Sept. 9, 1924. 1,507,998

C. G. HOARE ET AL

JOINT FOR ELBOWS AND KNEES OF ARTIFICIAL LIMBS

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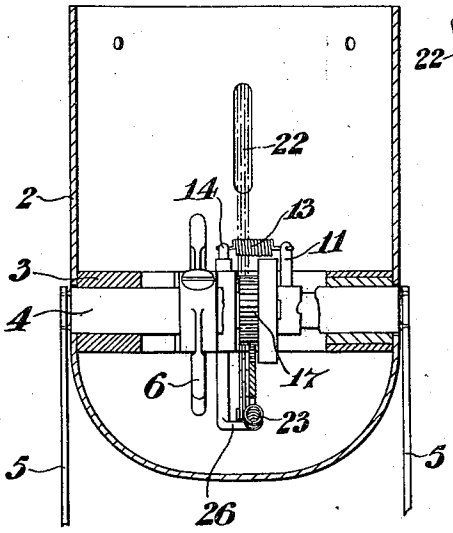


Fig. 3.

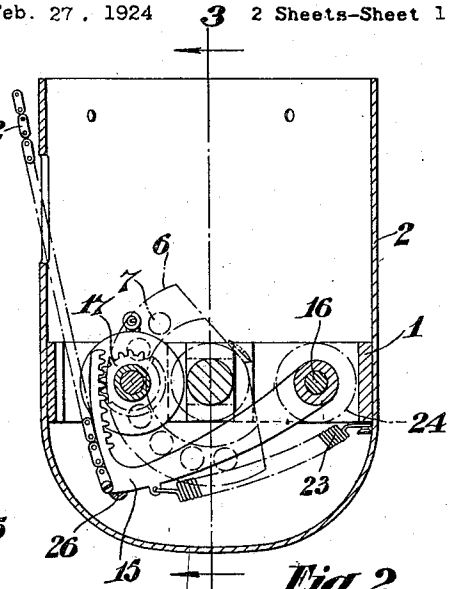


Fig. 2.

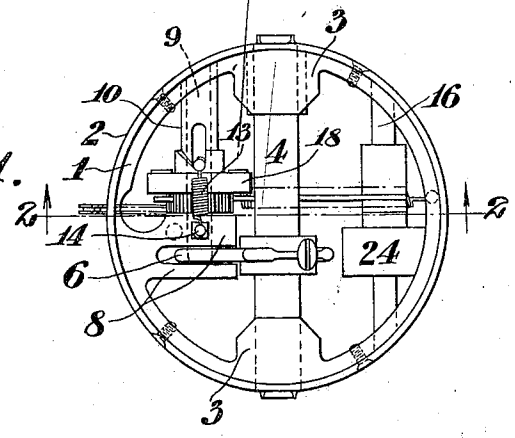


Fig. 1.

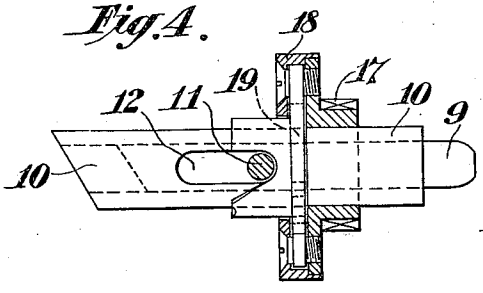


Fig. 4.

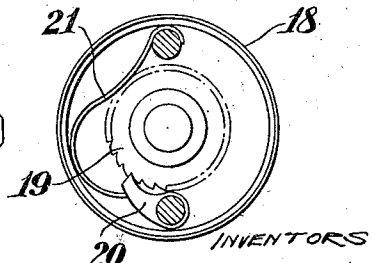


Fig. 5.

INVENTORS
C. G. HOARE
T. C. WATERS
By
Attys

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Fig. 6.

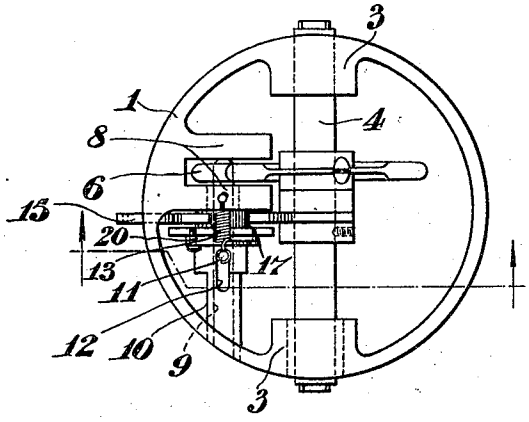


Fig. 7.

