April 1, 1952 M. C. PETRUCH 2,591,373

LOCKABLE KNEE JOINT FOR ORTHOPEDIC BRACES OR ARTIFICIAL LIMBS

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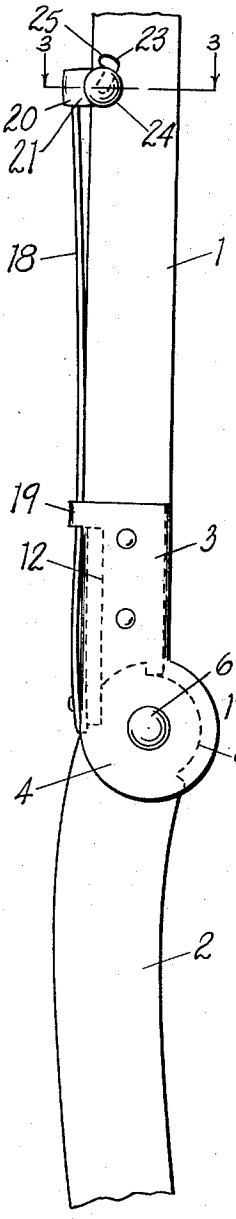


Fig. 1

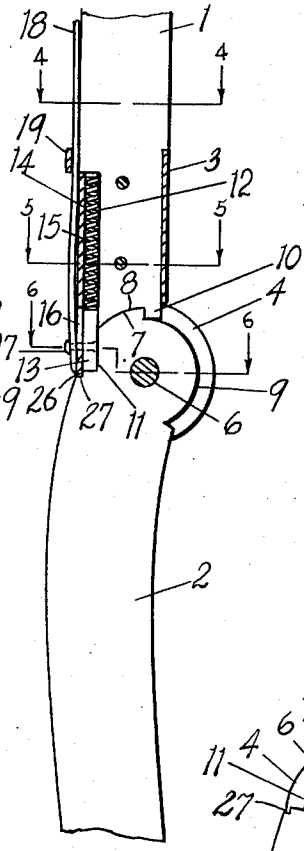


Fig. 2

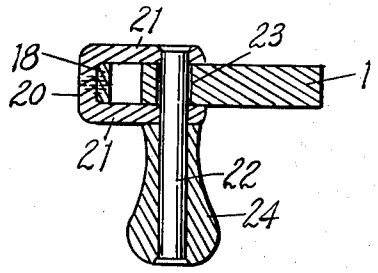


Fig. 3.

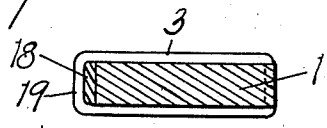


Fig. 4.

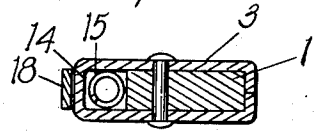


Fig. 5.

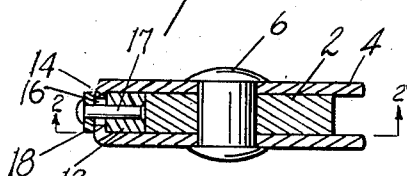


Fig. 6.

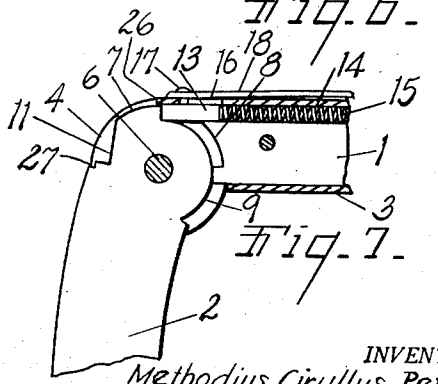


Fig. 7.

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LOCKABLE KNEE JOINT FOR ORTHOPEDIC BRACES OR ARTIFICIAL LIMBS

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5 Claims. (Cl. 128—80)

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This invention relates to improvements in lockable knee joint for orthopedic brace or artificial limb.

The principal objects of this invention are:

First, to provide a joint structure for an orthopedic brace which is easily locked or unlocked while in straight extended position of the joint.

