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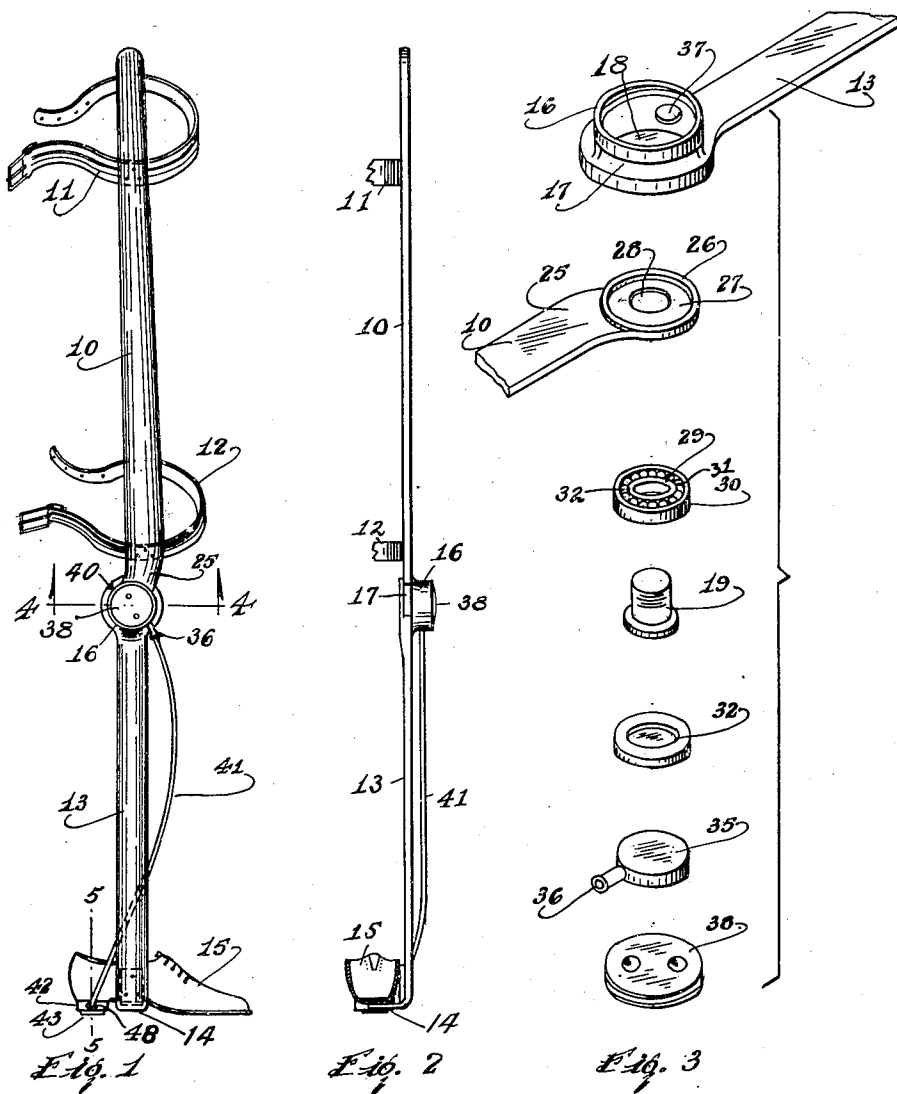
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2,485,036