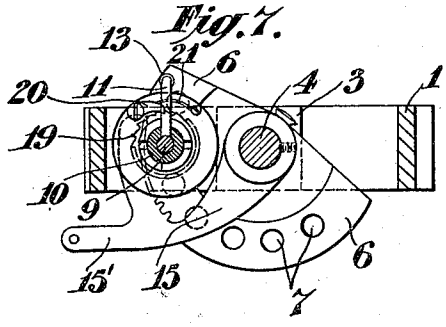
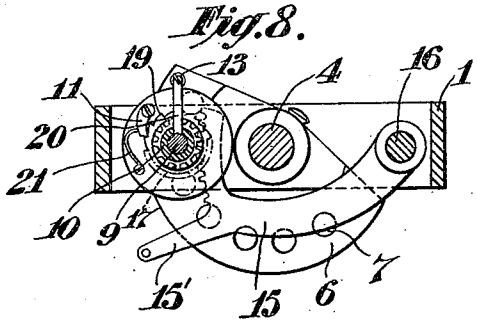


Fig. 8.



INVENTORS
C. G. HOARE
T. C. WATERS
By A. T. Cochran & Co. Atty.

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UNITED STATES PATENT OFFICE.

CYRIL GEORGE HOARE, OF CLAPHAM, LONDON, AND THOMAS CHARLES WATERS, OF CROFTON PARK, ENGLAND.

JOINT FOR ELBOWS AND KNEES OF ARTIFICIAL LIMBS.

Application filed February 27, 1924. Serial No. 695,552.

To all whom it may concern:

Be it known that we, CYRIL GEORGE HOARE and THOMAS CHARLES WATERS, both subjects of the King of Great Britain and Ireland, and residents, respectively, of Clapham, county of London, and Crofton Park, county of Kent, England, have invented certain new and useful Improvements in Joints for Elbows and Knees of Artificial Limbs, of which the following is a specification.

This invention relates to an improved joint for elbows and knees of artificial arms and legs, and is of the type in which the lower member of the arm or leg is movable by hand or by means operable from the shoulder or hip into various adjusted positions in a vertical plane from the fully flexed position to the fully extended position with the arm or leg straight, and is locked in any one of such positions and released therefrom. To effect these results it has previously been proposed to fit a concentric metal ring in the lower end of the bucket of the upper arm wherein is mounted in bearings a rotatable shaft, to the outer ends of which the forearm is connected by straps so that when the shaft is rotated the forearm is flexed or straightened, or vice versa, and to fit on the shaft a toothed wheel or a sector of a disc with holes or gaps near or in the edge, into any one of which a spring-pressed pin enters to lock the forearm and is withdrawn therefrom to release the forearm.

The present invention is an improved joint for elbows and knees of artificial arms and legs, comprising a concentric metal ring in the bucket of the lower end of the upper member of the arm or leg, having an inwardly projecting rib with a hole or gap near or in its inner edge, a rotatable shaft connected by straps to the lower member of the arm or leg and having a fixed disc or sector of a disc with a number of holes or gaps near or in its edge so mounted on the shaft that the disc or sector overlaps the rib and moves past the side thereof when the shaft is rotated and each hole or gap in the disc or sector successively registers with that in the rib, a bolt or blade adapted to engage in the registering holes or gaps, and means operable by a complete to and fro movement of the shoulder, hip or hands either to enter or to withdraw said bolt or blade into or from one or other of the holes or gaps in the disc or sector to lock the lower member of the arm or leg in any one of its various adjusted positions or to release it therefrom.

The disc or sector is keyed or otherwise fixedly mounted on the said shaft within the metal ring and is provided with a number of holes arranged concentrically near the edge of the disc, or with a number of gaps in the edge itself. Thus an arcuate slot near the edge of the disc may be divided into separate voids by radial bars, or the disc may have a serrated edge whereon teeth alternate with gaps. A spring-controlled bolt operable by pressure from the shoulder or by other means is arranged to enter its end into one or other of the said holes or gaps, or a blade pivoted at one end may enter its free end into one or other of the gaps in the edge, and so in either case lock the disc to the rib and therewith the lower member of the arm or leg.

