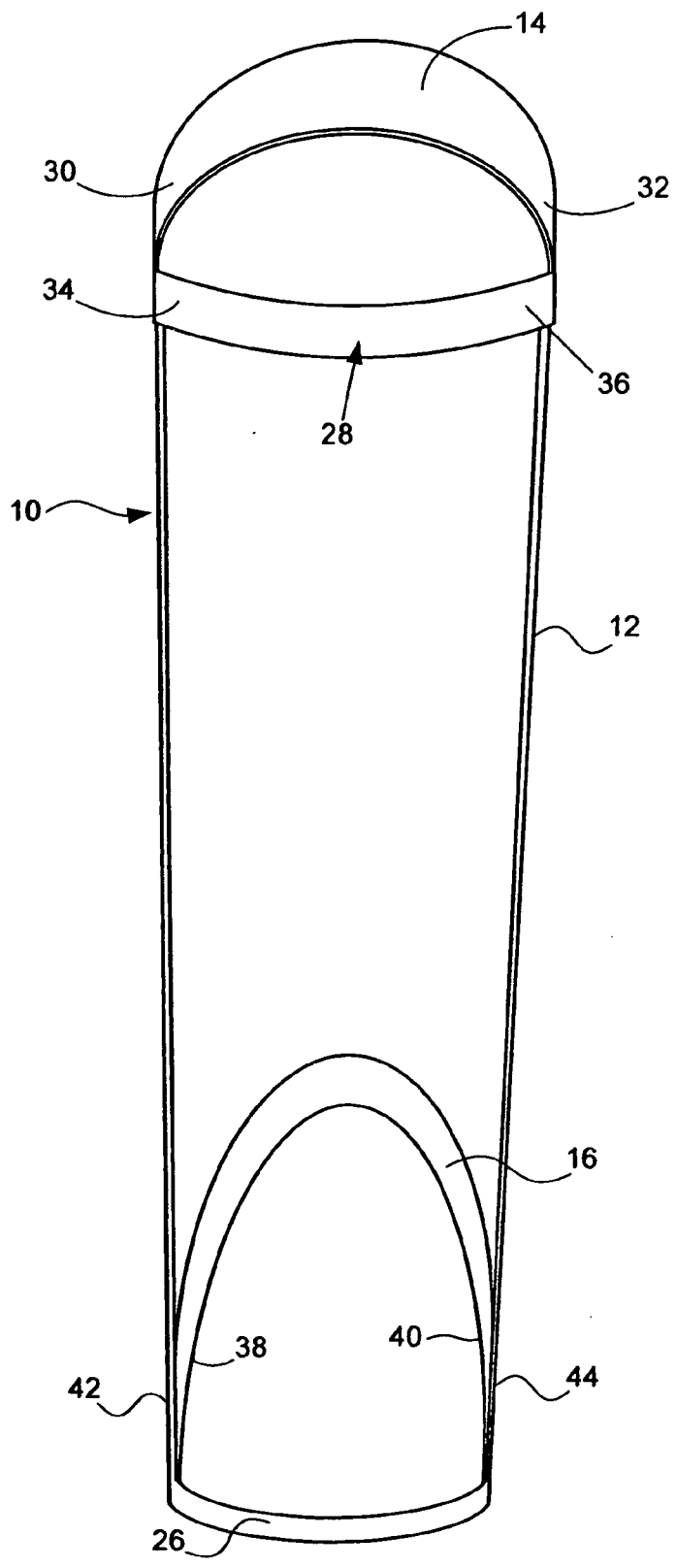


Figure 1

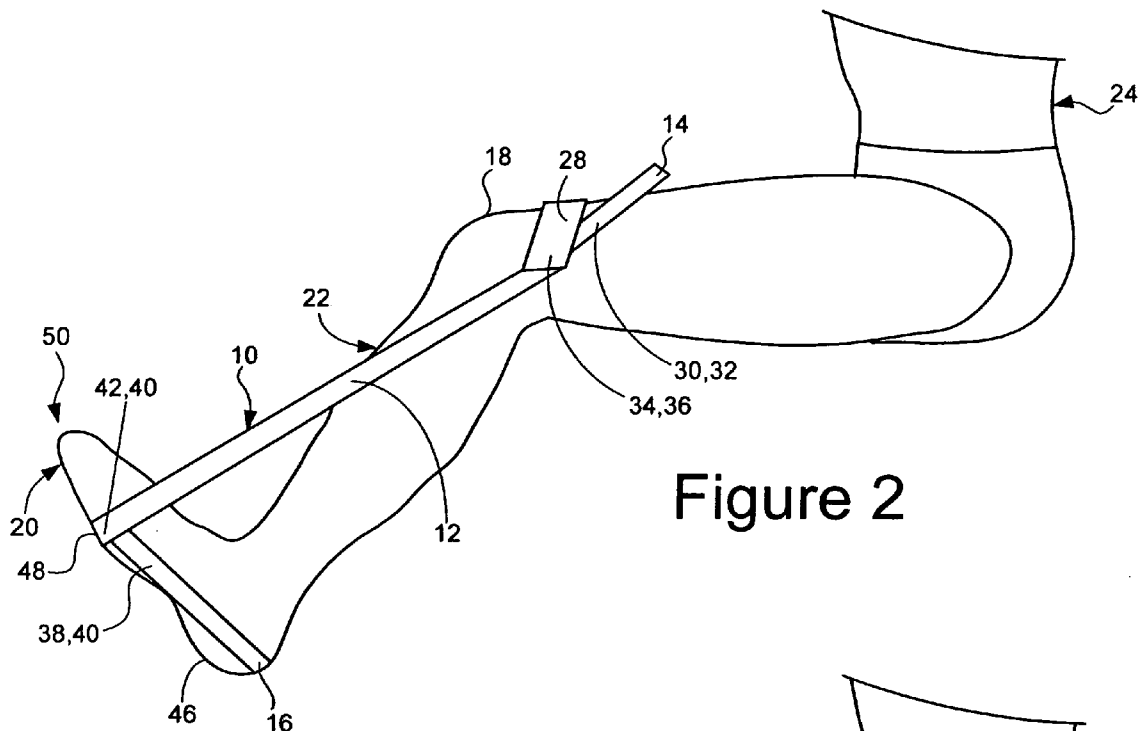


Figure 2

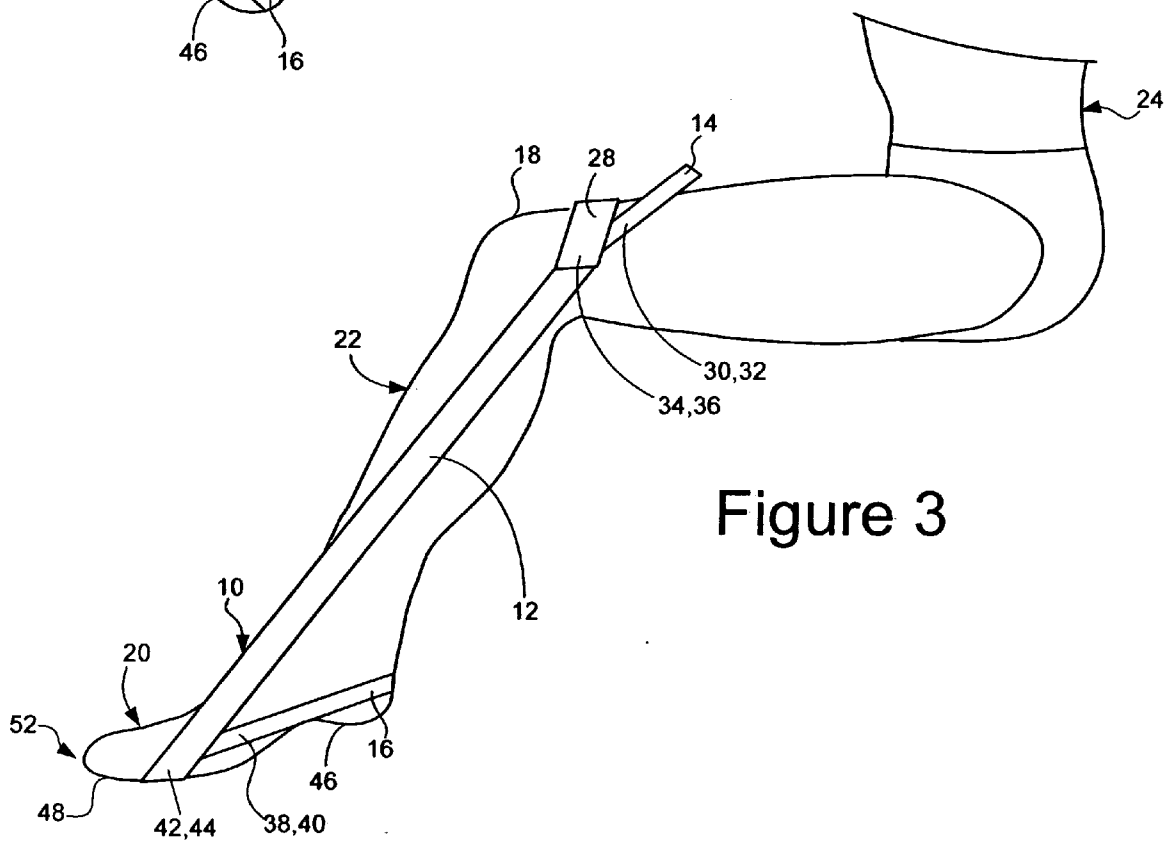


Figure 3

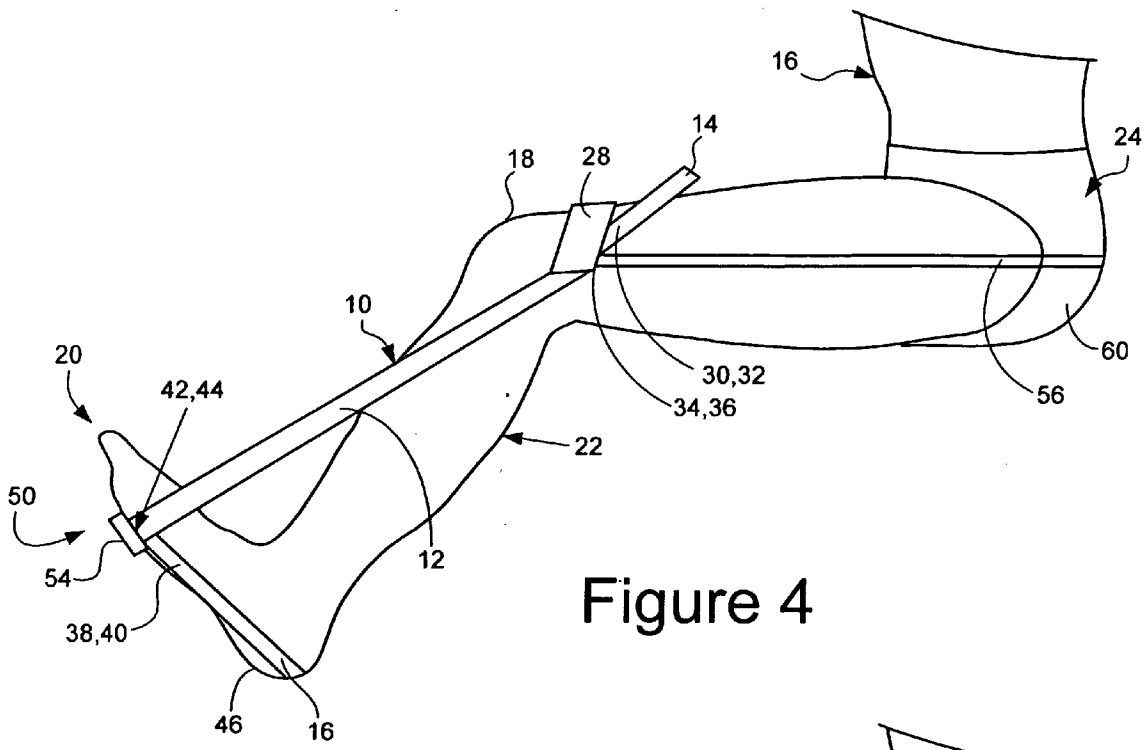