LOCK JOINT FOR ANATOMICAL APPLIANCES

Filed April 1, 1947

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

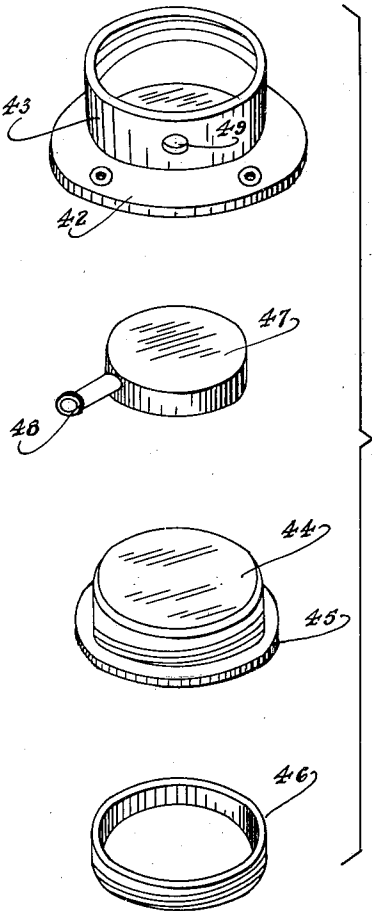


Fig. 6

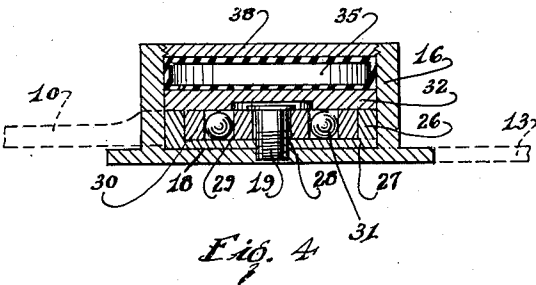


Fig. 4

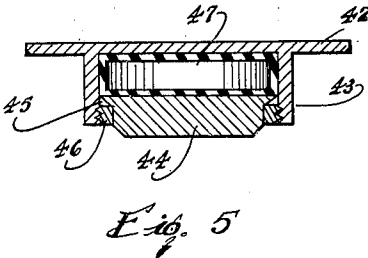


Fig. 5

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LOCK JOINT FOR ANATOMICAL APPLIANCES

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5 Claims. (Cl. 128—87)

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My present invention relates to prosthetic or anatomical devices, particularly to leg braces and artificial legs and it has for its object to provide a lock for the articulated parts of such appliances which is operated hydraulically when the weight of the wearer's body may require to be fully supported.

Another object of my invention is to provide an hydraulic lock for joints of leg appliances which is automatically operated by the wearer in his application of more or less of his bodily weight as he changes from a sitting to a standing position, or as he may shift his weight from toe to heel in walking.

Furthermore, my invention comprehends the incorporation, with the joint of an anatomical leg appliance, of an hydraulic locking mechanism in combination with an actuator incorporated in the shoe of the wearer for creating an operating fluid pressure controllable by the wearer's foot.

A still further object of the invention is the provision of an automatically operated hydraulic lock as an element of a jointed connection for anatomical appliances which is actuated by a piston in the heel of the wearer's shoe when he variously applies the weight of his body thereto as in rising to an erect position, or in the usual action of stepping forwardly.

To these and other ends my invention comprises further improvements and advantages as will be further described in the accompanying specification, the novel features thereof being set forth in the appended claims.

In the drawings:

Figure 1 is an elevational view of an anatomical leg brace illustrating one adaptation of my invention.

Figure 2 is a front elevation taken at right angles to Fig. 1.

Figure 3 is an exploded view showing the various elements of the hydraulic lock disassociated.

Figure 4 is a horizontal cross sectional view taken on the line 4—4 of Fig. 1.

Figure 5 is a vertical central sectional view through the actuator taken on the line 5—5 of Fig. 1.

Figure 6 is an exploded view showing, in their disassociated relationship, the several parts of the actuator.

Similar reference numerals, in the several figures, indicate similar parts.

My invention is applicable to a wide variety of joints employed on braces and artificial legs and for simplicity in illustration I have shown

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a joint corresponding to that of a human knee and forming the point of articulation between upper and lower brace members, which in practice are connected to like portions of a person's leg to form a support therefor.

Such a brace comprises an upper arm 10, provided with the usual padded leg encircling straps 11 and 12, and the lower arm 13 having at its lower end a laterally projecting extremity 14 designed to extend beneath the instep of a shoe 15 and to be more or less rigidly connected to the shoe. In carrying out my invention I provide a special form of connection between said arms. On one of them, for instance the lower arm 13, I provide an outwardly extending hub 16. The latter is slotted as indicated at 17 across its top and at its rear side in the plane of the outer face of the arm, a continuation of which forms a bottom 18 in the hub which has a central threaded aperture for a securing stud 19. The top end of upper arm 10 is in vertical alinement with the lower end 14 of the lower arm but in order to better simulate the action of the wearer's knee joint, I incline the lower end of arm 10 forwardly and provide it with a reversely curved neck 25. This neck extends into the slot 17 and carries a cylindrical head fitting within the hub 16. The head is cup-shaped, having a rim 26 and a bottom 27 the outer face of which rests in frictional engagement with the bottom 18 within hub 16. The bottom 27 is also provided with a circular central aperture 28 for the reception of the securing stud 19. The actual bearing by which the arms 10 and 13 are pivotally connected comprises inner and outer ball races 29—30 carrying anti-friction balls 31. The outer raceway or ring 30 fits closely within the rim 26 and the inner raceway 29 is carried by the bearing stud 19. Fitting within the hub 16 and extending over the ball raceways is a pressure disc 32 which is flat on one face and on its other side has a central cavity accommodating the head of the stud.

