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L. G. BLACK
ORTHOPEDIC APPLIANCE

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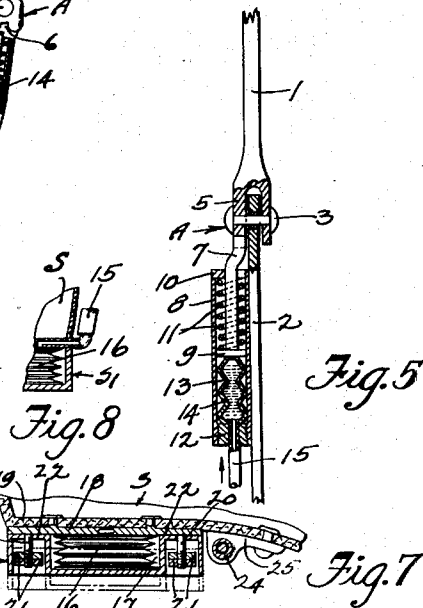
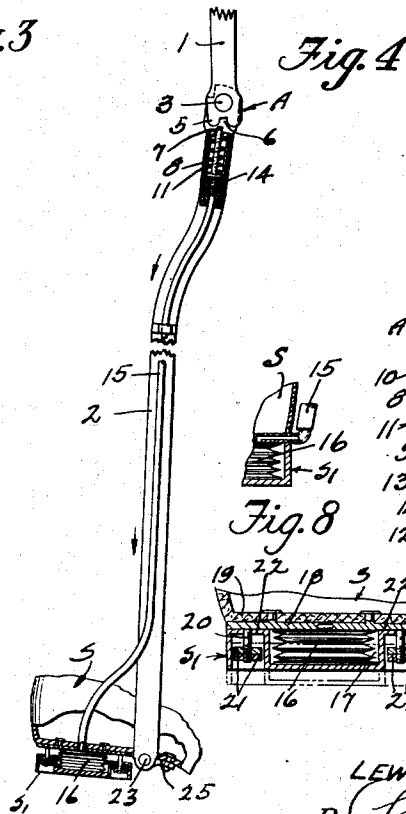
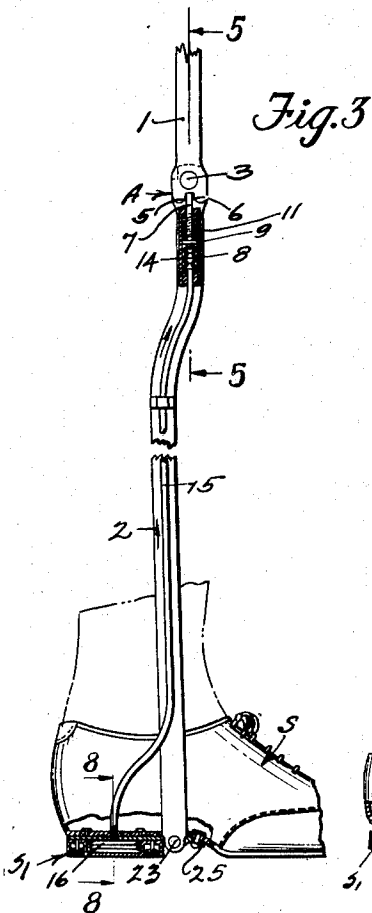
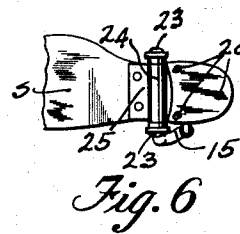
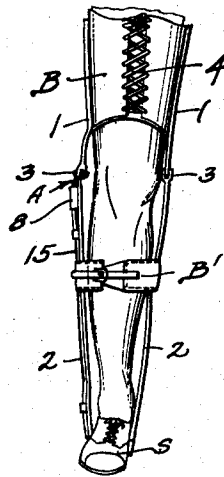
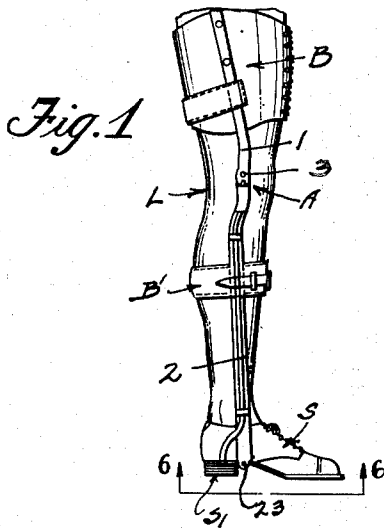
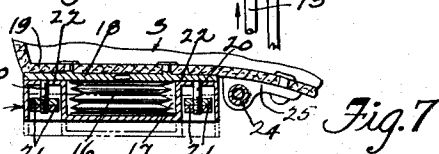


Fig. 8



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ORTHOPEDIC APPLIANCE

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This invention relates in general to orthopedic appliances and contemplates the provision of improvements applicable to leg braces of means which will readily and conveniently permit the flexing of the braces at the knee joint so that when walking a user will not be or appear to be stiff-legged and when changing from an erect to a sitting posture the braces will respond to the bending of the knee without any manual effort.

