The present invention relates to an adjustable joint, especially for reclining chairs, beds, folding cots, or the like, which comprises two arms which are pivotable relative to each other and one of which is provided with a locking part with a certain locking range, while the other arm carries a locking member which in the operative position acts upon the locking part so as to lock the two arms together and which is also movable to an inactive position in which it is disengaged from the locking part.

Joints of the above-mentioned kind are preferably applied for adjustable back or head rests, foot rests, or the like of reclining or folding chairs, folding beds or cots, especially of the kind as used for camping purposes, although they may also be used for adjustable flaps, covers, windows, ladders, and many other purposes.

Such joints must permit, for example, the head or back rest of a camping cot to be adjusted to different angles between a substantially horizontal and a vertical end position. They must be of a simple construction and must especially be adjustable to any desired angle without requiring any separate levers or the like to be operated. While especially in camping cots and the like, such joints must also be capable of withstanding very great forces and loads, they must still be of a small size and simple design and be absolutely reliable in operation even under unfavorable conditions. Finally, even when the cot or chair is folded together, these joints should not have any protruding or unsightly parts which detract from the appearance of the entire article.

For carrying the foldable head part of reclining furniture in different inclined positions, a device is known in which one of the two levers which are pivotable relative to each other is provided with a locking part in the form of a toothed segment which is disposed concentrically to the pivot axis of the lever and is operatively associated with another locking member in the form of a pawl. The part of the lever which carries the toothed segment is provided with a deflector which in one end position of the joint presses the pawl aside when the lever is pivoted back from its widest spread position to its closed position. This permits the spring-loaded pawl after being moved to its inactive position to slide laterally along the teeth of the toothed segment without engaging into the same. At the other end of the toothed segment, a further control device is provided for shifting the pawl from its inactive position back to its active position, that is, back toward the ratchet teeth. This device has the very undesirable disadvantage that the pawl is subjected not only to the stresses which are due directly to its operation, but also to bending and torsional stresses. Furthermore, this kind of movement of the pawl exerts a load upon its bearing whereby the joint will be worn out prematurely. Finally, a strong friction occurs when the pawl is shifted laterally off the toothed segment, which also results in an excessive wear upon the joint and reduces the length of its working service.

There is another known kind of adjustable joint, especially for furniture, in which the locking part consists of a sector-shaped member which is provided on its inner side with teeth and is secured at one end to one arm of the joint. This toothed member cooperates with a pawl which is pivotably mounted on the other arm and may be held by a spring in either of two positions, in one of which it is in engagement with the teeth of the toothed member, while in the other it is held at a certain distance from these teeth. Both ends of the locking range of the toothed member are provided with shifting means in the form of cams or higher teeth which in one end position of the joint lift the pawl out of engagement with the teeth and thus to the inactive position in which the pawl is then held by the spring, while in the other end position of the joint, they move the pawl from the inactive position back into the operative position and into engagement with the teeth. Due to the large arcuate locking part, this joint is very bulky and of a rather unsightly appearance. In order to take up the great stresses which usually occur in camping furniture, such a joint would have to be built of such hub dimensions that its installation in such a piece of furniture would be prohibitive as it would render the latter too unwieldy for camping purposes. Aside from this, in the collapsed position, for example, of a camping cot, the toothed locking part would also protrude to such an extent that it would not only be very unsightly, but might become the cause of injuries. Furthermore, the proper functioning of this joint depends upon a leaf spring of a very particular shape which has to be very accurately adjusted and does not remain in proper working order as well as safe in operation for a very long time.

Both of the aforementioned joints have in common that the locking pawl can be shifted from the inactive to the active position only at the end of the locking range of the associated locking part. In actual practice, this means that the head portion, for example, of a camping cot must first be moved to the horizontal position in which it must be pressed down with great force before the shifting means for the locking pawl will become operative, whereupon it may be pivoted in the direction opposite to the locking direction in order to adjust it to the desired angular position.