Second, to provide a knee joint for orthopedic braces and artificial limbs which is highly resistant to wear under the loads applied thereto in walking.

Third, to provide lock structure for a knee joint of a brace which is covered or enclosed to prevent tearing or wearing of the clothing surrounding the joint.

Fourth, to provide lock mechanism for a knee joint which is extremely simple and easy to assemble and repair while at the same time being entirely positive and effective in its locking action.

Fifth, to provide a knee joint for orthopedic braces or artificial limbs in which the stresses of walking on the joint are carried almost entirely by the main brace elements as distinguished from the pivotal connection therebetween.

Sixth, to provide a lockable knee joint for an orthopedic brace in which the principal stress encountered by walking on the brace is carried by the main elements of the brace and not transmitted to the lock elements whereby the lock structure is relatively small and long lived.

Other objects and advantages relating to details of my invention will be apparent from a consideration of the following description and claims. The drawings of which there is one sheet, illustrate a preferred form of my lock and joint as applied to the load carrying members of an orthopedic brace.

Fig. 1 is a fragmentary side elevational view of the joint and lock in the straight or extended position of the brace.

Fig. 2 is a fragmentary side elevational view of the joint with portions of the lock retaining sleeve broken away in vertical cross section along the plane of the line 2—2 in Fig. 6.

Fig. 3 is a transverse cross sectional view through the lock operating handle taken along the plane of the line 3—3 in Fig. 1.

Fig. 4 is a transverse cross sectional view through the upper brace member and lock operating finger taken along the plane of the line 4—4 in Fig. 2.

Fig. 5 is a transverse cross sectional view through the upper brace member and lock engaging spring taken along the plane of the line 5—5 in Fig. 2.

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Fig. 6 is a transverse cross sectional view through the brace joint and lock taken along the plane of the line 6—6 in Fig. 2.

Fig. 7 is a fragmentary side elevational view, partially in vertical cross section, of the brace joint and lock in bent position.

In the drawings I have illustrated one side of an orthopedic brace such as is normally worn on the knee of a partially disabled person. It should be understood that normally two of these brace structures are employed, one on each side of the knee, and that suitable connecting and attaching straps or fixtures are provided for attaching the upper and lower sections of the brace to the leg of the wearer, both above and below the knee. As an alternative, the brace structure may be incorporated in an artificial limb in which case only the upper end of the brace will be attached to the leg of the wearer and the lower brace will be built into an artificial lower limb.

The brace includes an upper brace member 1 of flat strap-like stock of the required rigidity and a lower brace member 2 of similar construction. The lower end of the upper brace member 2 is surrounded by and secured to a sleeve 3 of folded sheet metal construction. The lower end of the sleeve is provided with circular extensions 4 which project downwardly in lapped relationship on each side of the upper end of the lower brace member 2. A hinge pin or rivet 6 pivotally connects the circular extensions 4 with the lower brace member 2.

In order to relieve the hinge pin 6 from the main loads applied to the brace in walking, the upper end of the lower brace member 2 is provided with a segmental arcuate surface 7 concentric about the pin 6 and disposed toward the front side of the brace. The lower end of the upper brace member 2 is provided with a mating segmental arcuate surface 8 so that when the brace is in straight extended position the weight of the wearer is directed through the upper brace member and the abutting surfaces 7 and 8 to the lower brace member 2.

In order to regulate and limit the pivoting motion of the upper brace member about the hinge pin 6 and lower brace member 2, the lower brace member is provided with a segmental arcuate surface 9 radially recessed inwardly from the bearing surface 7. The upper brace member is provided with a locking lug 10 which

projects downwardly against the arcuate surface 9 and forms a limit stop coacting with the rear end of the bearing surface 7 to prevent forward overbending of the brace joint.

