

July 13, 1965

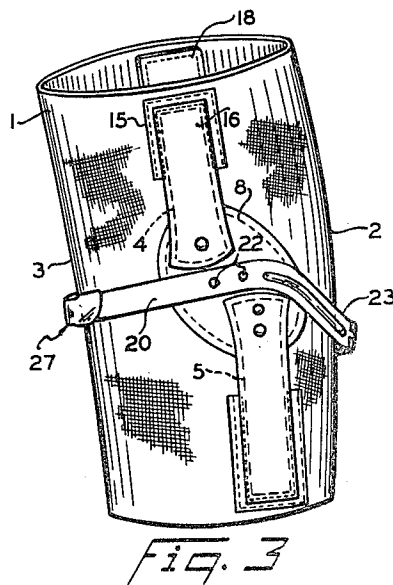
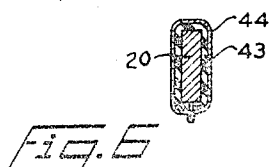
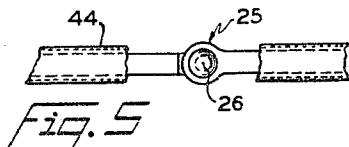
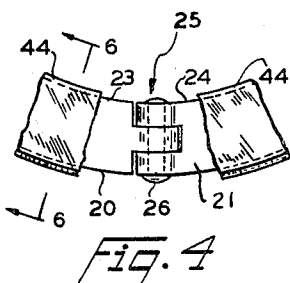
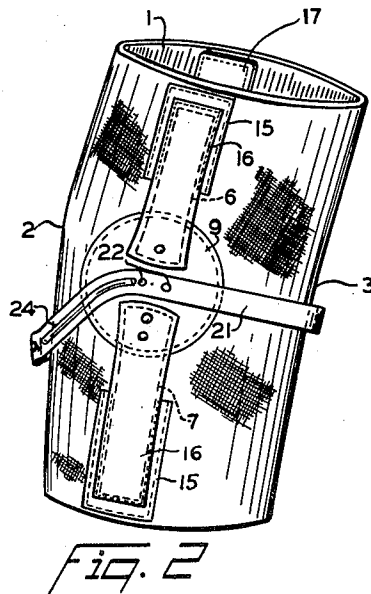
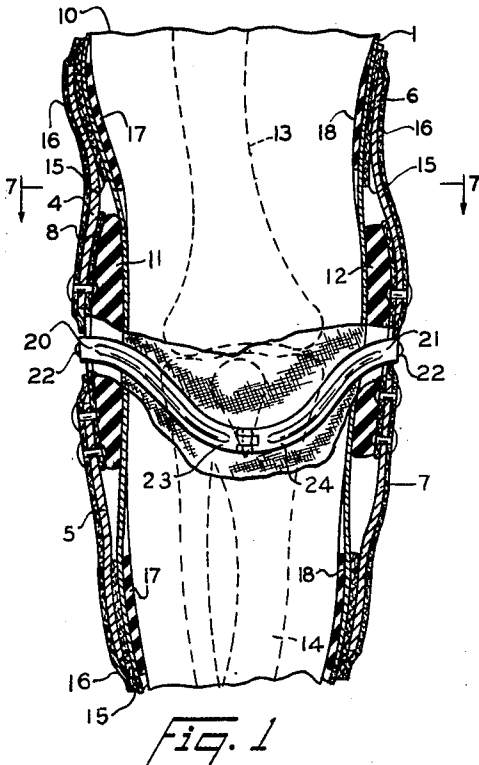
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3,194,233

CORRECTIVE AND PROTECTIVE KNEE BRACE

Filed Oct. 25, 1961

4 Sheets-Sheet 1



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CORRECTIVE AND PROTECTIVE KNEE BRACE