It is an object of the present invention to provide a joint which overcomes the above-mentioned disadvantages and is equipped with so-called "in-between" shifting means which permit the locking member to be shifted at any angular position from its inactive to its active position without requiring, for example, the head or back rest first to be moved to its horizontal end position.

According to the invention, the locking member is actuated upon by a control lever which, when the arm carrying the associated locking part is pivoted in either direction will also be pivoted about a certain angle and will then cooperate with the locking member in such a manner that the latter, after being shifted at one end position of the arms to the inactive position, will be maintained by the control lever in the inactive position when the arm carrying the locking part is pivoted in the locking direction, while when this arm is pivoted in the other direction, the locking member will be shifted to the active position.

A preferred feature of the invention consists in frictionally connecting the control lever with the arm carrying the locking part and it is for this purpose advisable.
to provide this locking part with a pair of side walls between which the control lever is pivotably mounted on the pivot pin connecting the two arms and in such a fashion as to allow the relative movement of these side walls that, when the arm carrying the locking part is pivoted it also tends to pivot the control lever. The friction between the control lever and these side walls of the locking part may be increased by slightly bending the eye portion of the control lever so as to give it a certain spring action. The joint according to the different embodiments of the invention is of a very simple and compact design, and especially it requires no spring which is liable to break or to lose its tension. The joint is therefore absolutely safe in operation and it also has the advantage that in no position of the respective piece of furniture, will there be any protruding parts of the joint.

A further important advantage of this joint is the fact mentioned at the beginning that it permits the so-called "in-between" shifting which facilitates the operation of the joint, especially in camping cots and the like, and increases its length of working service. In the use of the known joints, however, in which the locking member could be shifted only, for example, in the horizontal end position of the back rest and only by the exertion of a considerable force, it has been found that the back rest which usually consists of a thin U-shaped tube will become slightly distorted or bent so that often the locking member of only one joint was shifted, while the locking member of the other joint remained in its inactive position. Therefore, when the back rest was adjusted to the desired angle, it was held in this position only by one joint with the result that this joint was overloaded and possibly even destroyed, for example, by breaking of the teeth.

Apart from this, the respective part, for example, the back rest, often became permanently distorted and was only held at one end when under a load since one joint remained unlocked. This disadvantage is completely prevented by the joints according to the invention since under the most unfavorable conditions the two joints, for example, of the back rest, will surely lock by being offset relative to each other by one tooth spacing, which is of no practical importance since the back rest is also in this case firmly supported by both joints. If the new joints are, however, applied in the form of the infinitely variable type, there is definite assurance that the two joints of a cot or chair part will always be equally clamped so that a support of such a part only at one side thereof will never occur.

The objects, features, and advantages of the present invention will become more clearly apparent from the following detailed description thereof which is to be read with reference to the accompanying drawings, in which—

FIGURE 1 shows a sectional side view of a joint according to the invention with a toothed locking member or pawl, said section being taken within the plane of the control lever;

FIGURE 2 shows a cross section taken along lines A-B of FIGURE 1;

FIGURE 3 shows a view similar to FIGURE 1, but with the same joint in a different operating position;

FIGURE 4 shows a view similar to FIGURE 1 of a modification of the joint in which the locking member is shifted to the inactive position by the control lever;

FIGURE 5 shows a view similar to FIGURE 1 of a joint according to a modification of the invention, the locking member is shown in the inactive position;

FIGURE 6 shows the joint according to FIGURE 5 with the locking member in the active position;

FIGURE 7 shows a view similar to FIGURE 1, but of an infinitely variable joint according to another modification of the invention;

FIGURE 8 shows a view similar to FIGURE 1, but of a further modification of the infinitely variable joint;

FIGURE 9 shows a cross section taken along line C-D of FIGURE 8; while

FIGURE 10 shows a cross section similar to FIGURE 9, but of a modification of the joint as shown in FIGURE 9.