In a preferred embodiment of this invention, a sliding bolt is enclosed in a tube or sleeve supported parallel to the rotating shaft between the side of the metal ring and a rib inwardly projecting from the inside of said ring. Preferably the rib is slotted vertically to form two walls between which the edge of the disc is admitted so that when the bolt slides in its sleeve responsive to the operating means, it passes through the disc and through one or both walls of the rib and locks the former securely in the slot, but the rib may have one wall only and the disc in its rotation be arranged to overlap and be locked to the rib by the bolt passing through both rib and disc. The edges of the holes or gaps are countersunk or sloped and the end of the bolt is conical to correct faulty alignment and ensure that the bolt enters said holes or gaps when required.

The means whereby the bolt is operated comprises toothed gearing riding freely on the rotatable shaft and on the bolt sleeve respectively and meshing together so that the bolt is released to be thrown into the locked position, holding the forearm or lower leg by a spring when the latter is released by the wearer and is withdrawn through the agency of a cam, pawl and ratchet wheel adjacent to the toothed wheel on the bolt sleeve.

A convenient arrangement of the toothed gearing consists of a toothed quadrant pivoted on the rotating shaft and meshing with a toothed wheel which rides freely on the bolt sleeve and is fixed to a concentric disc on which is a spring-pressed pawl engaging a ratchet wheel mounted on the bolt sleeve and having an elongated boss with its outer end cam-shaped to act on a pin fixed into the bolt through a slot in the bolt sleeve and so force back the bolt and allow the forearm or lower leg to swing. A spring on the pin serves to throw the bolt into the locked position when the ratchet wheel and cam have been rotated to bring a slot in the end of the boss opposite to the pin and allow the latter to enter the slot and travel with the bolt towards the disc.

The pivoted quadrant is fitted with an outwardly projecting lever which has attached to it a strap or chain leading up to the shoulder or hip wherewith to withdraw the bolt and also a spring to bring the lever back so that the bolt may be thrown into the locked position.

The pivoting of the quadrant on the rotatable shaft may conveniently be done by forming a hole in its centre and threading the shaft therethrough, a collar being placed on the shaft on each side of the quadrant to keep it in alignment with the toothed wheel riding on the bolt sleeve. The teeth on the arc of the quadrant which mesh with those on the aforesaid toothed wheel may be outwardly or inwardly projecting according to whether the meshing is to be on the near side or on the remote side of the toothed wheel.

A preferred embodiment of this invention and two modifications thereof are illustrated in the accompanying drawings, wherein:—

Figure 1 is a plan view of a joint suitable for either elbow or knee.

Figure 2 is a vertical section taken on the line 2—2 of Figure 1.

Figure 3 is a vertical section taken on the line 3—3 of Figure 2 at right angles to Figure 2.

Figure 4 is a plan view to an enlarged scale of the bolt and ratchet wheel.

Figure 5 is an end view of Figure 4.

Figures 6 and 7 are plan and sectional elevation, showing a modified form of quadrant.

Figure 8 is a sectional elevation showing another form of quadrant.

Referring first to Figures 1 to 5, the metal ring 1 is fitted into the end of the bucket 2, and has bearings 3 in which the shaft 4 is rotatable by means of the straps 5 when the forearm or lower leg to which the straps are fixed, is moved to any position between the fully flexed and the fully extended. The sector 6 is keyed to the shaft 4 with its edge, which is provided with a number of counter-sunk holes 7, between the walls of a rib 8 projecting inwardly from the ring 1. Each of the holes 7 can be aligned with the bolt 9, the end of which can be passed through one of the walls of the rib 8 and can enter one or other of the holes to lock the sector 6 and with it the limb in any one of its adjusted positions.

The bolt 9 slides in the sleeve 10 which is fixed at one end in the ring 1 and at the other end in the wall of the rib 8. The bolt has a pin 11 which projects through a slot 12 in the sleeve 10 and is connected by a spring 13 to a pin 14 fixed to the rib 8.

The bolt 9 is operated by a toothed quadrant 15 which is pivoted on a spindle 16 fixed to the ring 1 and which meshes with a toothed pinion 17 which is fixed to a hollow disc 18 containing a ratchet wheel 19, pawl 20 and spring 21. The ratchet wheel 19 has an elongated boss with two cam-shaped edges diametrically opposite to one another on its outer end and turns freely on the bolt sleeve 10 when driven through half a revolution by each upward stroke of the quadrant 15 through the medium of the pinion 17, disc 18 and pawl 20. The quadrant 15 makes its stroke through a chain 22 fixed on the shoulder or hip of the wearer according to whether an elbow or a knee joint is employed. A pull on the chain 22 either by hand or by a downward movement of the stump of the upper arm or thigh causes the quadrant to make an upward stroke and when the wearer slackens the chain 22, a spring 23 returns the quadrant to its original position, the pinion 17 turning freely without driving the ratchet wheel 19. At one of its upward strokes, the quadrant drives the cam edge of the ratchet wheel 19 against the bolt pin 11 to withdraw the bolt 9 from the locking position in one of the holes 7 in the sector 6, and at the next upward stroke it releases the pin 11 which together with the bolt 9 is pulled by spring 13 into the locking position.