Filed Oct. 25, 1961

4 Sheets-Sheet 2

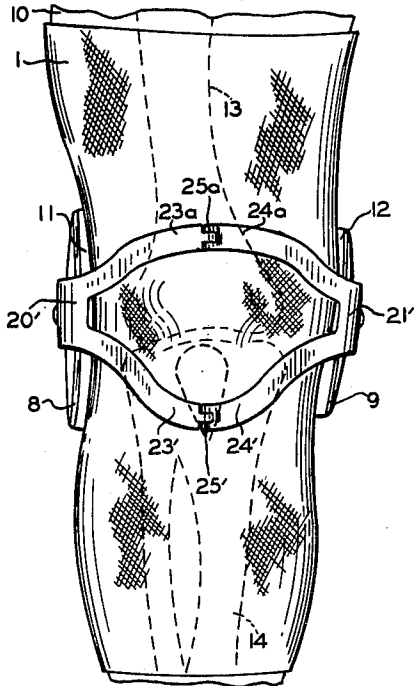


Fig. 8

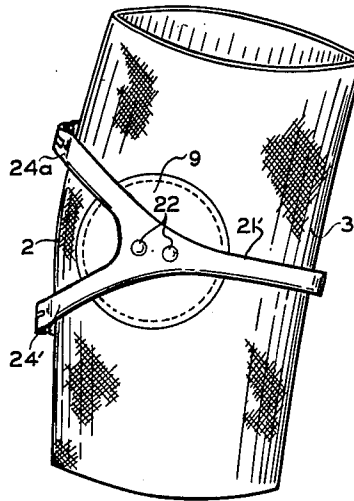


Fig. 9

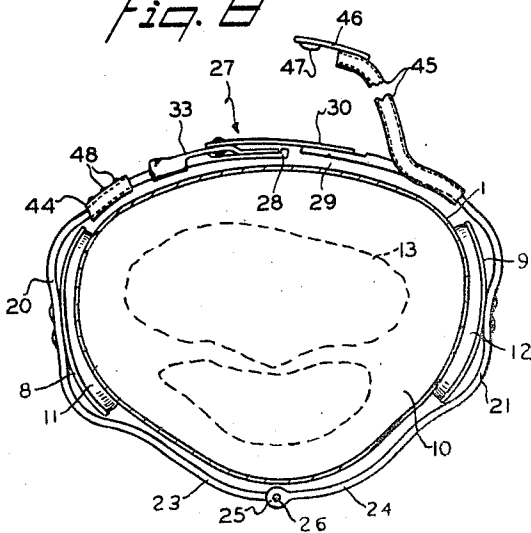


Fig. 7

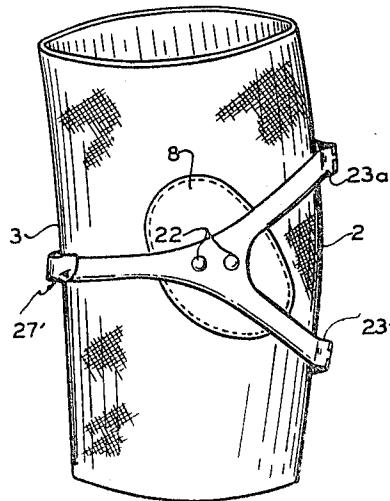


Fig. 10

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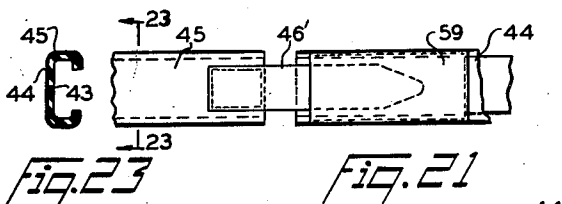
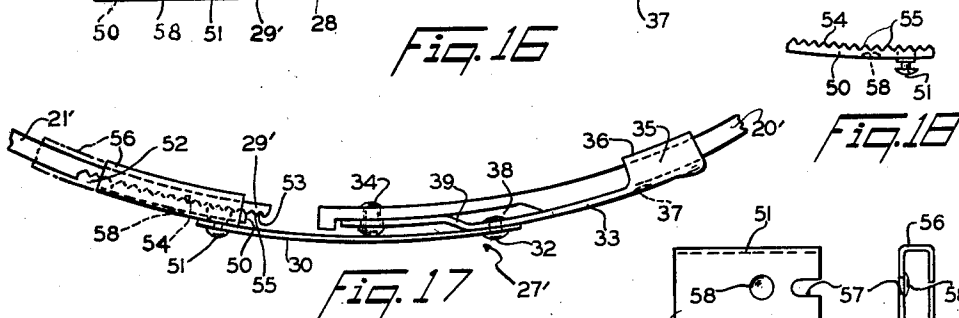
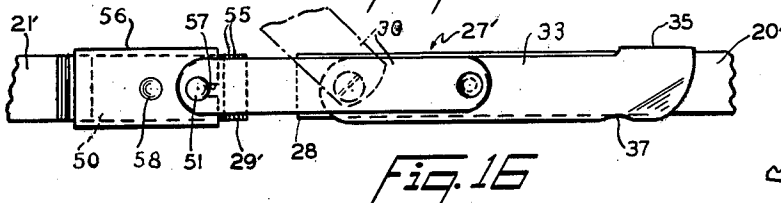
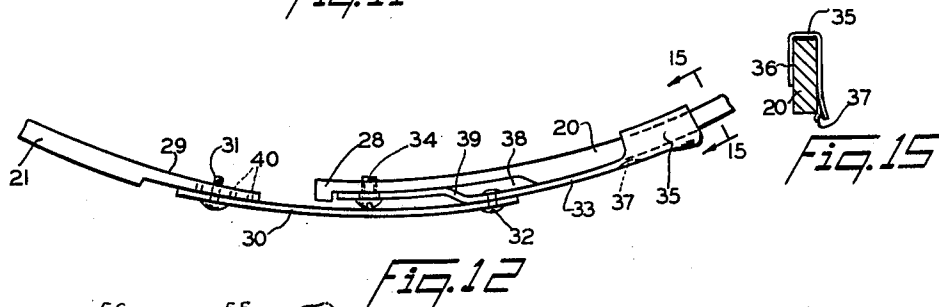
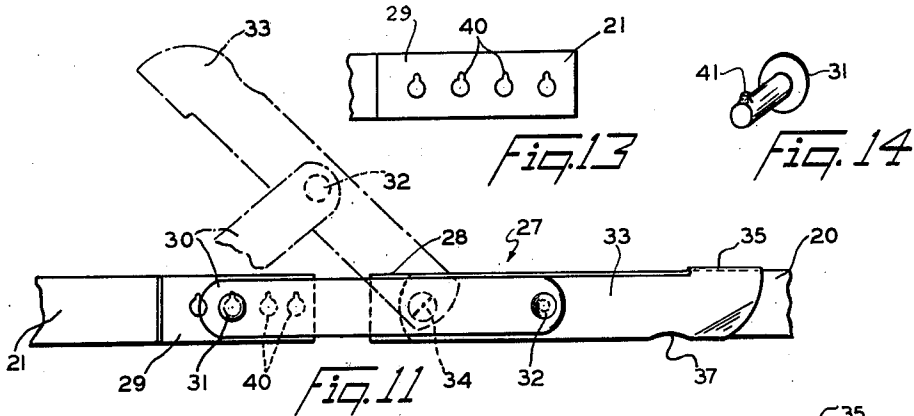
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CORRECTIVE AND PROTECTIVE KNEE BRACE