In order to prevent unintentional breaking or bending of the brace joint rearwardly, the upper end of the lower brace 2 is provided on its forward side with a locking notch 11 which extends as a chord of the arcuate bearing surface 7. The lower end of the upper brace member 1 has a forwardly opening notch as at 12 to align with the locking notch 11 when the brace is extended. A locking block 13 of rectangular cross section is slidable along the notch 12 into locking engagement with the notch 11. The locking block 13 is approximately the same thickness as the brace members 1 and 2 and is slidably retained on the upper brace member by the sides and forward edge wall 14 of the sleeve 3. A coil spring 15 retained in the notch 12 by the sleeve 3 constantly urges the locking block downwardly toward locking engagement with the lower brace member.

It will thus be seen that when the brace is extended to straight position, the locking block will snap into engagement with the notch 11 and prevent unintentional retraction or bending of the brace. In order to release the locking block and permit bending of the brace, the forward wall 14 of the sleeve 3 is cut away or slotted vertically as at 16 to pass a pin 17 secured to the locking block 13. The outer end of the pin 17 is secured to a narrow lock operating finger 18 which extends vertically upwardly along the forward side of the sleeve 3 and upper brace member 1. The finger 18 is of reversely bent and tensioned spring metal so that the upper end of the finger is constantly biased forwardly of the upper brace member 1 as is most clearly illustrated in Fig. 1. A loop 19 on the upper end of the sleeve 3 retains the intermediate portion of the finger 18 in alignment with the upper brace member 1.

The upper end of the finger 18 is secured within a rearwardly opening U-shaped clip 20 as by being welded thereto and the rearwardly extending flanges 21 of the clip 20 are lapped over the sides of the upper brace member 1. A pin 22 connecting the flanges of the clip 21 is slidably disposed in a forwardly angled slot 23 in the upper brace member 1. The pin 22 carries a smoothly rounded knob or handpiece 24 so that the finger 18 can conveniently be reciprocated through the clothing of the wearer.

When the pin 22 and finger 18 are moved upwardly, the locking block 13 is retracted from the locking notch 11, as previously described, and the brace joint is free to pivot. In the raised position of the pin 22 the springable character of the finger 18 urges the pin into the upper branch 25 of the angled slot 22 and prevents unintentional extension or downward movement of the locking block 13. By merely pressing the knob 24 rearwardly, the pin 22 will be aligned with the lower branch of the angled slot 23 permitting the spring 15 to advance the locking block 13 into locking engagement with the lower brace member when the brace is extended.

From the foregoing it will be apparent that my brace structure can be selectively positioned and retained in either locked, extended or unlocked pivoted position by a simple movement of the knob 24. Particular attention is directed to the fact that the locking block 13 is not subjected to the heavy load carrying stresses of the brace and is effectively guided in its locking and unlocking motion by the sleeve 3. In order that the locking block 13 shall be completely guided in its forward extended position, the lower end of the front wall 14 of the sleeve is extended across the locking block below the slot 16 as at 26 and a notch for receiving this lower portion 26 is formed in the forward edge of the lower brace member as at 27.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A lockable leg brace structure comprising elongated upper and lower brace members of strap-like structure, the adjacent ends of said members having mating concavo-convex arcuate bearing surfaces engaged in the aligned positions of said members, a radially recessed arcuate surface on the lower of said members adjacent the bearing surface thereon, a locking lug fixedly formed on the upper of said members and rotatable along said recessed surface into engagement with the end of the convex surface in the aligned positions of said members, a sleeve closely embracing and secured to the upper of said members and having projecting side plates lapped alongside the sides of the lower of said members, a hinge pin connecting said side plates and said lower member concentrically with said bearing surface, a locking notch formed in said lower member and intersecting the bearing surface thereon at the opposite end of the bearing from said recessed surface, said upper brace member being longitudinally notched underneath said sleeve to provide a slideway aligned with said locking notch in the aligned position of said members, a locking block slidable in said slideway and extensible into engagement with said locking notch, a spring in said slideway biasing said block to locking position, a block retracting finger of springable material secured at its lower end to said block and extending upwardly along the front edge of said upper member, a loop on said sleeve retaining said finger on said upper member, a clip on the upper end of said finger and lapped along the sides of said upper member, a pin carried by said clip and projecting into said upper member, said upper member having a forwardly angled slot receiving said pin, and a handpiece connected to said pin.