When the bolt 9 is withdrawn from the sector 6, the lower limb can be swung or placed by the wearer into any desired position and then locked therein by a pull on the chain 22 as hereinbefore described.

A rubber stop 24 serves as a buffer to absorb shock when the lower limb is swung into its fully flexed or extended position. A hook 26 prevents the quadrant 15 from getting out of mesh with the pinion 17 when the quadrant is returned by the spring 23.

Figures 6 and 7 illustrate a modified form of quadrant 15 which is made to ride freely on the shaft 4 and has a projection 15^1 to which the chain 22 is to be attached.

Figure 8 shows another form of quadrant 15 with projection 15^1 for the chain 22, but meshing with the pinion 17 on the near side

thereof instead of on the remote side as shown clearly in Figures 2 and 7.

We claim:—

1. An improved joint for elbows and knees of artificial arms and legs, comprising a concentric metal ring in the bucket of the lower end of the upper member of the arm or leg, having an inwardly projecting rib with a hole or gap near or in its inner edge, a rotatable shaft connected by straps to the lower member of the arm or leg and having a fixed disc or sector of a disc with a number of holes or gaps near or in its edge so mounted on the shaft that the disc or sector overlaps the rib and moves past the side thereof when the shaft is rotated and each hole or gap in the disc or sector successively registers with that in the rib, a bolt or blade adapted to engage in the registering holes or gaps, and means operable by a complete to and fro movement of the shoulder, hip or hands either to enter or withdraw said bolt or blade into or from one or other of the holes or gaps in the disc or sector to lock the lower member of the arm or leg in any one of its various adjusted positions or to release it therefrom.

2. An improved joint for elbows and knees of artificial arms and legs according to claim 1, wherein the bolt is enclosed in a tube or sleeve supported parallel to the rotatable shaft between the side of the metal ring and the rib inwardly projecting from the inside of said ring and slides in said sleeve responsive to the operating means, passing through the disc and rib and locking the disc to the rib.

3. An improved joint for elbows and knees of artificial arms and legs according to claim 1, wherein the bolt is enclosed in a tube or sleeve supported parallel to the rotatable shaft between the side of the metal ring and the rib inwardly projecting from the inside of said ring and slides in said sleeve responsive to the operating means, passing through the disc and rib and locking the disc to the rib, the rib being slotted vertically to form two walls between which the edge of the disc is admitted, the bolt passing through the disc and through one wall of the rib for locking the disc in the slot of the rib.

4. An improved joint for elbows and knees of artificial arms and legs according to claim 1, wherein the means whereby the bolt is operated comprises toothed gearing riding freely on the rotatable shaft and on the bolt sleeve respectively and meshing together so that the bolt is released to be thrown into the locked position by a spring and withdrawn by a cam, pawl and ratchet wheel adjacent to the toothed wheel on the bolt sleeve.

5. An improved joint for elbows and knees of artificial arms and legs according to claim 1, wherein the means whereby the bolt is operated comprises toothed gearing riding freely on the rotatable shaft and on the bolt sleeve respectively and meshing together so that the bolt is released to be thrown into the locked position by a spring and withdrawn by a cam, pawl and ratchet wheel adjacent to the toothed wheel on the bolt sleeve, said toothed gearing comprising a toothed wheel actuated by a strap from the shoulder or hip of a person and riding freely on the rotatable shaft, a toothed pinion fixed to a hollow disc containing a ratchet wheel with a spring pressed pawl and an elongated boss with two cam shaped edges diametrically opposite to one another on its outer end, turning freely on the bolt sleeve when driven by a stroke of the toothed wheel, said cam edges acting on a pin fixed to the bolt through a slot in the bolt sleeve to release or withdraw it therefrom.

In testimony whereof we have affixed our signatures hereto this 14th day of February, 1924.

CYRIL GEORGE HOARE.
THOMAS CHARLES WATERS.