Filed Oct. 25, 1961

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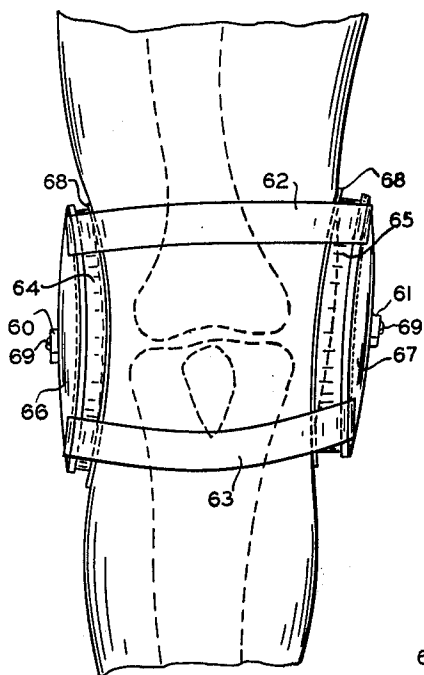


Fig. 24

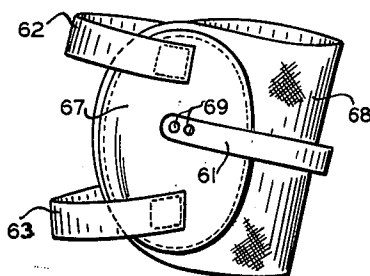


Fig. 25

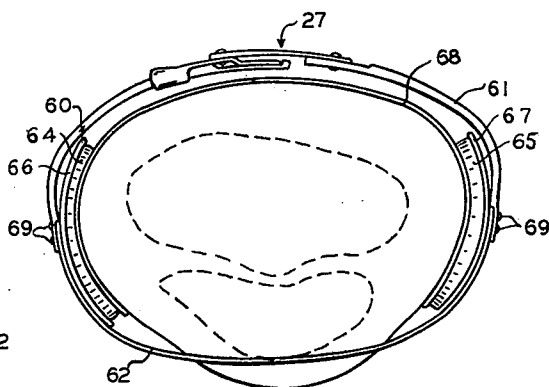


Fig. 27

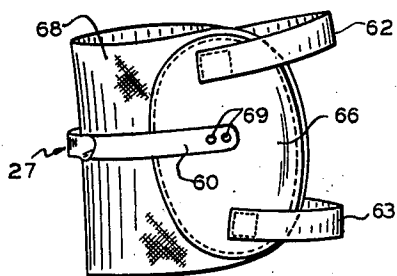


Fig. 26

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CORRECTIVE AND PROTECTIVE KNEE BRACE

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Filed Oct. 25, 1961, Ser. No. 147,633
11 Claims. (Cl. 128—80)

This invention relates to a corrective and protective knee brace, and more particularly to a brace which may be worn for long periods without interfering with normal circulation. It is an improvement on Patent No. 2,467,907, issued April 19, 1949, to the same inventor.