It is customary to provide leg braces which while capable of bending or pivoting with the knee of a user requires the latching and unlatching of connected parts of the braces, when changing from a sitting to a standing posture or vice versa, by manual effort. Hence, in such usual forms of orthopedic devices inconvenient and extraordinary operations are necessary for accommodating the braces to different postures of the user.

A primary object of this invention is to provide in connection with a more or less conventional type of leg brace a fluid operated means which includes pressure responsive elements positioned under the heel of the shoe and at approximately the knee joint which are effective for displacing fluid from one to the other of said elements as the posture of the user is changed, and a mechanical latch adjacent the knee joint which locks when the weight of the body is placed on the heel of one foot and unlocks when the weight is shifted to the heel of the other foot, as when walking. Other objects may appear as the description progresses.

I have shown a preferred form of appliance embodying my improvements in the accompanying drawing, in which:

Fig. 1 is an elevational view of a brace applied to a human leg as seen from a side;

Fig. 2 is a view of the same as seen from the front;

Fig. 3 is an enlarged elevational view of the structure shown in Fig. 1 except for certain thigh attaching portions and showing the upper and lower brace members in locked position as when the full weight of a body is on one of the heels of a foot;

Fig. 4 is a view similar to Fig. 3 except that the weight on the heel has been relieved and the upper and lower braces are unlocked;

Fig. 5 is a sectional elevation on line 5—5 of Fig. 3;

Fig. 6 is a fragmentary bottom plan view of a shoe to which the appliance is attached;

Fig. 7 is an enlarged detailed sectional view of the lower portion of the appliance as when affixed to a shoe as shown in Figs. 3 and 4; and

Fig. 8 is a fragmentary section on line 8—8 of Fig. 3.

It is usual in appliances of the general character of those disclosed herein to provide rigid

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upper braces 1, 1 on opposite portions of the upper leg L and relatively pivoted lower braces 2, 2, which are hinged together as at points 3. Usually the upper braces 1 are suitably attached to a wide belt B adapted to be laced as at 4 around the thigh of a leg, while the lower braces 2 are suitably attached to a narrow belt B' applicable to the calf of a leg, as shown in Figs. 1 and 2.

The lower braces 2 are also attachable by suitable means to a shoe S so that, theoretically at least, the braces 1 and 2 will pivot at points 3 when the knee is bent. But it is desirable in order to afford security and stability as the posture of the user is changed. Heretofore it has been necessary for a user to tighten or loosen a set screw or other device so that the braces 1 and 2 might be moved relatively, thereby inconveniencing a user when changing from one to another posture, whereas I have provided means which is automatically operable for adapting the braces to changes in posture. I prefer to accomplish such result by the employment of fluid pressure which operates to latch and unlatch the upper and lower braces in accordance with intended movements of the user. To such end I mount a latch A at the juncture of one set of braces 1 and 2 adjacent the knee position which includes a portion 5 at the lower extremity of a brace 1 which is provided with a notch 6, and a relatively adjustable latch bar 7 carried by the connected brace 2 and is adapted at times to seat in notch 6 of brace 1. Bar 7 is slidable in a cylinder 8 affixed suitably to brace 2 and has a head 9 thereon fitting the bore of said cylinder, between which and an end 10 a spring 11 is compressed and tends to move the latch bar 7 downwardly from engagement with notch 6 of brace 1 when the weight of the body is not on the heel S₁ of shoe S, but when the weight is on the heel spring 11 is compressed as latch bar 7 moves upwardly so that its upper end will engage notch 6.

In cylinder 8 between head 9 of bar 7 and an end closure 12 is a chamber 13 which, in the form of device shown, houses a bellows 14 or the like which is connected as by means of a flexible tube 15 with a bellows 16 or the like carried by the heel S₁ of the shoe S. The bellows 14 and 16 and their connecting tube 15 are filled with a suitable fluid so that when the weight of the body is placed on the heel S₁ as in Fig. 1 the contained fluid will be displaced from the bellows 16 into bellows 14 and thereby effect the raising of latch bar 7 into position of engagement with notch 6 of brace 1.