Figure 4

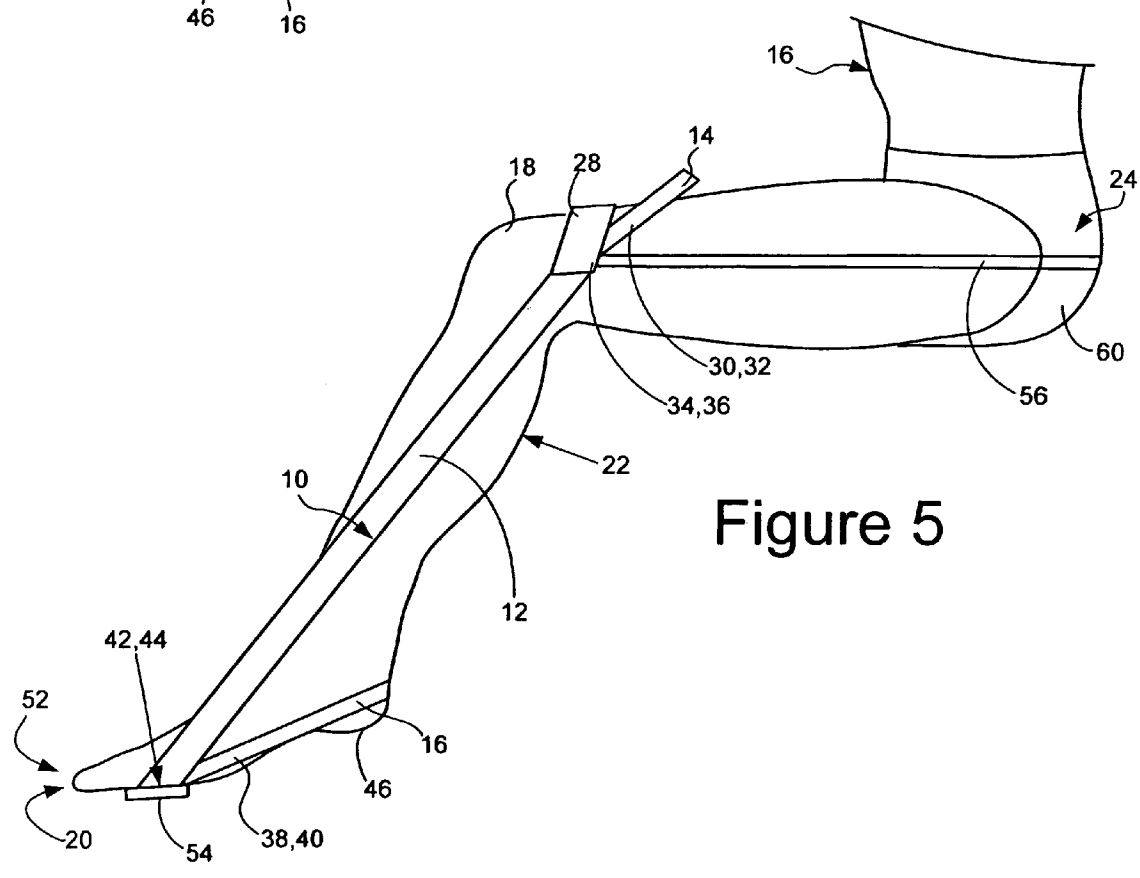


Figure 5

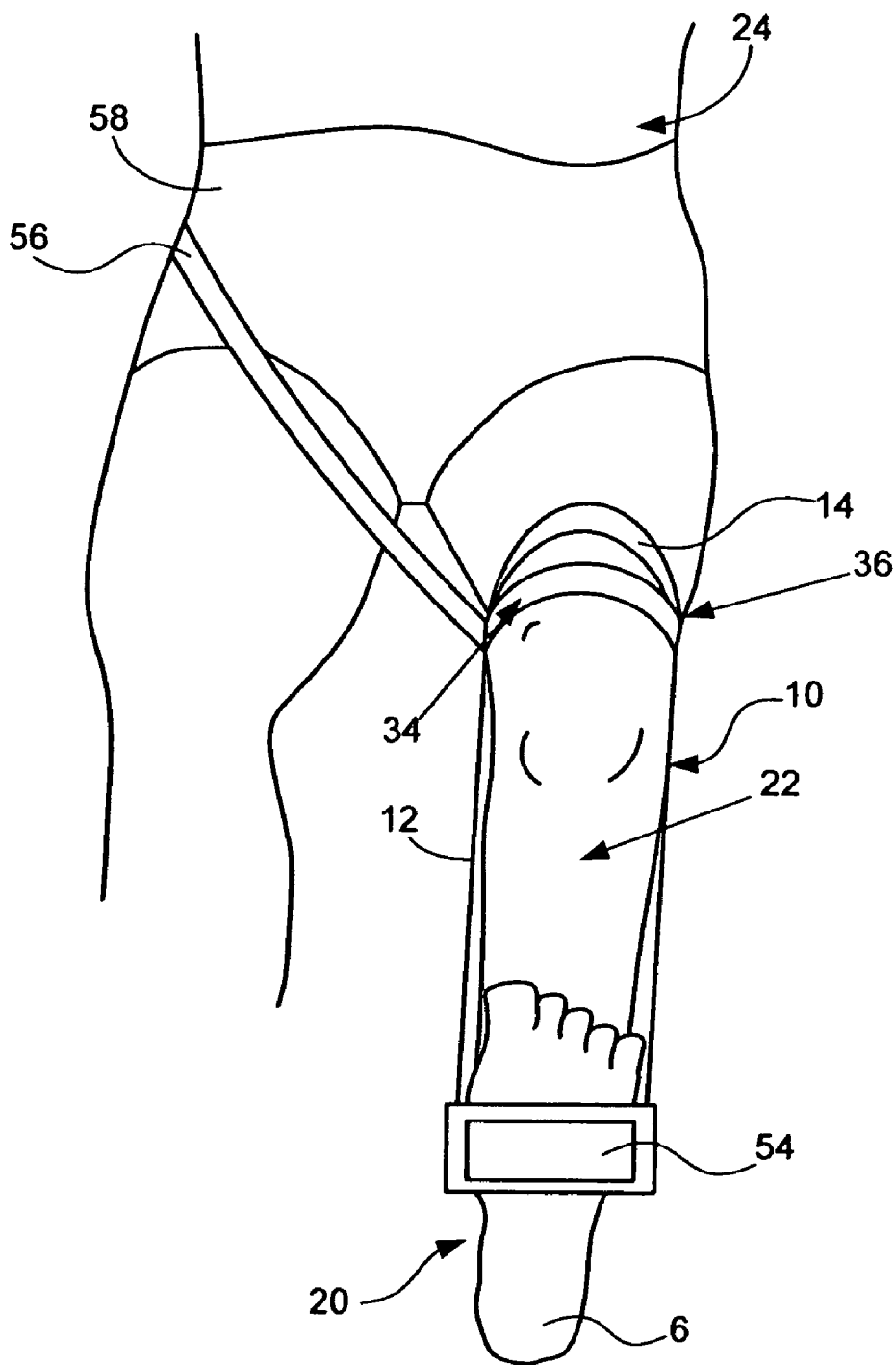
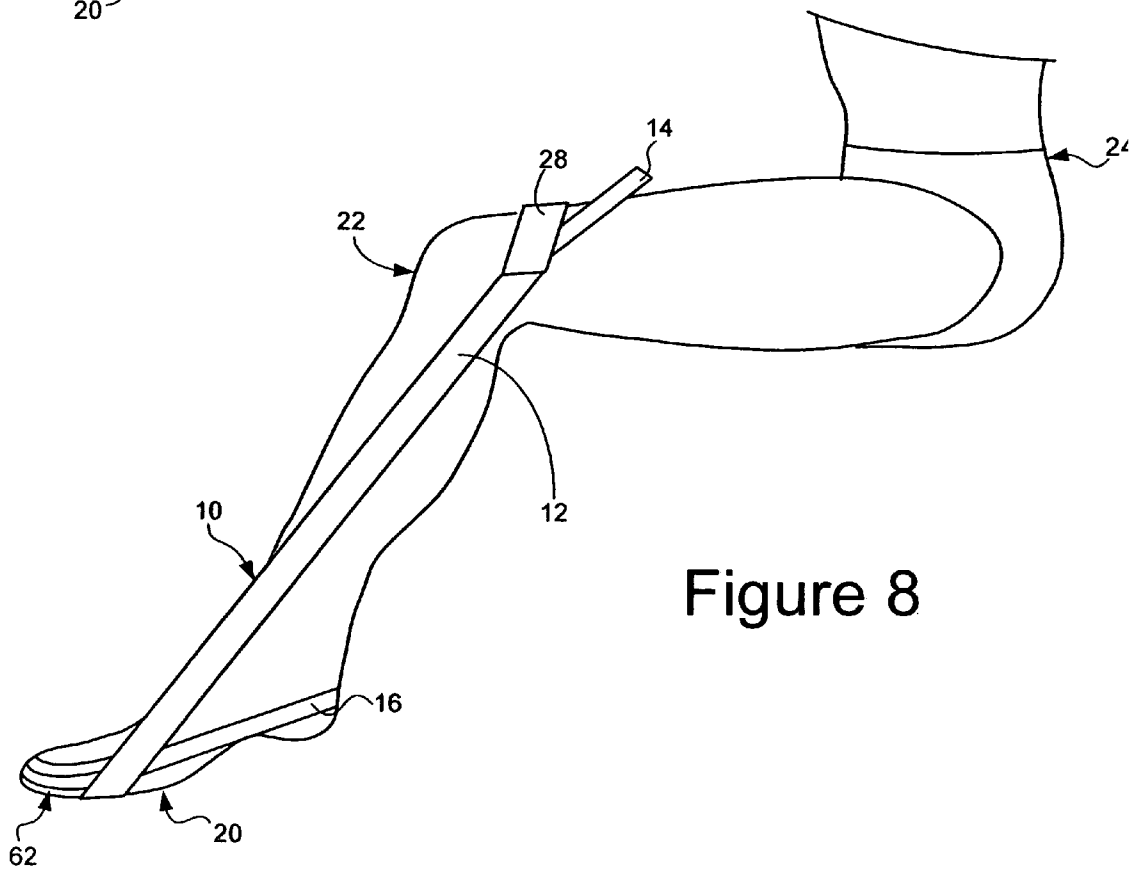
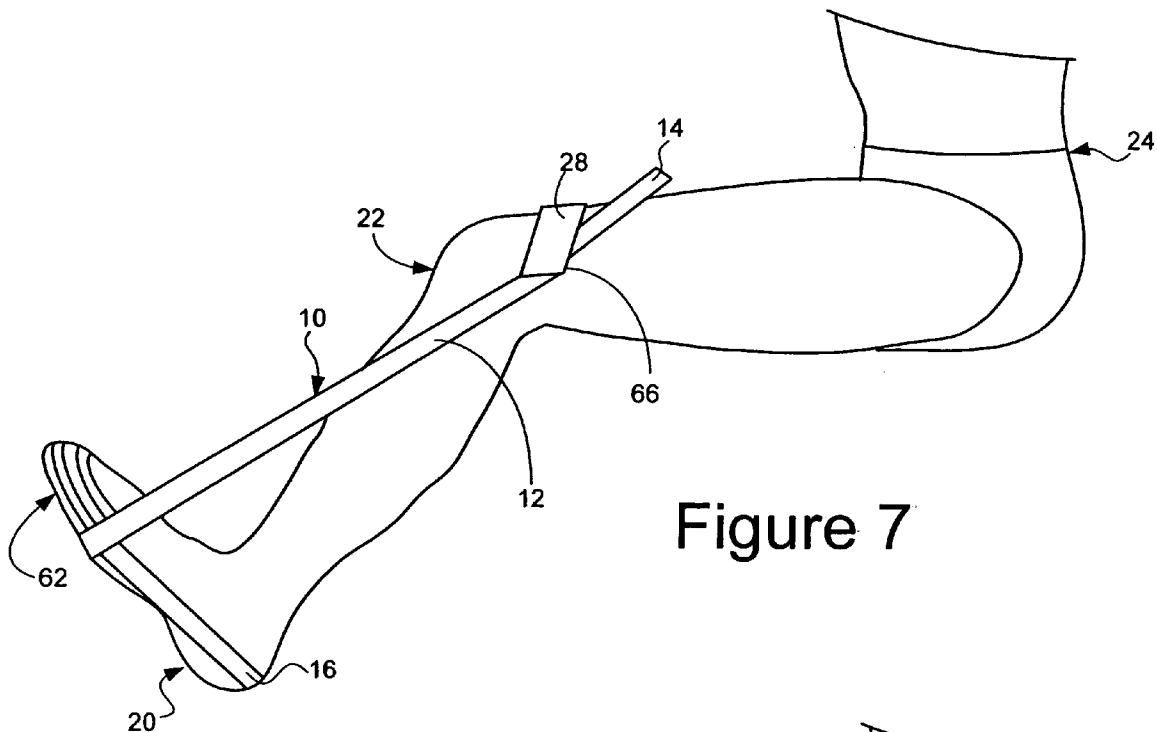