Corrective and protective braces for the joints of the human body, such as knee braces, are generally designed to supplement or substitute for parts of the joint, or parts of the extremities associated with the joint. Such braces normally limit the joint to a range of movement permitting normal function of the joint without undue strain. The parts of a joint may be naturally weak or may become weakened due to injuries or diseases such as old fractures, torn ligaments, arthritis or polio. The parts may also be weakened by diseases or injuries affecting the spinal cord or peripheral nerve and in which the muscles which control the function of the joint have become involved. Braces for preventing injury to the joint in athletics, or for pre-operative or post-operative protection for a weakened joint, or a joint injured through accident or disease, must provide support for the joint, and also should provide as near normal freedom of movement as possible.

Such braces, and in particular knee braces, usually employ straps or other means for encircling the knee in order to apply pressure on the knee proper. It is obvious that, ordinarily, whatever pressure is applied to the knee joint itself, equal pressure must be applied by straps elsewhere to the extremity involved, in this case, the leg. Straps, or other leg-encircling means, tend to interfere in varying degree with arterial and venous blood circulation as well as with the lymph supply to the structure of the limb involved.

It is, accordingly, the principal object of the present invention to provide a corrective and protective brace for a joint which will allow for a normal range of motion of the joint and, at the same time, will take the place of or supplement the function of one or more of the parts of the joint which have become weakened or injured as the result of accident, disease or natural causes.

A further important object of the invention is to provide a corrective and protective knee brace in which maximum support can be applied to the knee joint with a minimum amount of interference with the normal blood supply or circulation of the limb associated therewith.

A more particular object of the invention is to provide a protective and corrective knee brace that is adapted for use in the prevention of injuries, in the treatment of injuries, in cases in which the knee requires pre-operative or post-operative support, or in cases where the knee has been weakened as the result of injury or disease.

A further object is to provide a supporting knee brace which, when adjusted, holds lateral and rotative motion of the knee joint within normal limits, while allowing substantially a normal range of motion in the joint.

Other objects are to provide a knee brace having means for encircling the leg without the application of concurrent pressures on the leg that interfere with normal circulation, and which applies corrective and supporting pressure to the lateral and medial sides of the knee joint without pressure on the popliteal space posterior to the knee that would interfere with the blood supply to the leg.

Still other objects are to provide a knee brace which may be easily put on and taken off and which may be easily adjusted initially to apply the proper pressure to the joint.

Other objects and advantages will become apparent from the following description taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a front elevational view, partly in vertical section of a knee brace according to the present invention;

FIGURE 2 is a side elevational view thereof on a smaller scale, as viewed from the medial side of the leg;

FIGURE 3 is a side elevational view similar to FIG. 2, as viewed from the lateral side of the leg;

FIGURE 4 is an enlarged fragmentary view of a portion of the brace shown in FIG. 1;

FIGURE 5 is a top plan view of the portion shown in FIG. 4;

FIGURE 6 is a sectional view on the line 6—6 of FIG. 4;

FIGURE 7 is an enlarged sectional view on the line 7—7 of FIG. 1;

FIGURE 8 is a front elevational view of a modified form of knee brace according to the invention;

FIGURE 9 is a side elevational view on a smaller scale of the knee brace of FIG. 8 as viewed from the medial side of the leg;

FIGURE 10 is a side elevational view similar to FIG. 9 of the knee brace of FIG. 8 as viewed from the lateral side of the leg;

FIGURE 11 is an enlarged fragmentary rear elevational view of the adjustable clamping latch shown in FIG. 7;

FIGURE 12 is a top plan view of the parts shown in FIG. 11;

FIGURE 13 is a fragmentary rear elevational view of a portion of the brace shown in FIG. 11;

FIGURE 14 is an enlarged perspective view of a stud shown in FIG. 11;

FIGURE 15 is a sectional view on the line 15—15 of FIG. 12;

FIGURE 16 is a view similar to FIG. 11 showing a modified form of clamping latch;

FIGURE 17 is a top plan view of the parts shown in FIG. 16;

FIGURE 18 is a top plan view of the adjustable latch pivot stud carrier shown in FIG. 17;

FIGURE 19 is a rear elevational view of the latch adjustment locking slide shown in FIG. 16;

FIGURE 20 is an end elevation of the slide of FIG. 19;

FIGURE 21 is a rear elevational view of a modified form of protective covering fastener;

FIGURE 22 is a top plan view of the parts shown in FIG. 21;

FIGURE 23 is a sectional view on the line 23—23 of FIG. 21;

FIGURE 24 is a front elevational view of another modification of the knee brace according to the invention;

FIGURES 25 and 26 are side elevational views of the knee brace of FIG. 24 as viewed from the medial and lateral side of the leg, respectively; and

FIGURE 27 is a view similar to FIG. 7 of the knee brace of FIG. 24.