2. A lockable leg brace structure comprising elongated upper and lower brace members of strap-like structure, the adjacent ends of said members having mating concavo-convex arcuate bearing surfaces engaged in the aligned positions of said members, a radially recessed arcuate surface on a first of said members adjacent the bearing surface thereon, a locking lug fixed on the second of said members and rotatable along said recessed surface into engagement with the end of the recess forming said recessed surface in the aligned positions of said members, a sleeve closely embracing and secured to one of said members and having projecting side plates lapped alongside the end of the other of said members, a hinge pin connecting said side plates and said other member concentrically with said bearing surfaces, a locking notch formed in one of said members and extending in a chordal relation to the arc of said bearing surfaces, the other of said members being longitudinally notched to provide a slideway aligned with said locking notch in the aligned positions of said members, a locking block slidable in said slideway and extensible into engagement with said locking notch, a spring in said slideway

biasing said block to locking position, a block retracting finger of springable material secured at its lower end to said block and extending upwardly along the front edge of the upper of said members, a clip on the upper end of said finger and lapped alongside of said upper member, a pin carried by said clip and projecting into said upper member, said upper member having a forwardly and downwardly angled slot receiving said pin, and a handpiece connected to said pin.

3. A lockable leg brace structure comprising elongated upper and lower brace members of strap-like structure, the adjacent ends of said members having mating concavo-convex arcuate bearing surfaces engaged in the erected positions of said members, coacting stop surfaces on said members engageable in the erected positions thereof, a connecting piece secured to the member having the concave bearing surface and having a projecting side plate lapped alongside the end of the member having the convex bearing, a hinge pin connecting said side plate and said last member concentrically with said bearing surfaces, locking notches formed in said members and aligned across said bearing surfaces in the erected positions of said members, a locking block slidable in one of said notches and extensible into engagement with the other of said locking notches, a block actuating finger secured at its lower end to said block and extending upwardly along the front edge of the upper of said members, and a pin carried by the upper end of said finger and projecting into said upper member, said upper member having a forwardly and downwardly angled slot receiving said pin.

4. A lockable leg brace structure comprising elongated upper and lower brace members, the adjacent ends of said members having mating concavo-convex arcuate bearing surfaces engaged in the erected positions of said members, a stop surface on one of said members adjacent the bearing surface thereon, a locking face on the other of said members and rotatable into engagement with said stop surface in the erected positions of said members, a sleeve closely embracing and secured to said other of said members and having a projecting side plate lapped alongside the side of the said one of said members, a hinge pin connecting said side plate and said one member concentrically with said bearing surfaces, a locking notch formed in said one member and extending along a line intersecting the arc of the bearing surface thereon and facing oppositely from said stop surface, said other brace member being longitudinally notched underneath said sleeve to provide a slideway aligned with said locking notch in the erected position of said members, a locking block slidable in said slideway and extensible into engagement with said locking notch, a block retracting finger secured at one end to said block and extending along the upper of said members, and means on the upper end of said finger guidingly engaging the upper of said members.

5. A lockable leg brace structure comprising elongated upper and lower brace members, the adjacent ends of said members having mating concavo-convex arcuate bearing surfaces engaged in the erected positions of said members, a stop surface on a first of said members, a locking face on the second of said members and rotatable into engagement with said stop surface in the erected positions of said members, means pivotally connecting said members concentrically with said bearing surfaces, a locking notch formed in said second member and extending in a chordal relation to the arc of said bearing surfaces and facing oppositely from the locking face on said second member, said first brace member being provided with a slideway aligned with said locking notch in the erected positions of said members, a locking block longitudinally slidable and transversely retained in said slideway and extensible into engagement with said locking notch, a block retracting finger of transversely springable material secured at its lower end to said block and extending upwardly along the upper of said members, said finger being transversely bent and tensioned whereby the upper end thereof is biased transversely of the upper of said members, a pin carried by the upper end of said finger and engaging said upper member, said upper member having an angled slot receiving said pin, and a handpiece connected to said pin.

METHODIUS CIRYLLUS PETRUCH.

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The following references are of record in the file of this patent:

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