Figure 6



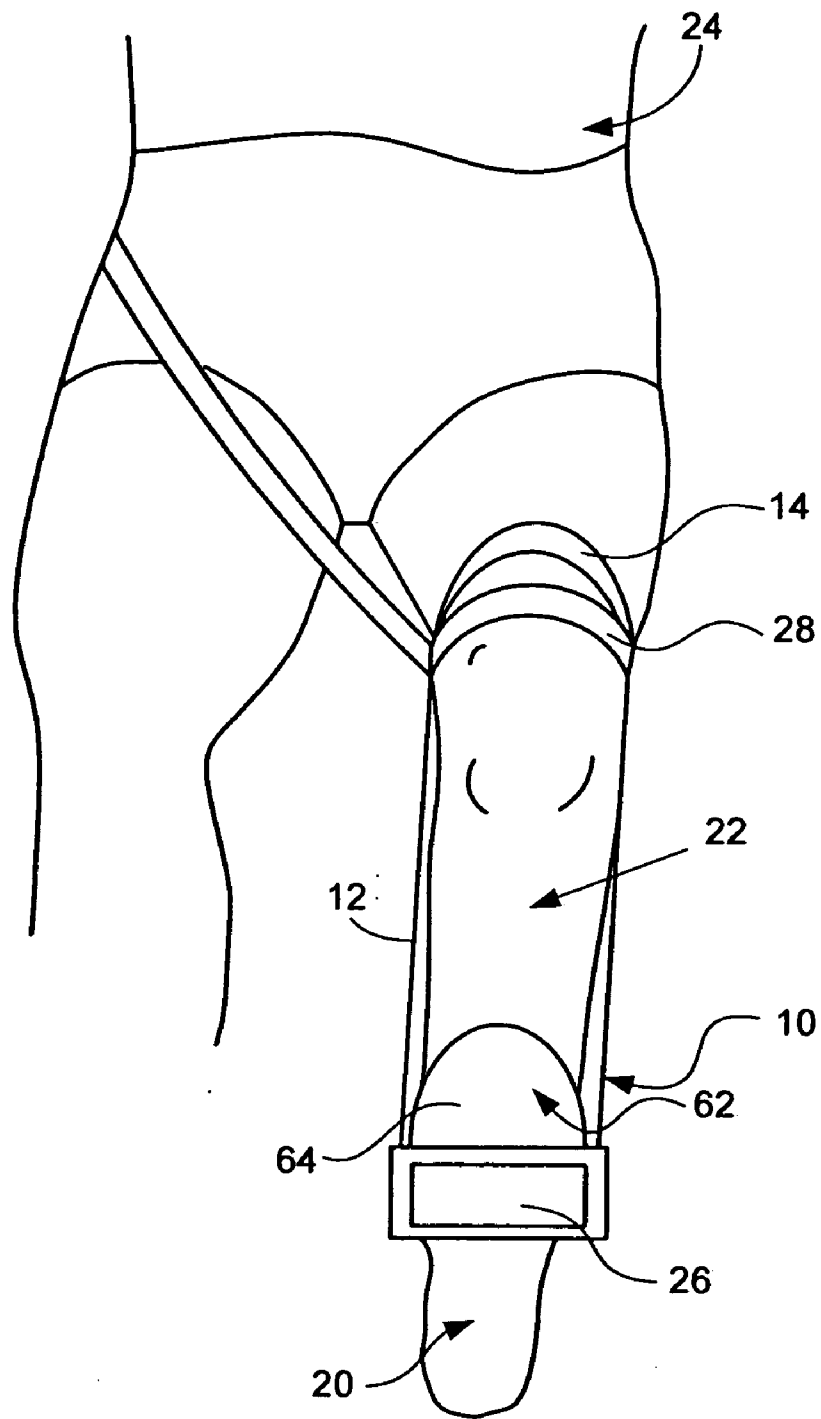


Figure 9

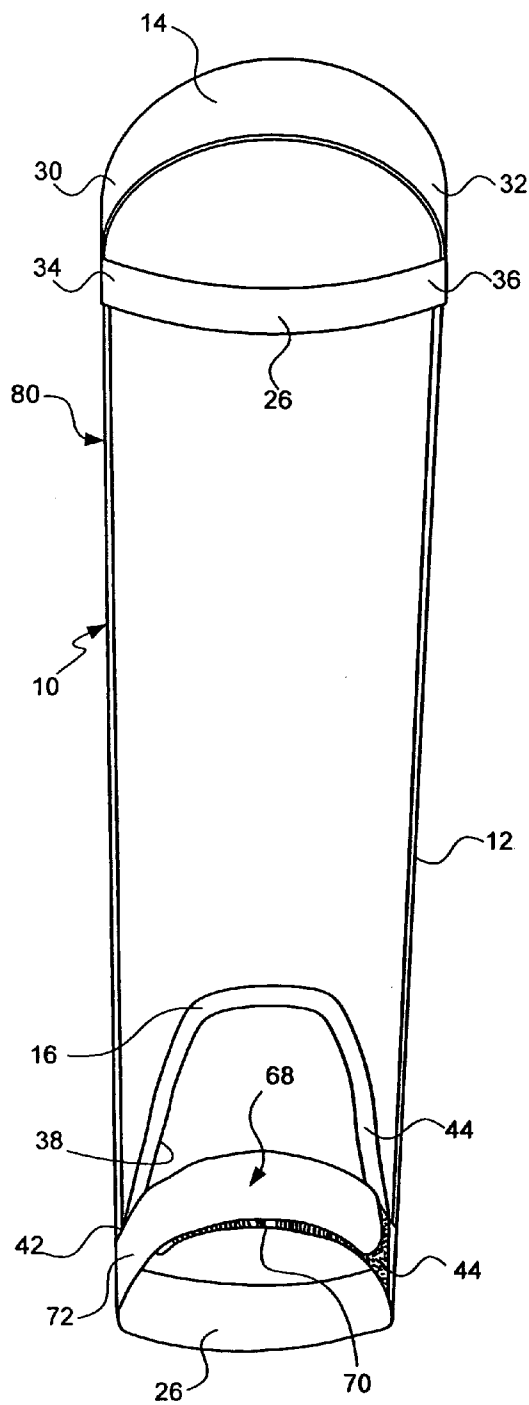


Figure 10

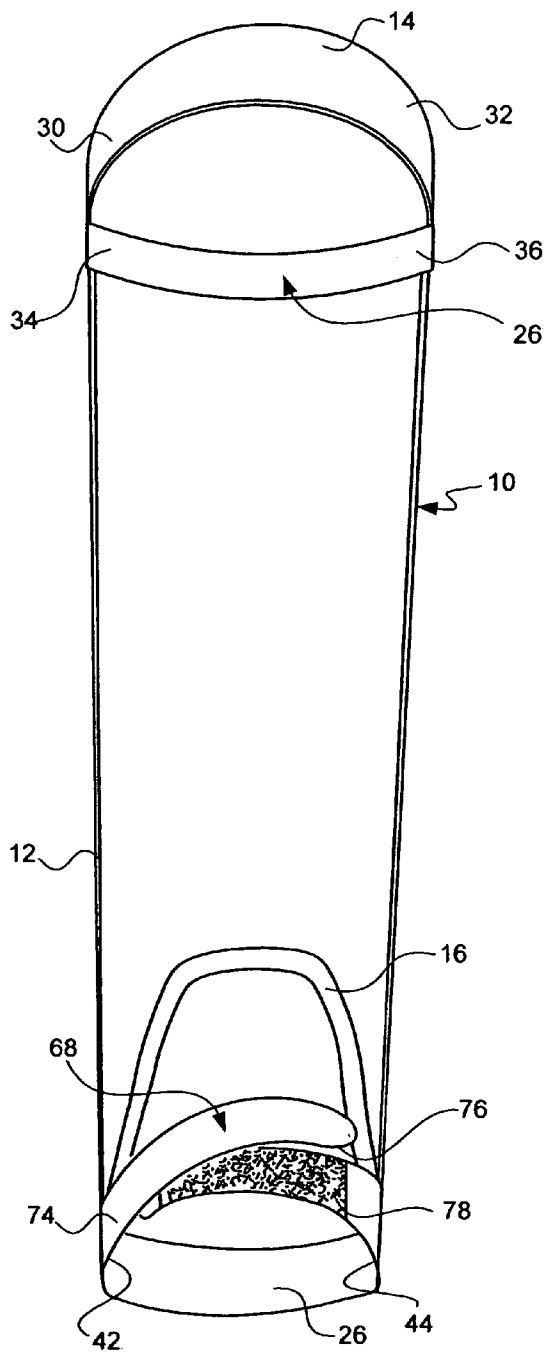


Figure 11



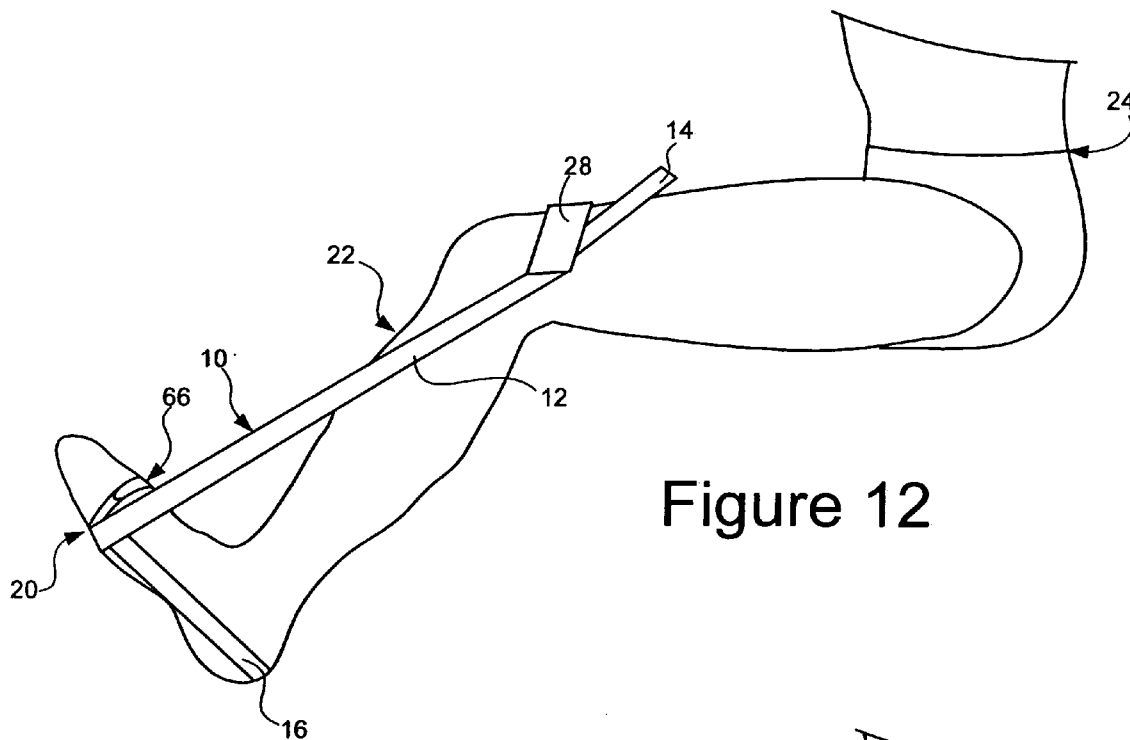


Figure 12

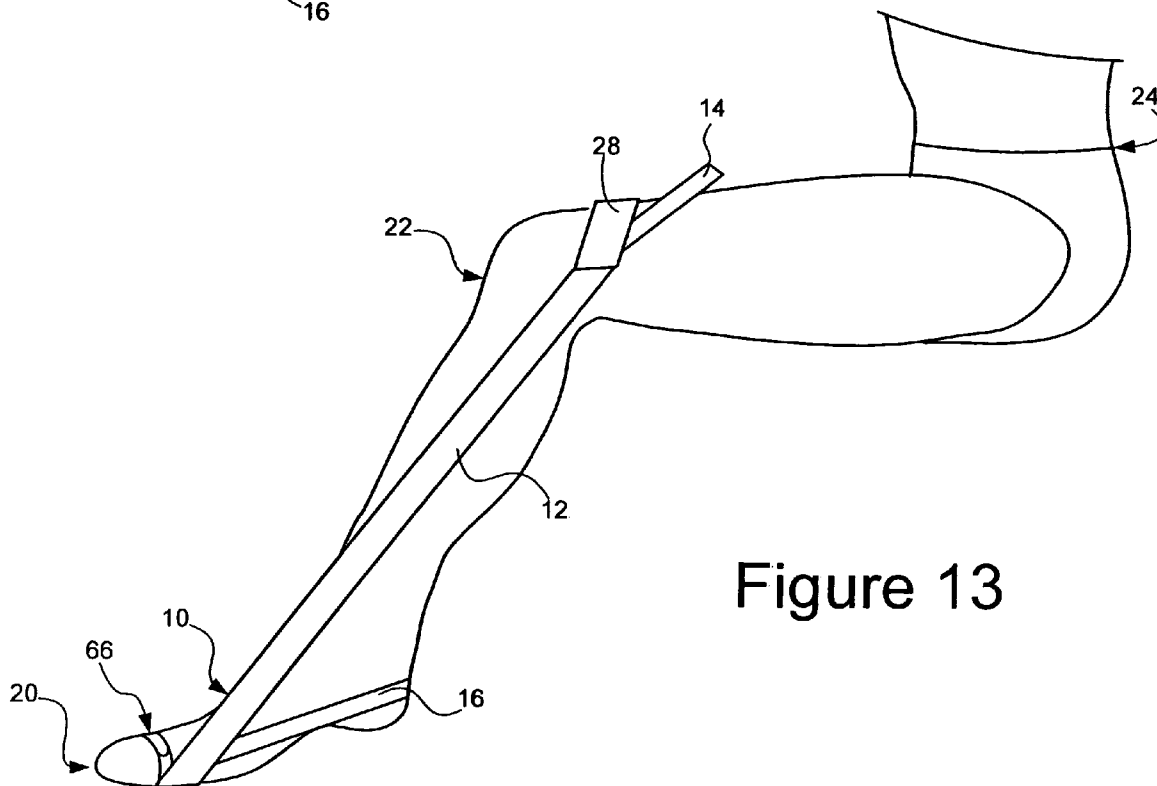


Figure 13

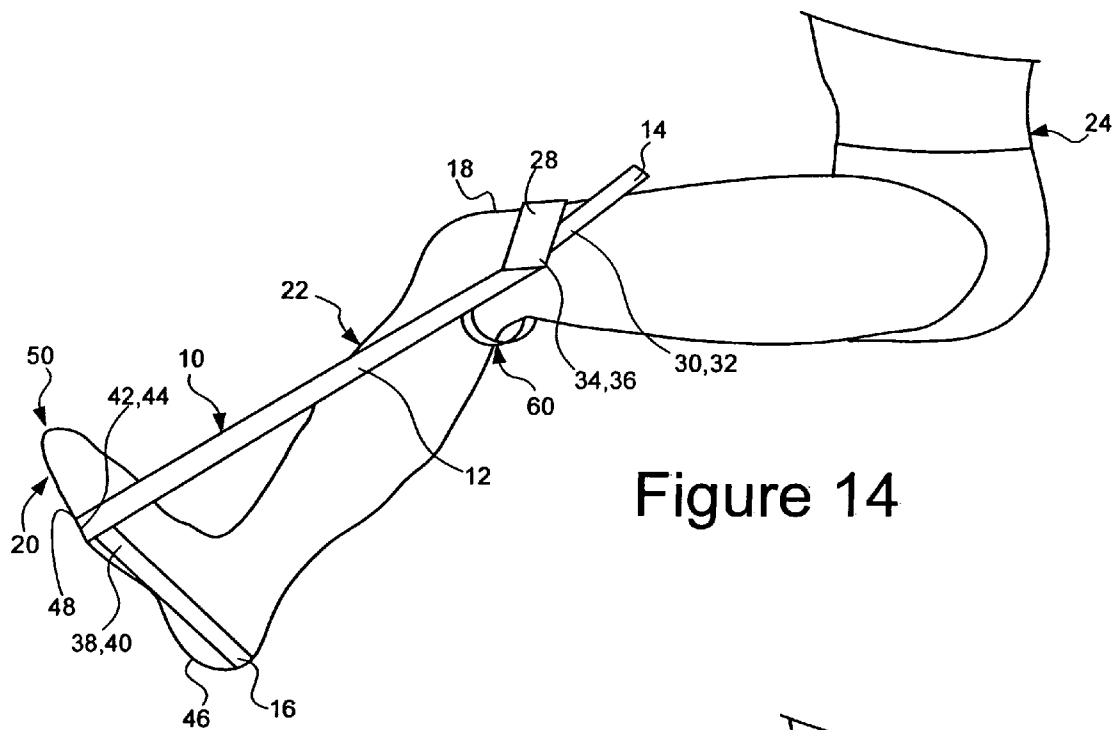


Figure 14

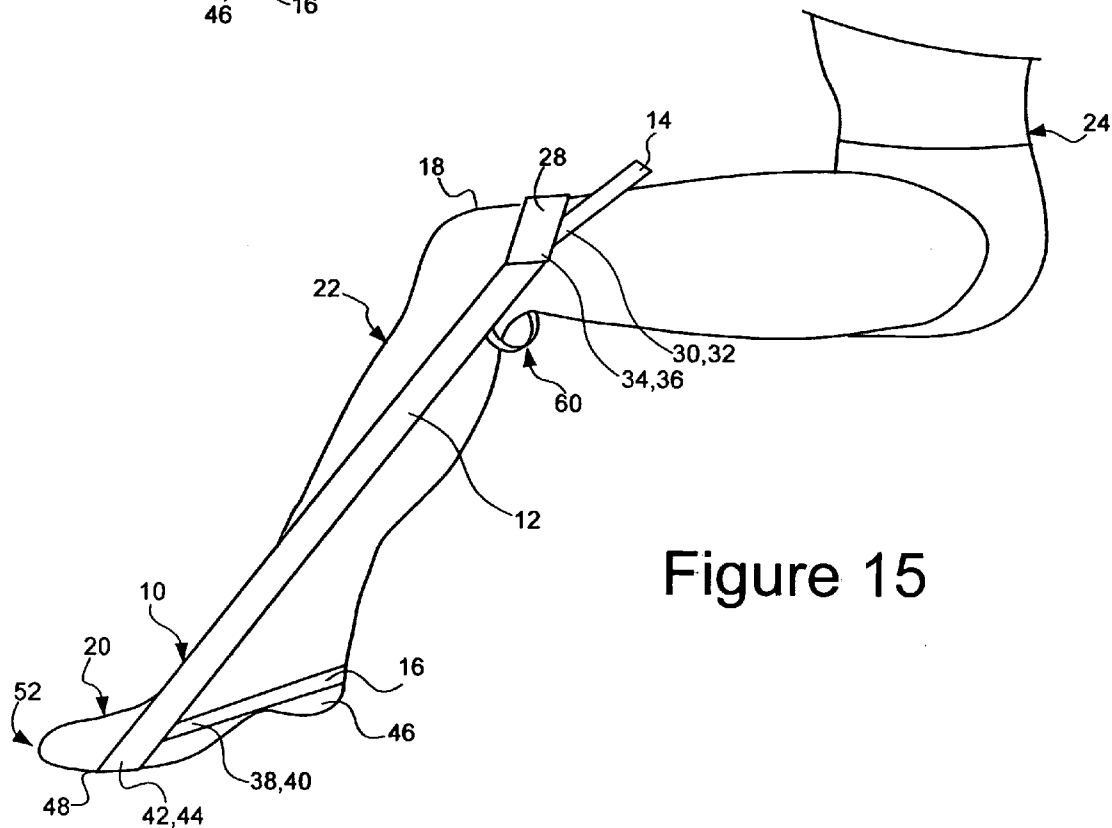


Figure 15



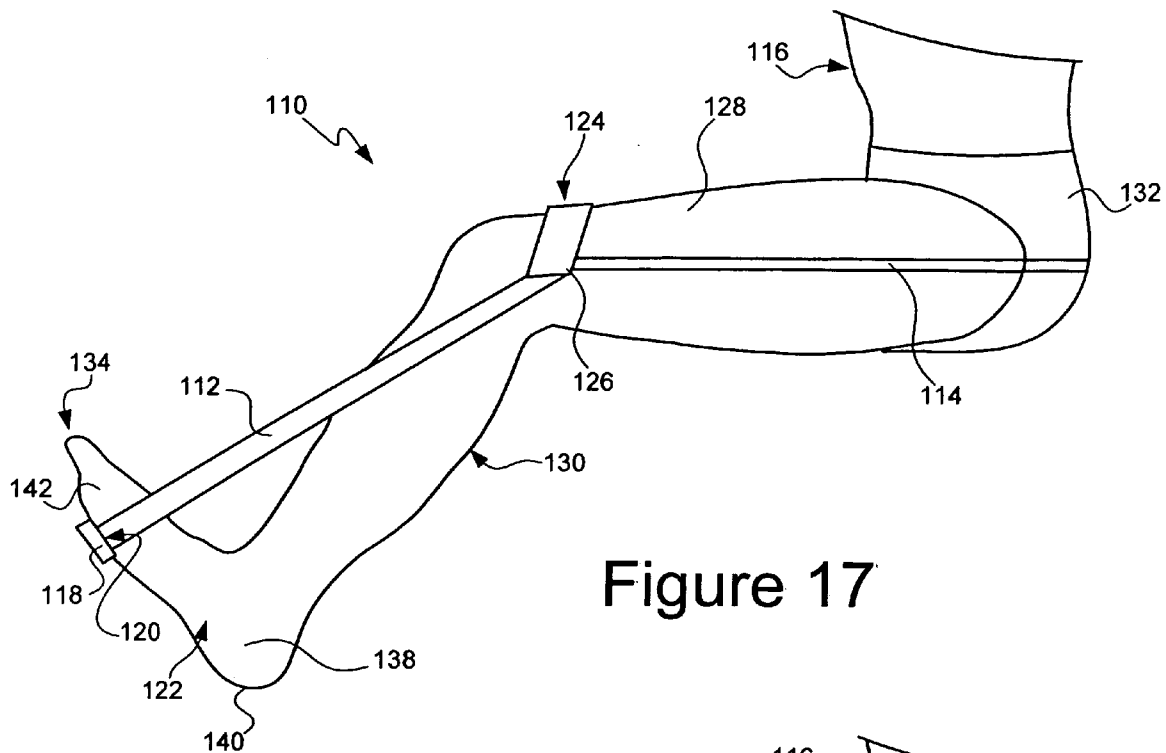


Figure 17

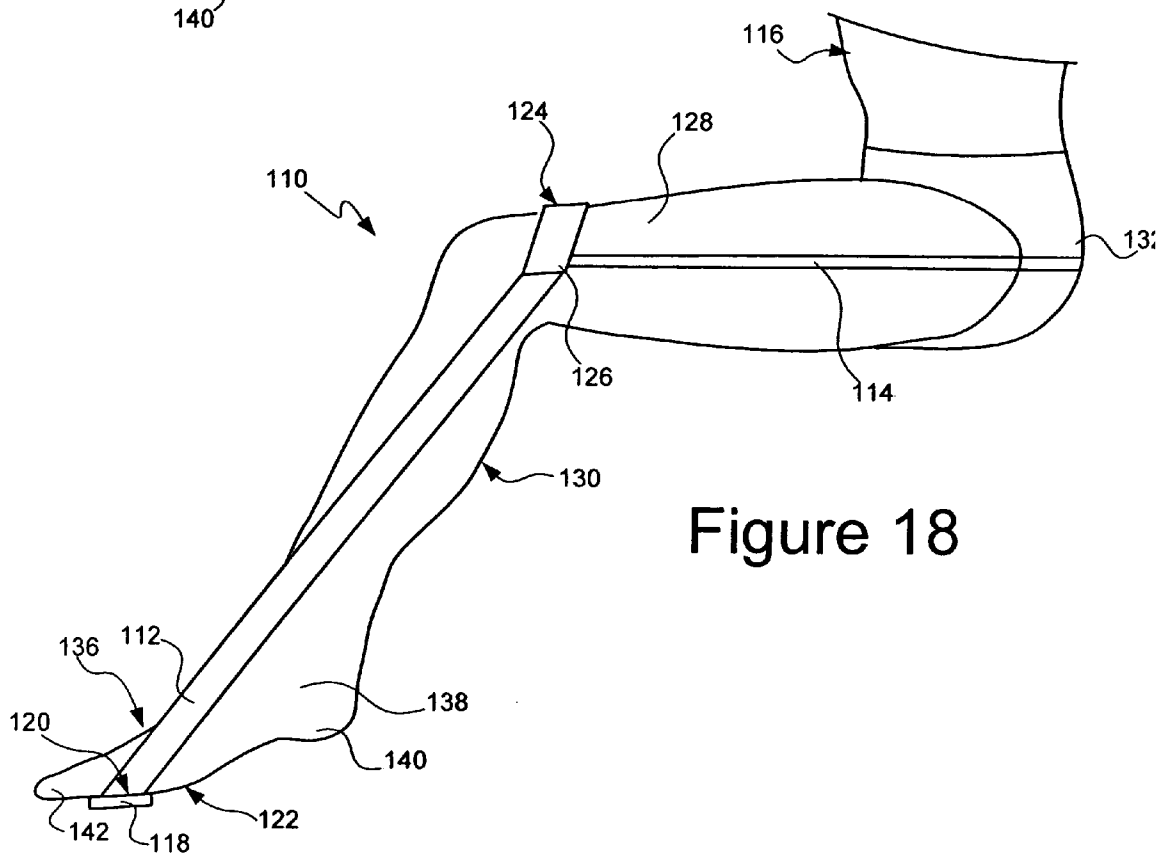


Figure 18

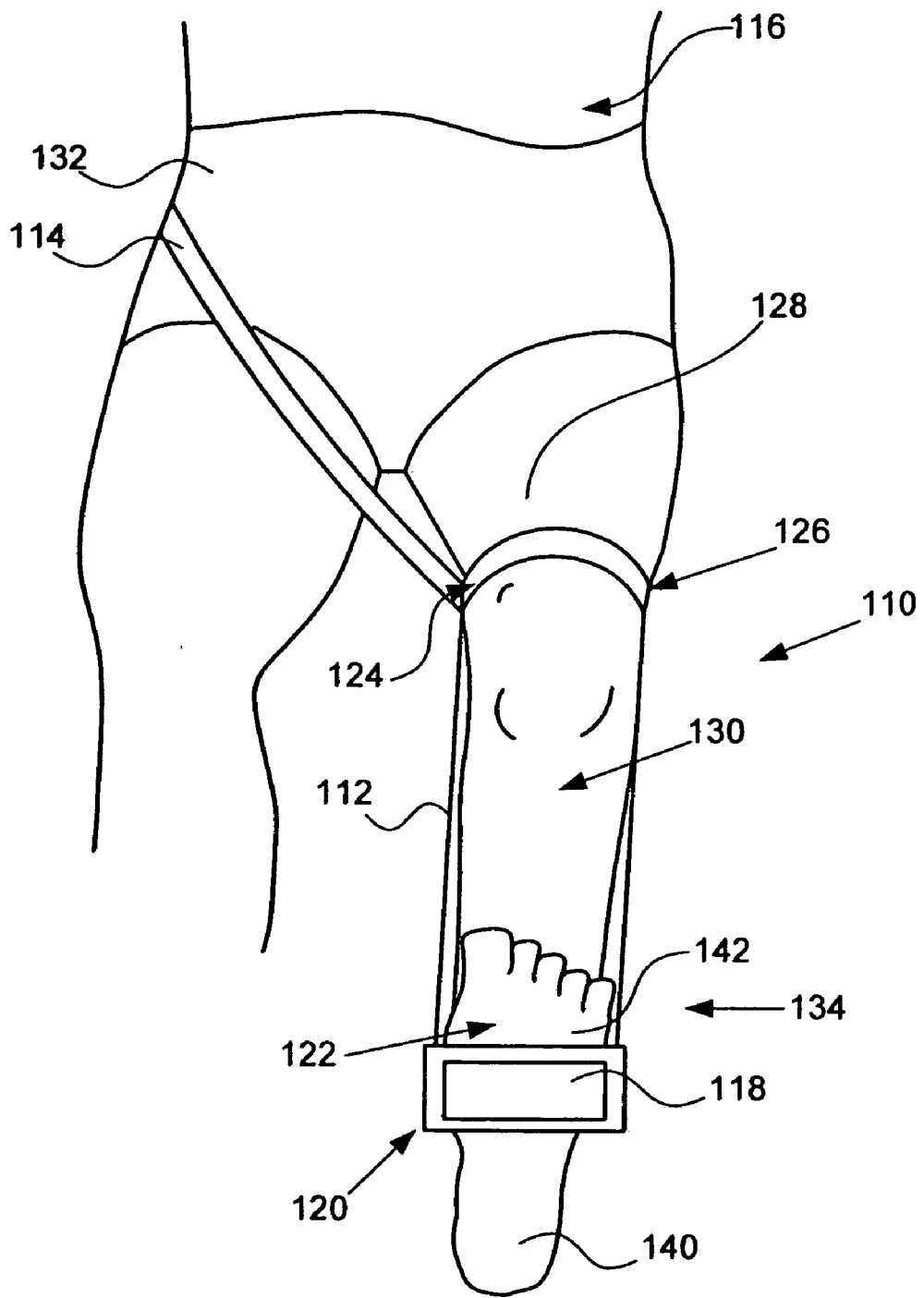


Figure 19

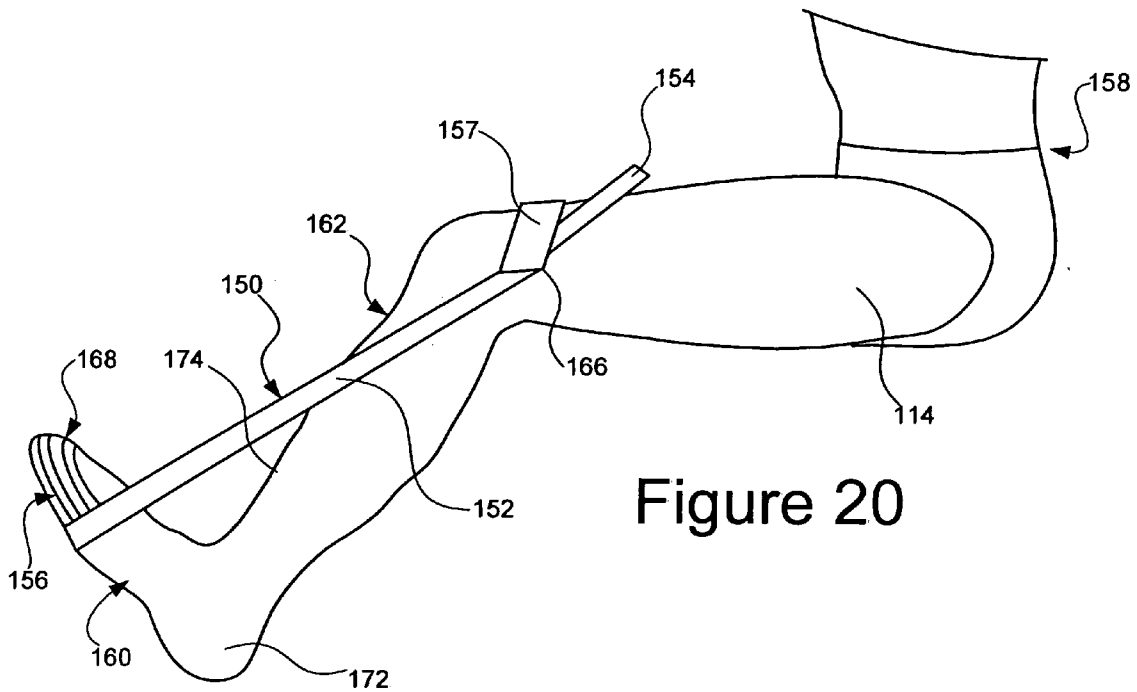


Figure 20