In the embodiment shown in FIGURES 1—3, a sleeve 1, made preferably of woven, knitted, or one or two way stretch fabric so as to be elastic, is shaped to conform to the contour of a person's leg at the knee joint, having a bulge at 2 and a depression at 3 for conforming to the front and back of the knee.

Four flat metal strips or springs 4, 5, 6 and 7 are secured at one end by rivets to metal or stiff leather plates 8 and 9, as shown, the springs being slightly arched as shown, for holding the elastic sleeve 1 extended when worn. Plate 8 is oval in shape and plate 9 is round, the former being on the right-hand, or lateral side of the leg 10 shown at the left in FIG. 1. To each plate 8 and 9 a respective

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pad 11 and 12 of sponge rubber or similar resilient material is secured by means of stitching or adhesive, or both, and the pad is secured in like manner to the sleeve 1 so as to be positioned on either side of the joint as shown. Springs 4 and 5 are secured to the right hand plate 8 and springs 6 and 7 to the left hand plate 9, the upper springs 4 and 6 being pivotally secured thereto by one rivet and the lower springs 5 and 7 being secured by two rivets. Springs 4 and 6 lie substantially parallel to the femur 13 and springs 5 and 7 substantially parallel to the tibia 14.

The outer ends of springs 4, 5, 6 and 7 are secured to sleeve 1 as by means of a two-layer leather or fabric pocket 15-16 stitched to the sleeve, the outer portion 16 of each pocket being shaped and extended as shown to cover the metal spring. Soft cushioning material may be secured to the inside of sleeve 1 at the outer ends of the springs as shown at 17 and 18, FIGURES 1, 2 and 3, to cushion the outer end of each spring.

Means for forcing pads 11 and 12 inward to exert pressure on either side of the knee joint are provided, comprising the members 20 and 21 and means for joining the ends thereof to completely encircle the knee, which knee-encircling structure is the subject of the present invention.

Pressure members 20 and 21 are made of a rigid material, preferably cast aluminum or the like, and are secured to the plates 8 and 9 respectively by the rivets 22. Members 20 and 21 are preferably offset inwardly as indicated in FIG. 7 where contact is made with plates 8 and 9 to distribute pressure to the plates at the center thereof. The forward portions of members 20 and 21 are again offset slightly inwardly adjacent pads 11 and 12 and thence curve around the front of the knee to meet in a hinged joint 25. Forward ends 23 and 24 of the members 20 and 21 are also offset downwardly as plainly shown in FIG. 1 to meet well below the knee joint to avoid any contact between members 20 and 21 and the kneecap. A hinge pin 26 joins the conventional hinge parts formed on the ends 23 and 24.

To the rear of the plates 8 and 9, members 20 and 21 are again offset slightly inwardly adjacent pads 11 and 12 and thereafter curve smoothly toward one another around leg 10 (FIG. 7) to a point directly to the rear of the knee joint where they are joined by a latching device generally denoted 27.

Any suitable means, including resilient connecting means, may be used for bringing toward one another the respective rear ends 28 and 29 of the members 20 and 21 but the toggle latch 27 is preferred. Toggle leg or link 30 (FIGURES 11 and 12) is pivotally secured at one end by a stud 31 to the end 29 of arm 21 and at the other end by a rivet 32 to a toggle latching link or locking leg 33 intermediate the ends thereof, rivet 32 constituting the knee pivot of the toggle.

Locking leg 33 is pivotally secured at one end to the end 28 of member 20 by a removable pin or screw 34 and the other end is provided with a laterally projecting ear 35 constituting a stop for engaging member 20 when the toggle is closed. The stop 35 may have a downwardly turned inner flange 36 (FIG. 15) for embracing the member 20, and the bottom edge of leg 33 is provided with a small inwardly projecting detent 37 for releasable engagement with the bottom edge of member 20. It will be noted in FIGURE 12 that the end 28 is reduced in thickness along the member 20 to provide a recess 38 to accommodate a portion of the leg 33, the leg being offset at 39.

It is advantageous to provide adjustment means for altering the distance between pads 11 and 12 when toggle 27 is closed, and for this purpose the rear end 29 of member 21 is provided with a plurality of bayonet-joint-type holes 40 (FIG. 13) into which the stud 31 on link 30 may be selectively inserted. Stud 31 is provided with a bayonet type lug at 41 (FIGURE 14) and is secured as by soldering or welding to the link 30. The holes 40 and stud 31 are oriented so that the stud may be inserted in

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or removed from the holes only when the link 30 is swung to a position normal to the member 21. Since the link 30 is not swung to this extent upon opening the toggle latch 27 (see broken lines in FIGURE 11), it is necessary to remove the screw 34 in order to adjust the size of the leg-encircling members 20-21.