As the weight of the body is shifted from one to the other foot as in walking the tension of spring 11 retracts bar 7 in cylinder 8 and at the same time compresses bellows 14 and effects a

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return of fluid into bellows 16, thereby unlatching bar 7 from brace 1, and permitting the bending of the knee of the user and the pivotal movement of braces 1 and 2. Bellows 16 is enclosed in a chamber 17 of the heel S₁. Said heel, as shown in Fig. 7 is movable relative to a heel plate 18 affixed to the bottom 19 of the shoe S as by means of studs 20 fixed to and depending from plate 18 and carrying lock nuts 21. Said studs extend through webs 22 in heel S₁ and as weight on the heel is relieved the fluid pressure in bellows 16 will be effective for moving the heel S₁ downwardly from plate 18 until the uppermost nuts 21 engage the lower sides of webs 22, as shown in Fig. 4.

The lower braces 2 are attached to shoe S in the following manner: Each brace 2 has an inwardly projecting trunnion 23 which is insertible in an adjacent end of a transverse tube 24 and said tube is attached to the bottom of said shoe S as by means of a suitable bracket or clamp 25. Thus when walking the foot of a user will pivot on the trunnions 23 of one foot as the heel is lifted and the weight of the body is carried by the heel of the other foot. As the weight is relieved from the heel of one foot and shifted to the other foot the bar 7 will automatically unlock from brace 1 and the leg may be normally bent at the knee without occasioning the operation of any latch or lock, but as soon as a step has been completed and the weight again is shifted to the first foot the braces will be again locked until the completion of an ensuing step by the other foot.

Thus, while standing erect, the weight of the body may be upon one or both feet depending upon a particular stance of the user, but when the user starts to walk all of the weight of the body is at least momentarily on first one foot and then the other while the latch A of one leg is locked and the other latch is unlocked. When changing from a standing to a sitting posture the mere lifting of one heel after the other will effect the unlocking of the leg braces and permit the knees to bend and a user to gracefully assume a sitting position.

It will be noted that in my appliance there are no valves or manually operable parts, a user will not appear to be stiff-legged or embarrassed while attempting to appear natural by reason of the necessity for operating certain parts when one desires to change his posture, and the complete appliance is of generally conventional character and requires nothing more in its application to a shoe than the removal of a usual heel and its replacement by one of my design and the application of the brace supports 25 to the bottom of the shoe arches.

I claim:

1. An orthopedic appliance comprising: a brace for a human leg including upper and lower sections attachable, respectively, to the leg at points above and below and hingedly connected adjacent the knee joint, a latch carried by said sections adjacent the knee joint, a shoe carried on the foot of a user to which said lower sections are pivotally attached and having a heel adjustable thereon, a bellows carried by the heel of the shoe and a second bellows carried by the lower sections of the brace whereby when the weight of a body is upon the heel the bellows thereon will contract and cause said latch to be moved to brace locking position and when the weight of the body is removed from the heel the heel bellows will ex-

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pand and the latch will be automatically adjusted so as to unlock the brace sections.

2. An orthopedic appliance comprising: a brace for a human leg including upper and lower sections attachable, respectively, to the leg at points above and below and hingedly connected adjacent the knee joint, a latch carried by said sections adjacent the knee joint, a shoe adapted to be worn on the foot of a user to which said lower sections are pivotally attached, a cylinder attached to one of said lower sections, a bellows carried by said cylinder and engaging said latch so that when the bellows is expanded, the latch will be urged into latched connection with the upper section, a spring in said cylinder urging said latch into engagement with said bellows and urging said bellows into contracted position as when the latch is disconnected from the upper section, and a second bellows carried within the heel of the shoe and in communication with the first mentioned bellows whereby fluid discharged from the first bellows will flow into and expand the heel bellows and fluid discharged from the heel bellows as the same is contracted will flow into and expand the first bellows for establishing a latched connection between the upper and lower sections of the brace as the weight is respectively relieved from and placed upon the heel of the shoe.

3. An orthopedic appliance comprising: a brace for a human leg including upper and lower sections attachable, respectively, to the leg at points above and below and hingedly connected adjacent the knee joint, a latch carried by said sections adjacent the knee joint, a shoe adapted to be worn on the foot of a user to which said lower sections are pivotally attached, a cylinder attached to one of said lower sections, a bellows carried by said cylinder and engaging said latch so that when the bellows is expanded, the latch will be urged into latched connection with the upper section, a spring in said cylinder urging said latch into engagement with said bellows and urging said bellows into contracted position as when the latch is disconnected from the upper section, and a second bellows carried within the heel of the shoe and in communication with the first mentioned bellows whereby fluid discharged from the first bellows will flow into and expand the heel bellows and fluid discharged from the heel bellows as the same is contracted will flow into and expand the first bellows for establishing a latched connection between the upper and lower sections of the brace as the weight is respectively relieved from and placed upon the heel of the shoe, said heel being adjustable on the shoe so that as the bellows carried thereby is expanded the heel will move away from the sole of the shoe but as said bellows is contracted, the heel will be restored to normal position against the sole of the shoe.

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