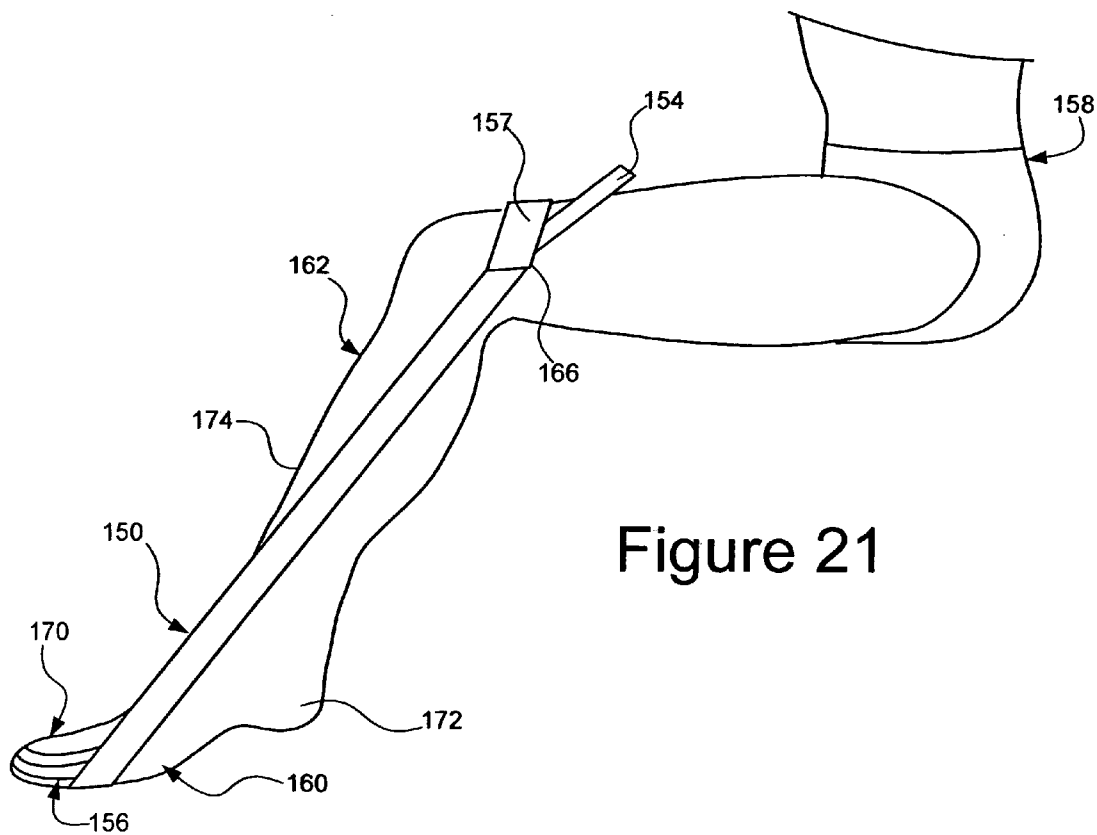


Figure 21

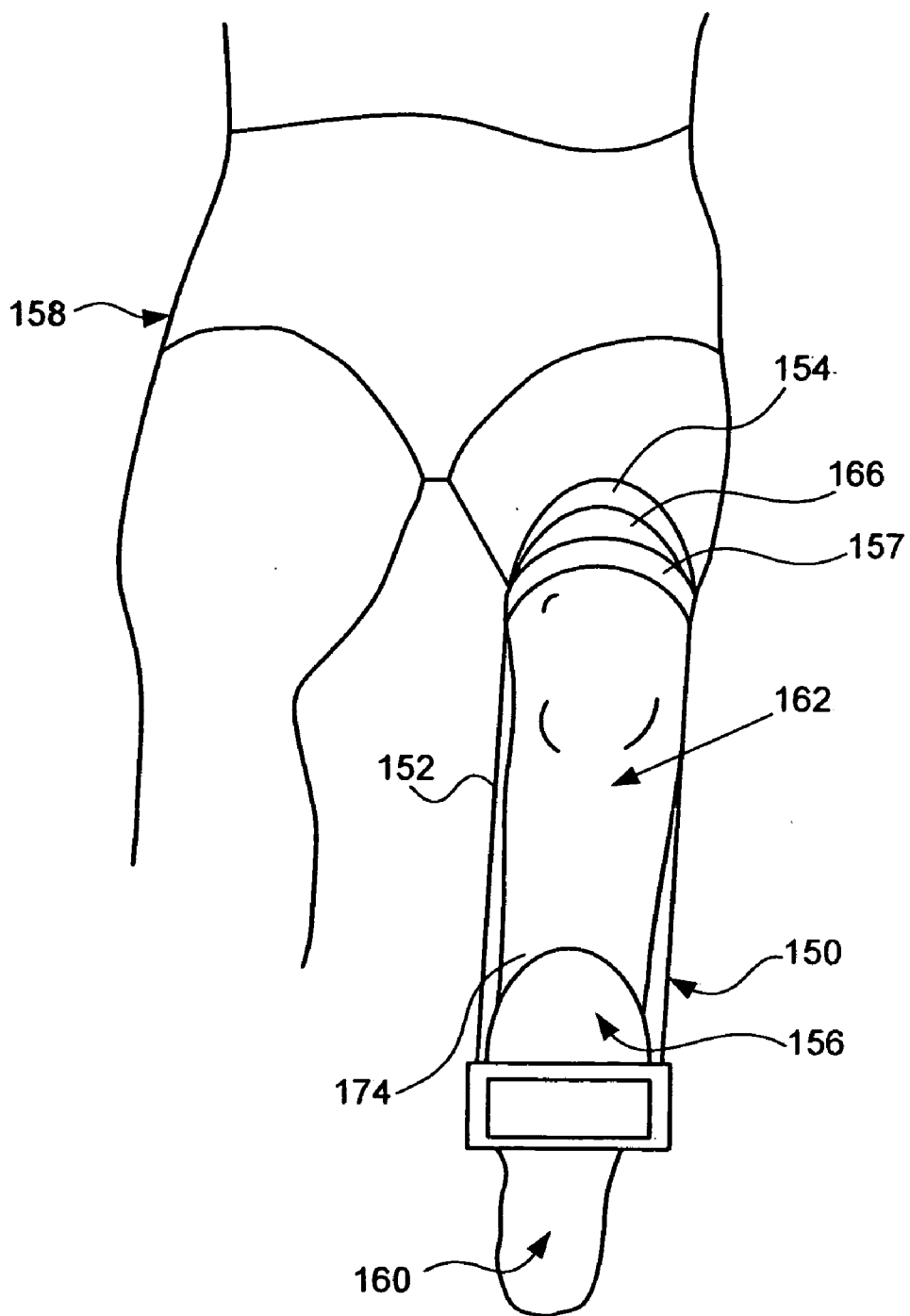


Figure 22

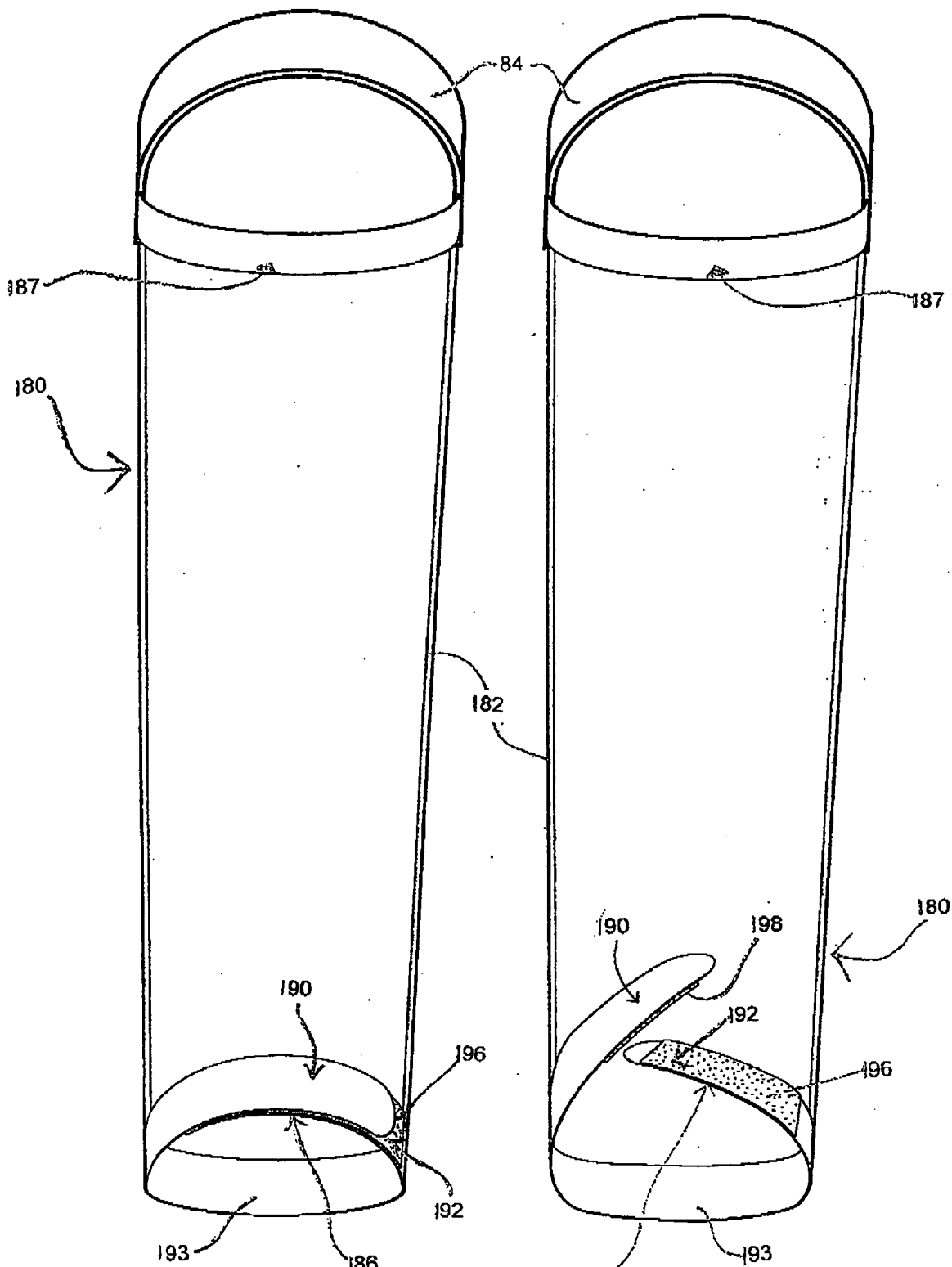


Figure 23

Figure 24



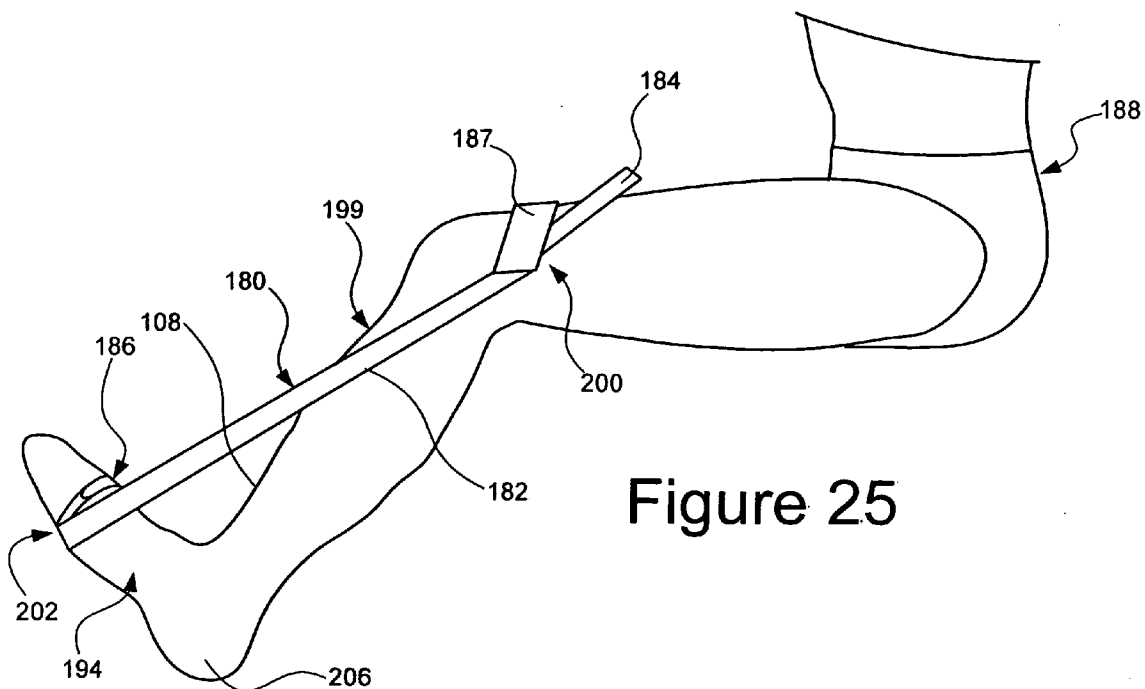


Figure 25

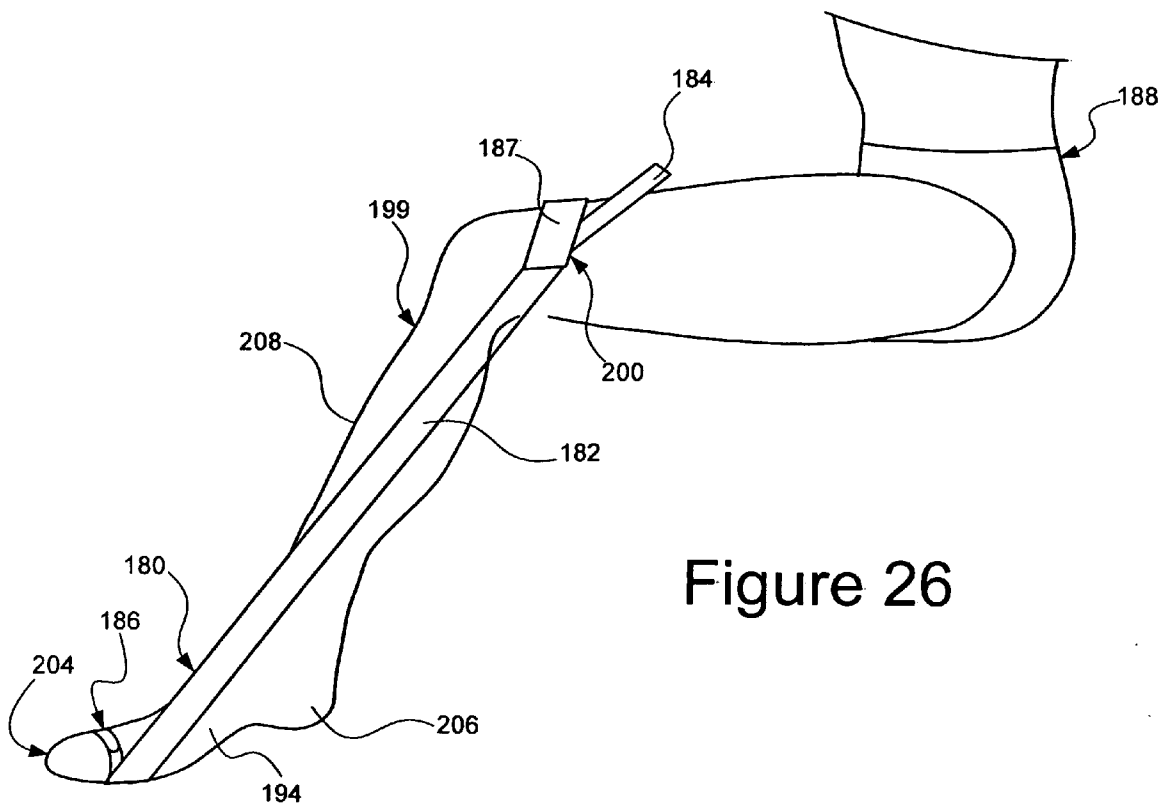


Figure 26

**APPARATUS FOR USE IN EXERCISING**

[0001] The present invention relates to apparatus for use in exercising.

[0002] Oxygenated blood is pumped under pressure from the heart to all parts of a human body along arteries and returns to the heart for re-oxygenation along veins. Blood may also be returned to the heart by muscle pump action. For example, when the calf muscle of a person's leg is flexed and the surrounding veins are thereby constricted, blood will be forced away from the area of constriction. Valves present in the veins ensure that all blood flowing from the area of constriction flows towards the heart.

[0003] Muscle pump action in a person's legs is generally reduced when they are in an upright seated position for extended periods. A person's capacity to return blood to the heart may therefore be reduced under such conditions. Further, blood has a tendency to pool in the lower regions of the body as a result of gravity.