It will now be apparent that the members 20 and 21 may be so curved as to closely follow the contour of the leg around the knee joint and yet spaced from the leg so as, at no time, to come in contact with the leg. It will also be apparent that when the brace is worn in athletic competition it will be desirable to provide members 20 and 21 with a protective covering of leather, or of sponge rubber 43 and leather 44 as shown in FIGURES 4, 5 and 6. The portions of the knee-encircling members which include the toggle latch 27 may be provided with a removable flap 45 of this covering, C-shaped in cross section, as plainly shown in FIGURES 7 and 23. The free end of the flap 45 is provided with a tab 46 having thereon a snap fastener 47 (FIG. 7) which may be engaged with one of a plurality of mating fasteners 48 provided on the covering 44.

The operation of the knee brace will now be described. The patient or athlete will slip his foot through sleeve 1 and pull it up in position over the knee joint in such position that pads 11 and 12 lie on either side of the joint. Toggle latch 27 is then closed to put pressure on the pads 11 and 12 to prevent excessive lateral or rotary motion of the joint.

At the first application of the brace some experimentation is necessary to select the correct hole 40 in which stud 31 should be located but, once adjusted, the brace may be locked in place by a simple downward movement of the toggle locking leg 33. When the members 20 and 21 are provided with protective covering, the flap 45 is then applied and secured in place in obvious manner.

FIGURES 8, 9 and 10 show a modified form of knee brace in which the springs 4, 5, 6 and 7 may be omitted. Knee-encircling members 20' and 21' are similar to members 20 and 21 except that the forward ends thereof are bifurcated, being provided with portions 23a and 24a which are offset upwardly above the knee cap as well as with the portions 23' and 24' offset therebelow. The portions 23a and 24a are hingedly joined at 25a and the portions 23' and 24' are similarly joined at 25'; the two hinged joints being axially aligned.

Members 20' and 21' are provided at the rear with a modified form of adjustable locking device 27' as shown in FIGURES 16-20 inclusive. The toggle and lock of device 27' is the same as the device 27 except that link 30 of the toggle latch 27' is pivotally secured to a removable anchor plate 50 by means of a stud 51. Anchor plate 50 is of the same width as member 21', the end 29' of which is recessed at 52 so that the anchor plate may be received in the recess at a plurality of selected positions therealong. The outer face 53 of the recess 52 and the adjacent inner face 54 of the anchor plate 50 are provided with mating serrations or teeth 55 so that the two parts are interengaged when the anchor plate 50 is clamped in recess 52.

To clamp the anchor plate 50 against the serrated face 53 of member 21' at any selected position in recess 52, a slide or keeper 56 is provided. The slide 56 is hollow and rectangular in cross section as shown in FIGURE 20 and is adapted to closely embrace the member 21' and to be slidable therealong. Anchor plate 50 in recess 52 is of a thickness to precisely fill the recess so that slide 56 may be moved rearwardly to embrace the anchor plate and the recessed end of member 21' to clamp the anchor plate in the recess. A slot 57 (FIG. 19) may be provided in one end of the slide 56 for stud 51 so that the slide may be moved under the toggle link 30. A conventional ball and socket type of detent may be provided as at 58 for keeping the slide 56 in place.

The operation of the brace of FIGURES 8-10 is the

same as above described for the embodiment of FIGURES 1-3. The hinged joint between the upper portions 23a and 24a of members 20' and 21' being above and axially aligned with the hinged joint between the lower portions 23' and 24', the encircling members 20' and 21' may be expanded and contracted by operation of the toggle latch 27' for applying and removing the brace. The initial adjustment of the brace may be accomplished by moving the slide 56 along arm 21' away from anchor plate 50, moving the plate toward one end or the other of the recess 52 and returning slide 56 into engagement with plate 50.

In FIGURES 21 and 22 is shown a modified form of fastening device for securing the flap 45 of the protective covering of the knee encircling pressure members over the latching device. The flap 45 is provided with a tab 46' and the adjacent end of the covering 44 is provided with a pocket member 59 stitched to covering 44. The free end of the flap 45 is secured in place by slipping the tab 46' into the pocket formed by the member 59 as shown in FIGURES 21 and 22.

In FIGURES 24-27 another modified form of knee brace is shown in which the knee encircling structure comprises the rigid metal arm members 60 and 61 behind the knee, being joined together by a toggle latch 27, and substantially non-elastic straps 62 and 63, or other non-stretchable but flexible members, connecting the pads 64 and 65 in front of the knee.