The hydraulic operating element of the joint connection comprises a flat expansible chamber 35, preferably made of rubber. It is circular in outline snugly fitting within the hub 16, and having a tubular neck 36 which passes through an aperture 37 located in the lower side of the hub opposite the slot 17. The chamber occupies the space between the inner pressure disc 32 and the inner side of a cover plate 38 which is removably screw threaded into the outer end of the hub 16. From this arrangement of parts it will be seen that, by inflating the chamber, pres-

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sure is exerted laterally on the one side against the cover plate and on the other side against the pressure plate, to frictionally lock the parts of the joint primarily by forcing together the broad contacting faces on the two arms, one of which is the inner bottom of the hub, the other being the outer portion of the head carrying the ball races.

The actuator for creating the necessary pressure in the aforementioned chamber 35 may be any suitable device connected to the neck 36 thereof. In order, however, that such action may be automatic I have provided a cylinder-piston mechanism, generally indicated as 40 in Fig. 1, which is connected to the chamber by a tubing 41 and is designed to be operated by the user applying thereto a certain proportion of the weight of his body.

To the above described end I place in a cavity of the heel of the shoe 15 a cylinder-piston combination, the cylinder member comprising a circular base 42 by which it is secured firmly in position, on which there is a rim 43 of a height substantially that of the thickness of a shoe heel. Within the cylinder is the piston 44 the outer face of which projects beyond the cylinder rim. On the inner edge of the piston there is a flange 45 fitting closely within the cylinder beneath a retaining ring 46 thereon. Between the bottom of the cylinder and the piston there is an elastic hollow body 47. It is preferably made of rubber and is circular and rectangular in cross section and fits closely the interior dimension of the cylinder and serves to yieldingly hold the piston normally projected and permit it to be forced inwardly of the cylinder. The body 47 is a substantial duplicate of the chamber 35. It has a tubular extension 48 at one side which leads outwardly through an opening 49 in the rim 43 and a corresponding passage formed in the shoe heel.

In practice the chamber 35 and the elastic body 47 are filled with a suitable fluid and are connected by the pipe 41, as shown in Fig. 1, which may be either a rigid or a flexible tubing securely united at its extremities to the neck 36 and the extension 48.

It will be readily appreciated that the form of ball bearing joint and the means for locking it either automatically, or accomplishing this result under control of the wearer of the appliance, as comprehended by my invention, is applicable to various types of joints used in connection with anatomical appliances. In the form of joint illustrated it will be seen that when the person to whom the appliance is fitted is in a standing position he can apply sufficient weight to compress the fluid in the hollow body 47 which reacts by the resulting expansion of the chamber 35 to securely lock the arms 10 and 13 together. By shifting his weight slightly he can also release the pressure on the lock to any extent desired.

I claim:

1. In an anatomical appliance embodying upper and lower brace members, a tubular hub on one of them receiving the adjacent end of the other, a pivot connecting said members, and an expansible chamber enclosed within said hub, of a hollow compressible actuator located in the heel of a shoe worn by the wearer of the appliance and a conduit connecting the chamber and

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actuator and forming therewith a hydraulic system serving to regulate the frictional pressure exerted on said pivotal connection upon the application by the wearer of his bodily weight upon the actuator.

2. In a leg brace, the combination with a lower brace member having a laterally projecting tubular hub located on its upper end and provided with a slot, a second brace member having an end extending within the hub in engagement with the bottom thereof and a closure for the outer end of the hub, of an expansible chamber located between said closure and the end of the second member, and means for forcing fluid under pressure into said chamber to lock the arms in frictional engagement.

3. An anatomical appliance comprising two articulated members, the pivotal point thereof embodying a closed hub portion, an expansible chamber located in the hub and bearing on the pivot, of a hollow compressible body connected to said chamber and forming therewith a variable fluid pressure mechanism serving to produce friction on said pivot, said compressible body being adapted to be compressed upon the application thereto of bodily weight of the wearer of the appliance.

4. In an anatomical appliance, the combination with leg brace members comprising a lower arm having a laterally extending tubular hub and an upper arm having an end extending into the hub and engaging at one side with the bottom thereof, ball bearing raceways within the hub carried by the other side of said arm and a stud uniting said parts for relative pivotal movement, of a closure for the outer end of the hub, an expansible chamber located between the closure and the bearing parts and means for forcing fluid under pressure into the chamber to frictionally lock the brace members together.

5. In an anatomical appliance, the combination with two brace arms having overlapping ends, one of them having a tubular hub enclosing the extremity of the other arm, a pivotal connection for the arms located within the hub, a closure for the outer end of the hub, and an expansible rubber chamber within the hub, an actuator comprising a cylinder adapted to be arranged in the heel of a shoe worn by the wearer of the appliance, a piston in the cylinder and a hollow rubber body arranged to be compressed by movement of the piston, a conduit connecting said body and chamber and forming in combination therewith a hydraulic system for regulating the frictional engagement of the parts of the arm's joint.

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