[0004] In general, blood has a tendency to clot when it slows or stops. The mentioned pooling of blood in the lower regions of the body, together with the reduced muscle pump action, creates an environment that is conducive to clotting. If a blood clot, also known as a thrombosis, forms in the described manner and dislodges from a lower region of the body, it will travel along the person's veins back towards the heart. A dislodged thrombosis, known as an embolus, will then enter the right hand side of the heart and will be pumped from the heart to the lungs via the pulmonary artery for re-oxygenation. The diameter of the veins on which the embolus travels, as it moves towards the heart from the lower regions of the body, increases as the embolus approaches the heart.

[0005] The pulmonary artery receives blood from the right hand side of the heart and feeds it into the lungs via numerous blood vessels. The diameter of each of these blood vessels is substantially less than the diameter of the pulmonary artery and as a result the embolus may stop or slow as it attempts to flow into one or more of these blood vessels. An embolus that stops or slows in the pulmonary artery effectively blocks or slows the rate at which these blood vessels take blood from the pulmonary artery to the lungs. Such an embolus is known as a pulmonary embolism.

[0006] A pulmonary embolism reduces the amount of blood flowing into the lungs and, as such, the amount of blood returning to the heart from the lungs. Further, the pulmonary artery has a reduced capacity to distribute blood to the lungs and the right hand side of the heart continues to pump blood into the pulmonary artery. The result is a build up of blood stemming back from the pulmonary artery and into the heart.

[0007] Generally, a pulmonary embolism subjects a heart to stress and in some cases this stress can cause heart failure.

[0008] Individuals tend to remain in upright stationary positions for extended periods when travelling in vehicles for long distances, for example, or while seated at the theatre or watching television. When travelling on an aeroplane, for example, a passenger may remain in a seated position for several hours with little to no movement of the legs. Space on board aeroplanes is generally very limited and there is

little capacity and/or opportunity to exercise the leg muscles. Such individuals are therefore at risk of developing deep vein thrombosis.

[0009] The National Institute of Neurological Disorders and Stroke (NINDS) describes restless legs syndrome (RLS) as a neurological disorder characterised by unpleasant sensations in the legs and an uncontrollable urge to move when at rest in an effort to relieve these feelings. Symptoms of RLS are typically described as burning, creeping, tugging sensations. The sensations may range in severity from uncomfortable to irritating to painful.

[0010] A characteristic of RLS is that lying down or relaxing tends to activate the mentioned symptoms. As such, people with RLS may have difficulty falling asleep and staying asleep. Left untreated, RLS may cause exhaustion and daytime fatigue.

[0011] According to NINDS, excessive exercise tends to aggravate the symptoms of RLS. However, NINDS has found that a program of regular moderate exercise helps to alleviate the symptoms of RLS.

[0012] In accordance with the present invention, there is provided Apparatus for use in exercising, including:

[0013] (a) means for retarding movement of the foot of one leg of a user of the apparatus as the foot moves from a first position towards a second position; and

[0014] (b) means for limiting movement of the means for retarding with respect to said foot,

[0015] wherein the means for retarding is couplable to the foot and the knee of said leg.

[0016] In accordance with the present invention, there is also provided a method for effecting a muscle pump action in a leg of a person, including the steps of:

[0017] (a) fitting the above-described apparatus to said leg;

[0018] (b) alternately pivoting the foot of said leg about the ankle joint between first and second positions,

[0019] wherein the step of fitting includes the steps of arranging a first section of the loop to underly engage the foot, stretching the loop so that a second section of the loop overly engages an upper portion of the leg, and arranging the means for retarding around a lower portion of the leg.

[0020] In accordance with the present invention, there is also provided apparatus for use in exercising, including:

[0021] (a) means for retarding movement of the foot of one leg of a user of the apparatus as the foot moves from a first position towards a second position, the means for retarding being couplable to the foot and the knee of said leg, and

[0022] (b) means being positionable under said knee, said means substantially preventing movement of a portion of the apparatus with respect to said knee.

[0023] In accordance with the present invention, there is also provided a method for effecting a muscle pump action in a leg of a person, including the steps of:

[0024] (a) fitting the above-described apparatus to said leg;

[0025] (b) alternately pivoting the foot of said leg about the ankle joint between first and second positions,

[0026] wherein the step of fitting includes the steps of arranging a first section of the loop to underly engage the foot, and stretching the loop so that a second section of the loop overly engages an upper portion of the leg.

[0027] In accordance with the present invention, there is also provided a method of inhibiting the development of deep vein thrombosis by performing the above-described method for effecting a muscle pump action.

[0028] In accordance with the present invention, there is also provided a method of mitigating the development of thrombosis inducing conditions by administering to a subject the above-described apparatus.

[0029] In accordance with the present invention, there is also provided a method of promoting blood circulation in the body of a subject by administering to the subject the above-described apparatus.

[0030] In accordance with the present invention, there is also provided a method of promoting blood circulation in the body of a person by performing the above-described method for effecting a muscle pump action.

[0031] In accordance with the present invention, there is also provided a method for prophylaxis of deep vein thrombosis including the step of administering to a subject the above-described apparatus.

[0032] In accordance with the present invention, there is also provided use of the above-described apparatus in the prophylaxis of deep vein thrombosis.

[0033] In accordance with the present invention, there is also provided a method of alleviating the symptoms of restless legs syndrome by performing the above-described method for effecting a muscle pump action.

[0034] In accordance with the present invention, there is also provided a method of alleviating the symptoms of restless legs syndrome including the step of administering to a subject the above-described apparatus.

[0035] In accordance with the present invention, there is also provided use of the above described apparatus to alleviate the symptoms of restless legs syndrome.

[0036] In accordance with the present invention, there is also provided a method for alleviating the symptoms of restless legs syndrome by administering to the person an apparatus including means for engaging the foot of one leg of a user of the apparatus, wherein the means for engaging is adapted to retard movement of the foot as the foot moves from a first position towards a second position.

[0037] In accordance with the present invention, there is also provided use of an apparatus to alleviate the symptoms of restless legs syndrome, the apparatus including means for engaging the foot of one leg of a user of the apparatus, wherein the means for engaging is adapted to retard movement of the foot as the foot moves from a first position towards a second position.

[0038] Preferably, the apparatus is light-weight and portable.

[0039] Preferably, the apparatus is collapseable for insertion into a travel bag or a coat pocket.

[0040] In accordance with another aspect of the invention, there is provided a method of alleviating the symptoms of restless legs syndrome in a person during a period of rest, including the step of said person exercising before said period of rest using an apparatus including:

[0041] (a) means for retarding movement of the foot of one leg of a user of the apparatus as the foot moves from a first position towards a second position; and

[0042] (b) means for limiting movement of the means for retarding with respect to said foot, wherein the means for retarding is couplable to the foot and the knee of said leg.

[0043] In accordance with another aspect of the invention, there is provided a method of alleviating the symptoms of restless legs syndrome in a person during a period of rest, including the step of said person exercising before said period of rest using an apparatus including:

[0044] (a) means for retarding movement of the foot of one leg of a user of the apparatus as the foot moves from a first position towards a second position, the means for retarding being couplable to the foot and the knee of said leg, and

[0045] (b) means being positionable under said knee, said means substantially preventing movement of a portion of the apparatus with respect to said knee.

[0046] In accordance with another aspect of the invention, there is provided a method for alleviating the symptoms of restless legs syndrome in a person, including the step of administering to the person, before a period of rest, an apparatus including means for engaging the foot of one leg of a user of the apparatus, wherein the means for engaging is adapted to retard movement of the foot as the foot moves from a first position towards a second position.

[0047] In accordance with another aspect of the invention, there is provided a method of alleviating the symptoms of restless legs syndrome in a person during a period of rest, including the step of the person exercising, before said period of rest, using an apparatus including means for engaging the foot of one leg of a user of the apparatus, wherein the means for engaging is adapted to retard movement of the foot as the foot moves from a first position towards a second position.

[0048] Preferred embodiments of the invention will now be described, by way of non-limiting example only, with reference to the accompanying drawings in which:

[0049] FIG. 1 is a diagrammatic illustration of an apparatus in accordance with a preferred embodiment of the invention;

[0050] FIG. 2 is a side view of the apparatus shown in FIG. 1, arranged in one condition of use;

[0051] FIG. 3 is a further side view of the apparatus shown in FIG. 1, arranged in another condition of use;

[0052] FIG. 4 is a side view of an apparatus in accordance with another preferred embodiment of the invention, arranged in one condition of use;

[0053] FIG. 5 is a further side view of the apparatus shown in FIG. 4, showing the apparatus in a different condition occurring in use;

[0054] FIG. 6 is a front view of the apparatus shown in FIGS. 4 and 5;

[0055] FIG. 7 is a side view of an apparatus in accordance with a further preferred embodiment of the invention, arranged in one condition of use;

[0056] FIG. 8 is a further side view of the apparatus shown in FIG. 7, showing the apparatus in a different condition occurring in use;

[0057] FIG. 9 is a front view of the apparatus shown in FIGS. 7 and 8;

[0058] FIG. 10 is a diagrammatic illustration of an apparatus in accordance with yet another preferred embodiment of the invention arranged in one condition;

[0059] FIG. 11 is a diagrammatic illustration of the apparatus of FIG. 10 arranged in a different condition.

[0060] FIG. 12 is a side view of the apparatus of FIG. 10, arranged in one condition of use;

[0061] FIG. 13 is a further side view of the apparatus shown in FIG. 10, showing the apparatus in a different condition occurring in use;

[0062] FIG. 14 is a diagrammatic illustration of an apparatus in accordance with a preferred embodiment of the invention in one condition of use;

[0063] FIG. 15 is a diagrammatic illustration of the apparatus shown in FIG. 14, arranged in another condition of use;

[0064] FIG. 16 is a diagrammatic illustration of an apparatus shown in FIGS. 14 and 15;

[0065] FIG. 17 is a side view of an apparatus in accordance with a preferred embodiment the invention, arranged in one condition for use;

[0066] FIG. 18 is a further side view of the apparatus shown in FIG. 17, but showing the apparatus in a different condition occurring in use;

[0067] FIG. 19 is a front view of the apparatus shown in FIGS. 17 and 18;

[0068] FIG. 20 is a side view of another apparatus in accordance with a preferred embodiment of the invention, arranged in one condition for use;

[0069] FIG. 21 is a further side view of the apparatus shown in FIG. 20, showing the apparatus in a different condition occurring in use;

[0070] FIG. 22 is a front view of the apparatus shown in FIGS. 20 and 21;

[0071] FIG. 23 is a diagrammatic illustration of an apparatus in accordance with a preferred embodiment of the invention, arranged in one condition;

[0072] FIG. 24 is a diagrammatic illustration of the apparatus of FIG. 23, showing the apparatus arranged in a different condition;

[0073] FIG. 25 is a diagrammatic illustration of the apparatus of FIGS. 23 and 24 arranged in one condition of use; and

[0074] FIG. 26 is a diagrammatic illustration of the apparatus of FIGS. 23, 24 and 25 arranged in a further condition of use.

[0075] A person may use the apparatus 10, shown in FIGS. 1, 2 and 3, to effect a muscle pump action in one of their legs. The apparatus 10 is suitable for use in a seated position where the user is in an upright position and their leg is bent. Alternatively, the apparatus 10 may be used by a person laying down in bed, where at least one leg of the person is bent so that the knee is raised with respect to the hips. In use, the apparatus 10 retards movement of the foot as the foot pivots about a respective ankle joint and moves from a first position towards a second position. The apparatus thereby effects a muscle pump action in the user's leg.

[0076] The apparatus 10 includes an elastically deformable endless loop 12, a handle 14 and a strap 16. While preferred embodiments of the invention are described with reference to an endless loop 12, the loop 12 may be any suitable shape such as a hoop, ring, rectangle, triangle or figure eight.

[0077] The loop 12 is elastically deformable so as to stretch around a knee 18 and a corresponding foot 20 of a leg 22 of a user 24 of the apparatus 10. In use, a first section 26 of the loop 12 underly engages the foot 20 and a second section 28 overly engages the knee 18 and is held in tension therebetween.

[0078] The second section 28 of the loop 12 has a non-slip surface, not shown; The non-slip surface increases the coefficient of friction between the knee 18 and the second section 28 of the loop 12 and thereby diminishes the case with which the knee 18 and the second section 28 of the loop 12 slide against each other. The non-slip surface may be a rubber strip, for example.

[0079] The handle 14 is a rectangular strip of flexible material coupled to the second section 28 of the loop 12. In one example of the invention, the handle is an inelastic woven synthetic polymer. The handle 14 is arranged so that, in use, it may be grasped by a user 24 to control movement of the second section 28 of the loop 12 with respect to the knee 18. In one example of the invention, the two shortest sides 30,32 of the rectangular handle 14 are sewn to corresponding first and second end portions 34,36 of the second section 28 of the loop 12. Alternatively, the handle 14 may be secured to the second section 28 of the loop 12 by a vulcanisation process, or by any other any suitable means.

[0080] The strap 16 is an elongate strip of material that is coupled to the first section 26 of the loop 12. First and second ends 38,40 of the strap 16 are sewn to corresponding first and second end portions 42,44 of the first section 26 of the loop 12. In one embodiment of the invention, the strap 16 elastically deformable and is arranged so that, in use, it can stretch from the first end portion 42, around the heel 46 of the user 24 to the second end portion 44. The strap 16 is thereby held in tension and prevents the first section 26 of

the loop 12 from slipping away from the heel 46. In use, the strap 16 prevents the first section 26 of the loop 12 from slipping off the foot 20.

[0081] The strap 16 may include first and second strips of elongate inelastic material, not shown, each having first and second end portions. The strips may be made of a woven synthetic polymer. The first end portions of the strips are secured to corresponding end portions 42,44 of the first section 26 of the loop 12. The second end portions of the strips are positionable around the heel 46 of the user 24 and are couplable to each other to secure the strip in that position.

[0082] In one embodiment, the first and second strips of the strap 16 include corresponding hook and loop velcro pieces. The user 24 fits the strap 16 by wrapping the first and second strips around his/her heel 46 so that the hook and loop velcro pieces overlap and interlock. The user 24 controls the length of the strap 16 by controlling the amount of overlap of the hook and loop velcro pieces. By adjusting the length of the strap 16, the user 24 can control the amount of tension in the strap 16. The amount of tension in the strap 16 ultimately controls the degree to which the first section 26 of the loop 12 can move away from the heel 46 of the foot 20.

[0083] Alternatively, the first and second strips of the strap 16 respectively include male and female portions of a snap-lock clip, not shown, where the male portion is adapted to receive, and secure therein, the female portion. The strap 16 is fitted to the user 24 by arranging the first and second strips around the user's heel 46 and then engaging the male and female portions. The length of the strips may be adjustable to alter the length of the strap 16 in order to best fit the user 24. The user 24 adjusts the length of the strap 16 to control the tension in the strap 16.