The pads 64 and 65 are preferably somewhat larger than the above described pads 11 and 12, and the metal or stiff leather plates 66 and 67 to which they are stitched are accordingly larger. Plates 66, 67 are preferably dished or cupped, as shown, and may both be oval in shape. The ends of straps 62 and 63 are stitched to the top and bottom, respectively, of the plates 66 and 67 and are adapted to encircle and contact the front of the leg above and below the knee to prevent the pads 64 and 65 from being pulled to the rear.

Pads 64 and 65 may be secured to an elastic member 68, which may be a sleeve such as the above described elastic sleeve 1 or simply a half sleeve, as shown, extending around the rear of the knee for holding the pads in position while fastening the brace.

The forward ends of members 60 and 61 are secured respectively to the plates 66 and 67 by rivets 69, and the members curve around behind the knee, spaced therefrom like the rear portion of the above described members 20 and 21. Means are provided for drawing together the rear ends of members 60 and 61, to put pressure on the pads 64 and 65, such as the toggle latch 67 previously described.

Members 60 and 61 and the latch 27 may have a protective covering for sport use.

The operation of the brace of FIGURES 24-27 is much the same as for the other above described embodiments. The brace is pulled on over the foot and pulled up to the knee with the pads 64 and 65 on either side of the joint. Latch 27 is then adjusted and closed to draw the pads together. Since the straps 62 and 63 contact the bony portions of the front of the leg above and below the knee, they prevent the pads from being drawn to the rear, and consequently the pads put the desired pressure on either side of the knee when latch 27 is closed.

The straps 62 and 63 are held taut against the front of the leg by the elastic half-sleeve 68 until latch 27 is closed. Thereafter, the pressure on the pads maintains the brace in place, and the arm members 60 and 61 are held spaced from the back of the knee. The popliteal space posterior to the knee is therefore free from constriction, and circulation to the limb below the knee is without interference, while the knee joint is supported by the pads 66 and 67 as hereinabove described.

It will now be apparent that there has been provided a brace which firmly prevents lateral motion and rotational motion of the knee joint beyond the normal limits

by reason of the compressive action of the pressure pads. The pads in turn are held in place by the compressive action provided by the rigid leg-encircling members, and also by reason of the attachment of the pads to the elastic sleeve 1 or half sleeve 68 and straps 62 and 63. Normal flexion and extension of the knee joint within its normal range is therefore not restricted.

The main vessels which supply and return blood to and from the lower portions of the leg are located in the popliteal space posterior to the knee and the brace does not exert pressure on or otherwise interfere with this area. There is very little, and purely localized, blood supply provided to the knee on its lateral and medial sides, and, consequently, interference with the blood and lymph supply to the knee and lower extremity is minimal.

The pressure which can be supplied against the joint may be easily adjusted initially by the toggle adjustment afforded by the parts 31, 40, or members 50, 56, and the pressure can be quickly applied by the toggle latch 27 or 27'. Consequently, after the initial adjustment, the knee brace of the present invention may be quickly and easily put on and taken off by the wearer.

The brace may be worn by orthopedic patients who ordinarily cannot freely move about because of the pain incident to the weight born by an injured or damaged knee. With the brace such patients can move about with safety while healing is taking place. In industry, time ordinarily lost by disabled workers with pre-operative and post-operative knees may be safely cut to the minimum by using the brace, and in some cases the necessity for operative attention may be eliminated by wearing the brace while natural healing takes place.

The brace is especially effective as a protective, as well as a remedial, device for athletes. Pre-season examinations frequently reveal structural weaknesses of the knee from a variety of causes which ordinarily require time consuming and elaborate methods of strapping and bandaging. With the above disclosed type of knee brace, the athlete himself may simply put on and take off the brace at will, once it has been adjusted to his knee by an expert or professional attendant.

As will be apparent to those familiar with the art, the invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The embodiments disclosed are therefore to be considered in all respects as illustrative rather than restrictive, the scope of the invention being indicated by the appended claims.

What is claimed is:

1. A corrective and protective brace for a human joint requiring corrective pressure at opposite sides of the joint, comprising, an elastic sleeve adapted to cover the joint when the brace is worn, pressure pads secured to the sleeve on opposite sides thereof, a pair of curved pressure members each of which is secured to one of said pads, said members being hingedly connected and encircling said joint when the brace is worn, and means at the free ends of said members for releasably securing said ends together to exert pressure on said pads, said members being rigid and being spaced from the joint when the brace is worn whereby there is minimal interference with the circulation in the joint.