Referring to the drawings, and first particularly to FIGURES 1 to 3, the joint according to the invention consists of a fixed arm which may be connected, for example, to the central part of a camping cot, reclining chair or the like, and carries a locking member in the form of a pawl which is pivotally mounted on a rivet by means of a bushing. The fixed arm is pivotally connected by a rivet to an arm which may serve, for example, for supporting the head portion or back rest of the cot or chair. The adjustable arm is provided with a locking part in the form of a toothed segment which is concentric to the rivet and has a plurality of ratchet teeth within the locking range.

Rivet 3 which forms the pivot of pawl 2 also pivotally supports another arm 8 which forms the leg portion of the cot or chair. In its operative position, this leg 8 is locked in a manner known as such to a locking part 9 which is rigidly connected to the leg 8. As illustrated in FIGURE 2, the locking part 7 which is associated with the locking pawl 2 has two lateral walls 7a and 7b between which a control lever 10 is clamped so firmly but resiliently that, when arm 6 carrying the locking part 7 is pivoted about the rivet 3, it will tend to take along the control lever 10 because of the frictional engagement between the latter and the two lateral walls 7a and 7b.

Pawl 2 is provided with a locking tooth 13 which has a locking surface 14, and with a projection 15 which is operatively associated with a detent 16 on the control lever 10 and serves as a holding device as will be later described in detail.

The length of the bushing 4 of pawl 2 is slightly greater than the thickness of the pawl so that the latter will be easily movable even after the entire joint is riveted together.

Control lever 10 is likewise mounted on a washer-like bushing 17 which has such a thickness that the friction between the control lever 10 and the lateral arms 7a and 7b of the locking part 7 will occur practically independently of the tension which is produced by the rivet 8. In order to increase this friction and to compensate for any possible wear, the eye portion of the control lever 10 may be slightly bent so as to make it resilient.

The entire joint is substantially enclosed by the shell-shaped end portions 1a and 1b of the fixed arm 1, and its different parts are secured together by the rivets 3 and 5.

When the joint is being used, for example, on a camping cot, the leg 8 is at first moved to its operative position as illustrated in FIGURE 1 and the adjustable arm 6 is then pivoted from the horizontal position, that is, from the collapsed position of the cot, in the direction of the arrow 11 which is hereafter called the locking direction, until the head or back rest 6 has moved to the desired angle. This pivoting movement may be carried out freely since by the engagement of the detent projection 15 on pawl 2 with the detent portion 16 on the control lever 10, pawl 2 will then be arrested in its inactive position, in which it is withdrawn from the path of movement of the ratchet teeth on the locking part 7. Since the control lever 10 is in frictional engagement with the adjustable arm 6, the pivoting movement of the latter exerts a force in the same direction upon the control lever 10, whereby the detent portion 16 of the latter is pressed against the detent projection 15 and pawl 2 is thus securely held in its inoperative position.

After the back rest has been adjusted to the desired angle, it is pivoted slightly in the direction opposite to the locking direction with the result that arm 6 takes along the control lever 10 and the hook-shaped part 11
acts upon the projection 12 of pawl 2 and turns the control lever 10 through the locking and the inactive position whereby the detent projection or point 15 is disengaged from the detent portion or abutment 16, and pawl 2 is no longer held in an inactive position.

Then the back rest and thus also the adjustable arm 6 are now again pivoted in the locking direction II, the control lever 10 is turned likewise so that its detent portion 16 will then engage with the back of the detent projection 15, as illustrated in FIGURE 3, whereby the pawl 2 is turned in the clockwise direction and into engagement with the teeth of the locking part 7 on the arm 6. The joint is then safely locked in the adjusted position on the back rest.