[0084] The user 24 may operate the apparatus 10 in a seated position where his/her leg 22 is bent. The user 24 first fits the apparatus 10 to the leg 22 by positioning the ball 48 of the foot 20 over the first section 26 of the loop 12. The user 24 then stretches the loop 12 so that the second section 28 of the loop 12 is positioned over an upper portion of their knee 18. The loop 12 is thereby held in tension between the upper portion of the knee 18 and the foot 20. The user 24 then arranges the strap 16 around the heel 46 of the foot 20 so that it is held in tension between first and second end portions 42,44 of the first section 26 of the loop 12. The user 24 grasps the handle 14 in either one or two hands, not shown, and is ready to commence exercising.

[0085] The user 24, with his or her foot 20 in a first position 50, moves the foot 20 towards a second position 52 by pivoting the foot 20 about the ankle. In doing so, the ball 48 of the foot 20 extends away from the knee 18 and the loop 12 bears against the foot 20. The loop 12 thereby retards movement of the foot 20 as the foot 20 moves from the first position 50 towards the second position 52. The apparatus 10, when used in the described manner, increases the work required by the relevant muscle groups of the user's leg 22 to move the foot 20 from the first position 50 towards the second position 52.

[0086] At some point during the described movement, the user 24 momentarily stops moving the foot 20 towards the second position 52 and moves the foot 20 back towards the

first position 50 by pivoting their foot 20 about the ankle joint. As this action is executed by the user 24, the loop 12 bears against the user's foot 20 and forces the foot 20 back towards the first position 50.

[0087] Alternately moving the foot 20 between the first and second positions 50,52 in the described manner, effects a muscle pump action.

[0088] The user's foot 20 is generally in the first position 50 when the heel 46 is in contact with the ground, or floor surface, and the ball 48 of the foot 20 is elevated from the ground. The user's foot 20 is generally in the second position 52 when the heel 46 is in contact with the ground and the ball 48 of the foot 20 is also in contact with the ground.

[0089] In alternative embodiments, the loop 12 is formed in sections. In further embodiments, the loop 12 is formed in sections, where the sections include elastically deformable material and inelastic material.

[0090] In one embodiment, the apparatus 10 includes a plate 54 and a belt 56 secured to the first and second sections 26,28 of the loop 12 respectively, as shown in FIGS. 4, 5 and 6.

[0091] The plate 54 is secured to and disposed between first and second end portions 42,42 of the first section 26 of the loop 12. The plate 54 may be secured in position by any suitable means. The plate 54 is arranged to underly engage the foot 20 of the leg 22 of the user 24 of the apparatus 10. The plate 54 is formed of rigid material and provides a firm surface for the foot 20 to engage during use of the apparatus 10. In alternative embodiments of the invention, the plate 54 may be a coarse surface for the foot 20 to engage and thereby retard movement of the foot 20 with respect to the first section 26 of the loop 12.

[0092] The belt 56 is secured to and disposed between the first and second end portions 34,36 of the second section 28 of the loop 12. In use, the user 24 secures the loop 12 around their foot 20 and knee 18 and then arranges the belt 56 around their waist 58 or hips 60. The belt 56 is used to prevent the second section 28 of the loop 12 from moving with respect to the knee 18.

[0093] The belt 56 may be permanently attached to the loop 12 and, in this embodiment, the belt 56 includes an adjustable snap-lock clip, not shown. The adjustable snap-lock clip has first and second parts, where the first part is adapted to receive the second part and secure the second part therein. The belt 56 is fitted to the user 24 of the apparatus 10 by arranging the belt 56 around the user's waist 58 and coupling together the first and second parts of the snap-lock clip. The adjustable snap-lock clip can also be used to alter the length of the belt 56 in order to best fit the user 24.

[0094] The loop 12 may be disconnectable so as to be fined around the user's foot 20 and knee 18 by engaging the male and female parts of a snap-lock clip disposed at respective ends of the disconnected loop 12. The male portion of the snap lock clip is adapted to receive, and secure therein, the female portion. Alternatively, the snap lock clip may be a buckle or any other suitable means for coupling together the ends of the endless loop 12.

[0095] The loop 12 may also be adjustable so as to change the peripheral length of the loop 12. In one embodiment, male part of the snap lock clip coupled to the loop 12 is

slidably positionable along the extent of the loop 12 to thereby change the peripheral length of the loop 12 when the loop 12 is closed. The degree of muscle pump action that is effected in the leg 22 of the user 24 will vary according to the tension of the loop 12. The user thereby controls the degree of muscle pump action by controlling the peripheral length of the loop 12. In alternative embodiments, the peripheral length of the loop 12 is adjustable by use of any suitable means.

[0096] In yet another embodiment, the elastically deformable loop 12 includes two parallel sides, being generally parallel to the user's leg 22, formed from an inelastic material. In this example of the invention, at least one of the first and second sections 26,28 of the loop 12 is formed of an elastic material.

[0097] In yet another embodiment, the apparatus 10 also includes a foot piece 62 as shown in FIGS. 7, 8 and 9. The foot piece 62 is secured to the first section 26 of the loop 12 and is arranged to receive a front portion of the foot 20 of the user 24. A sole 64 portion of the foot piece 62 is secured to the loop 12 by a suitable adhesive. Alternatively, the foot piece 62 may be sewn to the loop 12 or secured to the loop 12 by any suitable means. In use, the foot piece 62 prevents movement of the foot 20 with respect to the first section 26 of the loop 12.

[0098] Alternatively, an upper portion of the foot piece 62 may be secured to an outer peripheral portion of the first section 26 of the loop 12.

[0099] In yet another embodiment, the apparatus 10 includes first and second strips 68,70. First ends 72,74 of the strips 68,70 are secured to corresponding first and second end portions 42,44 of the first section 26 of the loop 12. In use, the first section 26 of the loop 12 underly engages the user's foot 20 and the strips 68,70 are arranged to overly engage the user's foot 20 and to couple to one another to secure the user's foot 20 in position.

[0100] The strips 68,70 include corresponding hook and loop velcro pieces 76,78, so that a user may position their foot 20 over the first section 26 of the loop 12 and secure their foot 20 in that position by overlapping the hook and loop velcro pieces 76,78 over their foot 20. The hook and loop pieces 76,78 interlock over the foot 20 to substantially prevent movement of the foot 20 with respect to the first section 26 of the loop 12.

[0101] Alternatively, the strips 68,70 are also formed of an elastically deformable material. The strips 68,70 are designed to stretch over a user's foot 20 to thereby secure the foot 20 between the first section 26 of the loop 12 and the second strap 66.

[0102] In yet another embodiment, the strips 68,70 include an adjustable snap-lock clip, not shown. The adjustable snap-lock clip has first and second parts, where the first part is adapted to receive the second part and secure the second part therein. The strips 68,70 may be fitted over the user's foot 20 and coupled together by engaging the first and second parts of the snap-lock clip. The adjustable snap-lock clip can also be used to alter the length of the strips 68,70 in order to best fit the user's foot.

[0103] The apparatus 10 may also include a knee strap 60, as shown in FIGS. 14 to 16. The knee strap 60 is a

rectangular strip of an inelastic woven synthetic polymer. Opposed short ends 62,62 of the knee strap 60 are sewn to respective sections of the endless loop 12 so that, in use, the first section 26 of the endless loop 12 underly engages the foot 20; the second section 28 of the endless loop 12 overly engages the knee 18 and the knee strap 60 underly engages the same knee 18. In the event that the first section 26 of the endless loop 12 disengages the foot 20 during use, the knee strap 60 prevents the second section 28 of the endless loop 12 from moving towards and hitting the torso of the user 24. Additionally, the knee strap 60 prevents the second section 28 of the endless loop 12 from slipping off the knee and moving towards the foot 20 of the user 24.

[0104] The short ends 62,64 of the knee strap 60 are above-described as being sewn to respective sections of the endless loop 12. However, the short ends 62,64 of the knee strap 60 may be secured to the respective sections of the endless loop 12 by any suitable means.

[0105] The knee strap 60 is described as being a strip of an inelastic woven synthetic polymer. However, the knee strap 60 may be elastic and, in use, bear against the leg 22 of the user 24. The knee strap 60 may be made of any suitable material.

[0106] The knee strap 60 may have a non-slip surface, not shown. The non-slip surface increases the coefficient of friction between the knee 18 and the knee strap 60 thereby diminishes the ease with which the knee 18 and the knee strap 60 slide against each other. The non-slip surface may be a rubber strip, for example.

[0107] The person 24 can use the apparatus 10 to exercise their leg 22 while they are in a seated position. Alternatively, the person can use the apparatus 10 to exercise their leg 22 while they are laying down. When in such a position the knee 18 of the leg 22 being exercised is raised with respect to the hips 60 of the user 24.

[0108] Use of the apparatus 10 effects a muscle pump action in the leg 22 of the user 24 and thereby increases blood circulation. The user 24 of the apparatus 10 can thereby prevent blood from pooling in their legs.

[0109] The apparatus 110 shown in FIG. 17, FIG. 18 and FIG. 19 includes an elastically deformable endless loop 112 and a belt 114. The endless loop 112 includes a plate 118 secured to a first portion 120 of the endless loop 112. The plate 118 is arranged to underly engage a foot 122 of one leg 130 of a user 116 of the apparatus.

[0110] The belt 114 is attached to second and third portions 124, 126 of the endless loop 112 by velcro hook and loop contacts. Alternatively, the belt 114 may be secured to the endless loop 112 by any suitable means. The belt is used to secure an upper portion of the apparatus to the user 16.

[0111] A user 116 may operate the apparatus 110 from a seated position. In this case, the user 116 fits the apparatus 110 to his/her leg 130 before commencing exercising. To fit the apparatus 110, the user positions the plate 118 under his or her foot 22 and stretches the elastically deformable loop 112 over a thigh portion 128 of the same leg 30. The belt 114 is secured around the user's waist 132 and prevents second and third portions 124, 126 of the endless loop 112 from slipping down the user's thigh 128.

[0112] The user 116, being in a seated position with his/her foot 122 in a first position 134, moves his/her foot 122 towards a second position 136 by pivoting the foot 122 about the ankle joint 138. As this action is executed by the user 116, the loop 112 bears against the user's foot 122 and thereby retards the movement of the foot 122. Accordingly, the amount of work required to move the foot 122 from the first position 134 towards the second position 136 is increased. This movement effects a muscle pump action in the leg 130.

[0113] At some point during the described movement of the foot 122 towards the second position 136, the user stops moving the foot 122 and begins to move the foot 122 back towards the first position 134. As this action is executed by the user 116, the elastically deformable endless loop 112 bears against the user's foot 122 and thereby assist in moving the foot 122 back towards the first position 134.

[0114] The user's foot 122 is in the first position 134 when the heel 140 of the foot 22 is in contact with the ground, or floor surface, and the ball 142 of the foot 122 is elevated from the ground. The user's foot 122 is in the second position 136 when the heel 140 of the user's foot is in contact with the ground and the ball 142 of the user's foot 122 is also in contact with the ground,

[0115] In alternative embodiments of the invention, the foot 122 is in the first position when the heel 140 is closer to the ground or floor surface than the ball 142 and the user's foot 122 is in the second position when the ball 142 of the user's foot 122 approaches the ground or floor surface.

[0116] Repeating the above-described actions using the apparatus 110 for an extended period increases the muscle pump action activity in the leg 130 being exercised.

[0117] In one example of the invention, the belt 114 is permanently attached to the endless loop 112 and the belt 114 includes an adjustable "snap lock" clip. The adjustable "snap lock" clip has first and second parts, where the first part is adapted to receive the second part and secure the second part therein. The belt 114 is fitted to the user 116 of the apparatus 110 by arranging the belt 114 around the user's waist 132 and engaging the first and second parts of the "snap lock" clip. The adjustable "snap lock" clip can also be used to alter the length of the belt 14 in order to best fit the user 116.

[0118] In a further example of the invention, the endless loop 112 includes a "snap lock" clip that is used to fit the endless loop 112 around the users foot 122 and thigh 128 by engaging the male and female parts of the "snap lock" clip. In this example of the invention, the "snap lock" clip is also used to alter the length of the endless loop 112 in order to best fit the user 116.

[0119] Accordingly, the length of the endless loop 112 as presented between the foot 122 and thigh 128 of a user 116 can be varied.

[0120] In yet another example of the invention, the elastically deformable endless loop 112 includes two parallel sides, being generally parallel to the user's leg 130, formed from an inelastic material. In this example of the invention, corresponding adjacent ends of the two parallel sides are bridged by elastic material, adapted to engage the foot 122 and the thigh 128 of one leg 130 of the user 116.

[0121] In yet another example of the invention, the elastically deformable endless loop 112 includes two parallel sides, being generally parallel to the user's leg 130, formed from an inelastic material. In this example of the invention, one of the adjacent ends of the two parallel sides is ridged by elastic material adapted to engage the user's foot and another one the adjacent ends of the parallel sides, is bridged by an inelastic material adapted to engage the user's thigh 28.

[0122] An apparatus 150 shown in FIGS. 20, 21 and 22 includes an elastically deformable endless loop 152, a handle 154 and a foot piece 156. The handle 154 is sewn to a first section 157 of the endless loop 152 and is arranged so that, in use, a user 158 may grasp the handle 154 and thereby control movement of the first section 157 with respect to a corresponding leg of the user 158. Alternatively, the handle 154 may be secured to the endless loop 152 by a vulcanization process or by any other any suitable means.

[0123] The foot piece 156 is secured to a second section of the endless loop 152 and is arranged to receive a front portion of a foot 160 of the user 158. The second section of the endless loop 152 opposes the above-mentioned first section when the endless loop 152 is in use. A sole portion of the foot piece 156 is secured to the endless loop 152 by a suitable adhesive. Alternatively, the foot piece 156 may be secured to the endless loop 152 by any suitable means. In use, the foot piece 156 substantially prevents movement of the foot 160 with respect to the second section of the endless loop 152.

[0124] A user 158 may operate the apparatus 150 from a seated position. In this case, the user 158 first fits the apparatus to a leg 162 of their body before commencing exercising. To fit the apparatus 150, the user 158 inserts his/her foot 160 into the foot piece 156 and stretches the first section of the endless loop 152 over a thigh portion 166 of the corresponding leg 162. The user 158 grasps the handle 154 in either one or two hands and is ready to commence exercising.

[0125] The user 158, with his/her foot 160 in a first position 168, moves the foot 160 towards a second position 170 by pivoting the foot 60 about the ankle joint 172. In doing so, the foot 160 extends away from a shin 174 portion of the leg 162. As this action is executed, the endless loop 152 bears against the user's foot 160 and thereby retards the movement of the foot 160. The endless loop 152, when used in the described manner, increases the work required by the relevant muscle groups of the user's leg 162 to move the foot 160 from the first position 168 towards the second position 170.

[0126] At some point during the described movement, the user 158 stops moving the foot 160 and moves the foot 160 back towards the first position 168. As this action is executed by the user 158, the endless loop 152 bears against the user's foot 160, via the foot piece 156, and forces the foot 160 back towards the first position 168.

[0127] Alternately moving the foot 160 between the first and second positions 168, 170 effects a muscle pump action in the relevant muscle groups of the user's leg 162.