2. A corrective and protective brace for a limb joint requiring corrective pressure on opposite sides thereof, comprising: structure adapted to encircle the limb at the joint and support the brace when the latter is worn, said structure including an elastic member; a pair of pressure pads secured to said structure on opposite sides thereof; a rigid member secured to each of said pads, said rigid members being curved to at least partially encircle said limb at the joint in spaced relation thereto when the brace is worn; and means connected to one end of each rigid member for releasably securing said ends together to exert inward pressure on said pads.

3. The brace of claim 2 having a soft resilient covering

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on said rigid members whereby said brace is adapted for athletic use.

4. A corrective and protective brace for a limb joint requiring corrective pressure on opposite sides thereof, comprising: an elastic sleeve adapted to encircle the limb at the joint when the brace is worn, a pair of pressure pads secured on the sleeve on opposite sides thereof, a curved separable rigid structure secured to said pads, said structure extending around and being spaced from said limb when the brace is worn, and means on said structure adapted to urge said pads together whereby pressure is put on the joint by said pads without circulation-interfering pressure elsewhere on the limb.

5. In a corrective and protective knee brace, an elastic sleeve adapted to conform to the wearer's leg at the knee when the brace is worn, pressure pads secured to said sleeve at opposite sides thereof, curved rigid pressure members secured to said pads, said members being separably connected together at the ends thereof when the brace is worn for completely encircling said knee in spaced relation thereto and forcing said pads against opposite sides of the wearer's knee joint.

6. A corrective and protective knee brace for exerting pressure on opposite sides of the wearer's knee joint, comprising an elastic sleeve adapted to be worn over the knee, pressure pads secured to opposite sides of said sleeve, a curved rigid pressure member secured to the outer side of each pad and adapted to partially encircle the knee to the front and rear thereof when the brace is worn, said members being spaced from the knee and being vertically offset in front of the knee when the brace is worn, and means connecting the ends of said members for forcing said pads against the knee, one of said connecting means being a hinged joint and the other means being an adjustable latch, said latch being releasable for putting on and taking off the brace.

7. A corrective and protective knee brace for exerting pressure on opposite sides of the wearer's knee joint without interfering with circulation in the wearer's limb comprising: an elastic sleeve adapted to be worn over the knee, said sleeve conforming to the knee joint and extending above and below said joint when the brace is worn; a plate carrying a resilient pad secured on opposite sides of said sleeve; and substantially rigid curved members secured to said plates and adapted to partially encircle the knee to the front and rear thereof, said members being spaced from the knee when the brace is worn and being vertically offset and hingedly joined together in front of the knee, and said members being releasably secured together for completely encircling the knee and forcing said pads against the knee joint.

8. The knee brace of claim 7 wherein said rigid members are bifurcated in front of the knee when the brace is positioned thereon, one of the bifurcations of each member being offset above the knee and the other bifurcation being offset below the knee, the ends of the corresponding upper and lower bifurcations of the members

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being hingedly joined together, said hinged joints being coaxial.

9. A corrective and protective knee brace for exerting pressure on opposite sides of the wearer's knee joint without interfering with circulation in the wearer's limb, comprising: an elastic sleeve adapted to be worn over the knee, said sleeve conforming to the knee and extending above and below the knee joint when the brace is worn; a plate carrying a resilient pad secured on opposite sides of said sleeve; means carried by said plates and secured to said sleeve adjacent the upper and lower ends thereof for keeping said sleeve extended; a substantially rigid curved member secured to each plate and adapted to extend around the knee to the front and rear thereof in spaced relation thereto when the brace is worn; the forward ends of said members being vertically offset and hingedly joined together in front of the knee when the brace is worn; toggle means having a pair of toggle legs each having an end pivotally connected to the rearward end of a respective one of said members for forcing said rearward ends of a respective one of said members for forcing said rearward ends together to exert a compressive force on said pads, one of said toggle legs having its other end pivotally connected to the second toggle leg medially of the ends thereof; and latch means on the free end of said second toggle leg for releasably securing said free end to its respective member.

10. The knee brace of claim 9 including means for pivotally and releasably securing one of said toggle legs to its respective member in one of a plurality of selected positions along the rearward end of said member whereby said brace is adjustable.

11. A corrective and protective knee brace for exerting pressure on opposite sides of the wearer's knee joint, comprising: a pair of oppositely disposed pressure pads adapted to engage the opposite sides of the joint; flexible means comprising a pair of straps the ends of which are secured to said pads, said straps, when the brace is worn, extending around in front of the wearer's knee with one strap above the knee and the other below the knee; pressure means including a pair of curved rigid members each of which is secured at one end to one of said pads, said members being adapted to extend around in back of the wearer's knee in spaced relation thereto when the brace is worn; and means connected to the free ends of said members for releasably securing said ends together for exerting pressure on said pads.

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