[0128] An upper portion of the foot piece 156 may be secured to an outer peripheral portion of the second section of the endless loop 152, the foot piece 156 being secured

thereto by an adhesive. Alternatively, the foot piece 56 may be secured to the endless loop 52 using any suitable means.

[0129] The foot piece 156 may be coupleable to the endless loop 152 by a connection device. (not shown) In this case, the sole of the foot piece includes a first part of the connection device that is connectable to a corresponding second part secured to the second section of the endless loop 152. In use, the user 58 fits the foot piece 156 on a respective foot 160 and connects the foot piece to endless loop 152 by connecting the first and second parts of the connection device. Alternatively, any suitable method of temporarily securing the foot piece 156 to the endless loop 152 may be used.

[0130] In one example of the invention, the foot piece 156 is coupleable to the second section of the endless loop 152 and the foot piece 156 is a shoe.

[0131] An apparatus 180 shown in FIGS. 23, 24, 25 and 26 includes an elastically deformable endless loop 182, a handle 184 and a strap 186. The handle 184 is sewn to a first section 187 of the loop 182 and is arranged so that, in use, a user 188 may grasp the handle 184 and thereby control movement of the first section 87 of the loop 182 with respect to a corresponding leg of the user 188. Alternatively, the handle 184 may be secured to the endless loop 82 by a vulcanisation process or by any other any suitable means.

[0132] The strap 186 includes first and second strips 190,192, each having an end secured to a second section 193 of the loop 182. The strips 190,192 are arrangeable so as to overlay and thereby secure the foot 194 of the user between the endless loop 182 and the strap 186.

[0133] In one embodiment the strips 190,192 include corresponding hook and loop velcro pieces 196,198, so that a user 188 may position his/her foot 194 inside the loop 182 and secure the foot 194 in that position by overlapping the hook and loop velcro pieces 196,198. The hook and loop pieces 196,198 interlock over the foot 194 to substantially prevent movement of the foot 194 with respect to the second section. 193 of the loop 182.

[0134] In further embodiments, the strips 190,192 are formed of an elastically deformable material. The strips 190,192 are designed to stretch over a user's foot 194 to thereby secure the foot 194 between the endless loop and the strap 186. The strips 190,192 may include hook and loop velcro pieces 196,198, so that a user may position the foot 194 inside the loop 182 and secure the foot in that position by overlapping the hook and loop velcro pieces 196,198. In use, the elastically deformable strips 190,192 substantially prevents movement of the foot 194 with respect to the second section 193 of the loop 182 and the elastically deformable strips 190,192 permits the strap 186 to be arranged over the user's footwear.

[0135] A user 188 may operate the apparatus 180 from a seated position. In this case, the user 188 first fits the apparatus by inserting his/her foot 194 between the endless loop 182 and the strap 186 and secures the foot 194 in that position by arranging the strap 186 securely over the foot 194. The user 188 then stretches the first section 187 of the endless loop 182 over a thigh portion 200 of the same leg 196. The user 188 grasps the handle 184 in either one or two hands and is ready to commence exercising.

[0136] The user 188, with their foot 194 in a first position 202, moves their foot 194 towards a second position 204 by pivoting their foot 194 about the ankle joint 206. In doing so, the foot 194 extends away from a shin portion 208 of the leg 199. As this action is executed, the loop 182 bears against the user's foot 194 and thereby retards the movement of the foot 194. The loop 182, when used in the described manner, increases the work required by the relevant muscle groups of the leg 199 to move the foot 194 from the first position 202 towards the second position 204.

[0137] At some point during the described movement, the user 188 momentarily stops moving the foot 194 towards the second position 204 and moves the foot 194 back towards the first position 202 by pivoting their foot 194 about the ankle joint 206. As this action is executed by the user 188, the endless loop 182 bears against the user's foot 194 and forces the foot 194 back towards the first position 202.

[0138] Alternately moving the foot 194 between the first and second positions 202,204, as described, effects a muscle pump action in the relevant muscle groups of the leg 199.

[0139] Embodiments of the invention have been described by way of reference to a user in a seated position. However, the embodiments of the invention may be applicable to a user in any suitable exercise position.

[0140] In alternative embodiments of the invention, the endless loop 12,112,152,182 is formed in sections. In further embodiments of the invention, the endless loop 12,112,152, 182 is formed in sections, where the sections include elastically deformable material and inelastic material.

[0141] A sufferer of restless legs syndrome (RLS) can use the apparatus 10,110,150,180 to exercise their legs before a period of rest, or relaxation, to alleviate symptoms of RLS during the period of rest. The sufferer may use the apparatus 10,110,150,180 in a seated position or in a laying down position. A sufferer of RLS may use the apparatus 10,110, 150,180 to moderately exercise his or her legs before they go to sleep to thereby prevent the onset of the symptoms of RLS while they are attempting to fall asleep.

[0142] Advantageously, the apparatus 10,110,150,180 is portable and can be collapsed into a form that can be carried as hand luggage on aeroplane, for example.

[0143] Advantageously, the apparatus 10,110,150,180 is suitable for use in a seated position on trains and aeroplanes, for example.

[0144] Advantageously, the apparatus 10,110,150,180 is suitable for use while laying down in a bed.

[0145] Advantageously, the apparatus 10,110,150,180 is relatively cheap and easy to manufacture.

[0146] Advantageously, the apparatus 10,110,150,180 is used to mitigate thrombosis inducing conditions and therefore avoid illnesses such as deep vein thrombosis.

What is claimed is:

1. Apparatus for use in exercising, including:

(a) means for retarding movement of the foot of one leg of a user of the apparatus as the foot moves from a first position towards a second position; and



- (b) means for limiting movement of the means for retarding with respect to said foot, wherein the means for retarding is couplable to the foot and the knee of said leg.
2. The apparatus claimed in claim 1, wherein the means for retarding is arrangable to underly engage the foot of the user of the apparatus and overly engage the knee.
3. The apparatus claimed in claim 1, wherein said means for retarding is an endless loop, the loop being at least partially elastically deformable.
4. The apparatus claimed in claim 2, wherein the means for limiting substantially prevents movement of the portion of the loop that is arrangable to underly engage the foot.
5. The apparatus claimed in claim 4, wherein the means for limiting is arrangable to receive and at least partially extend around a lower portion of the leg of the user.
6. The apparatus claimed in claim 2, wherein the means for limiting is a strap coupled between first and second sections of the loop.
7. The apparatus claimed in claim 6, wherein the strap includes first and second straps coupled between the first and second sections of the loop, the straps being positionable for mutual engagement around a lower portion of the leg of the user.
8. The apparatus claimed in claim 7, wherein the first and second straps include -corresponding hook and loop velcro portions positionable for mutual engagement.
9. The apparatus claimed in claim 1, wherein the means for limiting is at least partially-elastically deformable.
10. The apparatus claimed in claim 1, wherein the means for limiting is adjustable so as to change the size of the means for retarding.
11. The apparatus claimed in claim 3, wherein the peripheral length of the loop is adjustable so as to change the size of the loop.
12. The apparatus claimed in claim 11, wherein the peripheral length of the loop corresponds to the degree to retarding effected by the means for retarding.
13. The apparatus claimed in claim 3, including means being arrangable to underly engage the knee for substantially preventing movement of a portion of the apparatus with respect to said knee.
14. The apparatus claimed in claims 3, wherein the portion of the means for retarding that is arrangable to overly engage the knee includes a surface that at least partially reduces the ease with which said portion moves with respect to the knee during use of the apparatus.
15. The apparatus claimed in claim 13, wherein the means being arrangable to underly engage the knee includes a surface that at least partially reduces the ease with which said means moves with respect to the knee during use of the apparatus.
16. Apparatus for use in exercising, including:
- (a) means for retarding movement of the foot of one leg of a user of the apparatus as the foot moves from a first position towards a second position, the means for retarding being couplable to the foot and the knee of said leg, and
- (b) means being positionable under said knee, said means substantially preventing movement of a portion of the apparatus with respect to said knee.
17. The apparatus claimed in claim 16, wherein the means for retarding is arrangable to underly engage the foot of the user of the apparatus and overly engage the knee.
18. The apparatus claimed in claim 17, wherein said means for retarding is an endless loop, the loop being at least partially elastically deformable.
19. The apparatus claimed in claim 17, wherein the portion of the means for retarding that is arrangable to overly engage the knee includes a surface that at least partially reduces the ease with which said portion moves with respect to the knee during use of the apparatus.
20. The apparatus claimed in claim 16, wherein the means being positionable under said knee includes a surface that at least partially reduces the ease with which said means moves with respect to the knee during use of the apparatus.
21. A method for effecting a muscle pump action in a leg of a person, including the steps of:
- (a) fitting the apparatus claimed in any one claims 3 to 15 to said leg;
- (b) alternately pivoting the foot of said leg about the ankle joint between first and second positions,
- wherein the step of fitting includes the steps of arranging a first section of the loop to underly engage the foot, stretching the loop so that a second section of the loop overly engages an upper portion of the leg, and arranging the means for retarding around a lower portion of the leg.
22. A method for effecting a muscle pump action in a leg of a person, including the steps of:
- (a) fitting the apparatus claimed in claim 16 to said leg;
- (b) alternately pivoting the foot of said leg about the ankle joint between first and second positions,
- wherein the step of fitting includes the steps of arranging a first section of the loop to underly engage the foot, and stretching the loop so that a second section of the loop overly engages an upper portion of the leg.
23. A method of inhibiting the development of deep vein thrombosis by performing the method steps of claim 21.
24. A method of mitigating the development of thrombosis inducing conditions by administering to a subject the apparatus claimed in claim 1.
25. A method of promoting blood circulation in the body of a subject by administering to the subject an apparatus claimed in claim 1.
26. A method of promoting blood circulation in the body of a person by performing the method steps of claim 21.
27. A method for prophylaxis of deep vein thrombosis including the step of administering to a subject the apparatus claimed in claim 1.
28. Use of the apparatus claimed in claim 1 in the prophylaxis of deep vein thrombosis.
29. A method of alleviating the symptoms of restless legs syndrome by performing the method steps of claim 21.
30. A method of alleviating the symptoms of restless legs syndrome including the step of administering to a subject the apparatus claimed in claim 1.
31. Use of the apparatus claimed in claim 1 to alleviate the symptoms of restless legs syndrome.
32. A method for alleviating the symptoms of restless legs syndrome by administering to the person an apparatus including means for engaging the foot of one leg of a user

of the apparatus, wherein the means for engaging is adapted to retard movement of the foot as the foot moves from a first position towards a second position.

33. Use of an apparatus to alleviate the symptoms of restless legs syndrome, the apparatus including means for engaging the foot of one leg of a user of the apparatus, wherein the means for engaging is adapted to retard movement of the foot as the foot moves from a first position towards a second position.

34. A method of alleviating the symptoms of restless legs syndrome in a person during a period of rest, including the step of said person exercising before said period of rest using an apparatus including:

(a) means for retarding movement of the foot of one leg of a user of the apparatus as the foot moves from a first position towards a second position; and

(b) means for limiting movement of the means for retarding with respect to said foot, wherein the means for retarding is couplable to the foot and the knee of said leg.

35. The method claimed in claim 34, wherein the means for retarding is arrangable to underly engage the foot of the user of the apparatus and overly engage the knee.

36. The method claimed in claim 34, wherein said means for retarding is an endless loop, the loop being at least partially elastically deformable.

37. The method claimed in claim 35, wherein the means for limiting substantially prevents movement of the portion of the loop that is arrangable to underly engage the foot.

38. The method claimed in claim 37, wherein the means for limiting is arrangable to receive and at least partially extend around a lower portion of the leg of the user.

39. The method claimed in claim 35, wherein the means for limiting is a strap coupled between first and second sections of the loop.

40. The method claimed in claim 39, wherein the strap includes first and second straps coupled between the first and second sections of the loop, the straps being positionable for mutual engagement around a lower portion of the leg of the user.

41. The method claimed in claim 40, wherein the first and second straps include corresponding hook and loop velcro portions positionable for mutual engagement.

42. The method claimed in claim 3, wherein the means for limiting is at least partially elastically deformable.

43. The method claimed in claims 3, wherein the means for limiting is adjustable so as to change the size of the means for retarding.

44. The method claimed in claim 36, wherein the peripheral length of the loop is adjustable so as to change the size of the loop.

45. The method claimed in claim 44, wherein the peripheral length of the loop corresponds to the degree to retarding effected by the means for retarding.

46. The method claimed in claim 36, including means being arrangable to underly engage the knee for substantially preventing movement of a portion of the apparatus with respect to said knee.

47. The method claimed in claim 36, wherein the portion of the means for retarding that is arrangable to overly engage the knee includes a surface that at least partially reduces the ease with which said portion moves with respect to the knee during use of the apparatus.

48. The method claimed in claim 46, wherein the means being arrangable to underly engage the knee includes a surface that at least partially reduces the ease with which said means moves with respect to the knee during use of the apparatus.

49. A method of alleviating the symptoms of restless legs syndrome in a person during a period of rest, including the step of said person exercising before said period of rest using an apparatus including:

(a) means for retarding movement of the foot of one leg of a user of the apparatus as the foot moves from a first position towards a second position, the means for retarding being couplable to the foot and the knee of said leg, and

(b) means being positionable under said knee, said means substantially preventing movement of a portion of the apparatus with respect to said knee.

50. The method claimed in claim 49, wherein the means for retarding is arrangable to underly engage the foot of the user of the apparatus and overly engage the knee.

51. The method claimed in claim 50, wherein said means for retarding is an endless loop, the loop being at least partially elastically deformable.

52. The method claimed in claim 50, wherein the portion of the means for retarding that is arrangable to overly engage the knee includes a surface that at least partially reduces the ease with which said portion moves with respect to the knee during use of the apparatus.

53. The method claimed in claim 49, wherein the means being positionable under said knee includes a surface that at least partially reduces the ease with which said means moves with respect to the knee during use of the apparatus.

54. A method for alleviating the symptoms of restless legs syndrome in a person, including the step of administering to the person, before a period of rest, an apparatus including means for engaging the foot of one leg of a user of the apparatus, wherein the means for engaging is adapted to retard movement of the foot as the foot moves from a first position towards a second position.

55. A method of alleviating the symptoms restless legs syndrome in a person during a period of rest, including the step of the person exercising, before said period of rest, using an apparatus including means for engaging the foot of one leg of a user of the apparatus, wherein the means for engaging is adapted to retard movement of the foot as the foot moves from a first position towards a second position.

56. A method for alleviating the symptoms of restless legs syndrome in a person during a period of rest, by administering to the person, before a period of rest, the apparatus substantially as hereinbefore described with reference to the FIGS. 17 to 26 accompanying drawings.

57. A method for alleviating the symptoms of restless legs syndrome by administering to the person the apparatus substantially as hereinbefore described with reference to the FIGS. 17 to 26 of the accompanying drawings.

58. Use of the apparatus substantially as hereinbefore described with reference to FIGS. 17 to 26 to alleviate the symptoms of restless legs syndrome.