If the back rest is thereafter to be adjusted to a steeper angle, it only needs to be pivoted upwardly for the desired distance from the position according to FIGURE 3. The hook-shaped part 11 of the control lever 10 then passes again upon the projection 12 of pawl 2, and since the latter is then no longer held by the detent portion 16, it is urged in the direction toward the locking part 7 and into engagement with one of the teeth thereof. The locking surface 14 of tooth 13 of pawl 2 then shifts from one tooth space of ratchet member 7 into the other until the back rest has been adjusted to the desired angle. Since the control lever 10 is frictionally connected to the adjustable arm 6, a considerable force is exerted during this pivoting movement upon the projection 12 of pawl 2, whereby the latter is forced against the teeth of ratchet member 7 so that for adjusting the back rest in the direction opposite to the locking direction, a certain resistance has to be overcome. This feature is very desirable especially in camping cots and the like which are provided with a very elastic covering since, if a person sits down carelessly upon the central part of the cot, the back rest may under the action of the tightened elastic covering slip suddenly upwardly in the direction opposite to the locking direction II and may thus cause considerable annoyance or even an injury to such a person.

If the back rest of the camping cot or reclining chair is to be readjusted to a lower angle, pawl 2 must first be moved to its inactive position. For this purpose, the back rest, so that is, the adjustable arm 6, is pivoted in the direction opposite to the locking direction II to a substantially vertical position until the locking surface 14 of tooth 13 of the pawl runs up upon a higher cam portion 19, as shown in FIGURE 1, which is provided at the front end of the locking range I of the locking part 7 on arm 6. When this cam portion 19 will pivot the pawl 2 out of its active position, as shown in FIGURE 3, until the detent 16 of the control lever 10 engages with the detent projection 15 on pawl 2 and the latter is thus arrested in the inactive position.

The adjustable arm 6 may then again be moved in the locking direction II to any newly desired angular position in which it may then be locked in the manner as described.

Instead of moving the pawl 2 from the active to the inactive position by means of the cam portion 19, as shown in FIGURES 1 and 3, it is also possible to do this by means of the control lever 10. For this purpose, in place of the cam portion 19 on arm 6, pawl 2 may be provided with a projection 20, as shown in FIGURE 4 which is merely intended to illustrate the principle of this modification, and in which therefore those parts which are shown in FIGURES 1 to 3 but are not necessary to explain this modification and its function are omitted for the sake of clarity.

While the desired angular position of the back rest is adjusted in the manner as previously described, the movement of pawl 2 from the active to the inactive position proceeds according to FIGURE 4 as follows:

When the adjustable arm 6 is pivoted from one angular position in which it was previously arrested in the direction opposite to the locking direction II to a point beyond the substantially vertical position, then pawl 2 will slide beyond the teeth of the locking part 7. Control lever 10 which is in frictional engagement with the adjustable arm 6 then presses with its hook-shaped part 11 upon the projection 12 of pawl 2 which is thereby pivoted in the direction toward the ratchet member 7. As soon as pawl 2 arrives at the front end of the locking range II, as soon in the locking direction II, it slides at 21 upon the peripheral surface of the locking part 7 and is thereby turned for a certain distance in the counterclockwise direction. If the adjustable arm 6 is then again pivoted in the opposite direction, that is, in the locking direction II, control lever 10 is again taken along by arm 6 because of its frictional engagement with the latter so that the hook-shaped end 11 of the control lever will press upon the projection 20 of pawl 2 before the detent portion 16 can engage with the back of the projection 15. Since the projection 20 lies at the right of the center of the rivet 3 in FIGURE 4, pawl 2 will then be acted upon by a force which tends to pivot the pawl in the counterclockwise direction. Pawl 2 will thereby be pivoted until its detent projection 15 engages with the detent portion 16 of control lever 10 so that the pawl is then locked in the inactive position.

If the adjustment of the joint according to the invention is to be infinitely variable, the ratchet teeth on the locking part 7 as previously described are to be omitted and, as shown in FIGURES 5 and 6, in place of these teeth the locking area 1 of this member 7 is provided with a substantially cylindrical surface, while tooth 13 of pawl 2 according to FIGURES 1 to 4 is replaced by an eccentric surface 210 which is adapted to act upon this cylindrical surface of the locking part 7. For locking the adjustable arm 6 in a particular angular position in which it is to be used, the eccentric surface 210 and the cylindrical surface of the locking part 7 are clamped together in the manner as shown in FIGURE 6. The eccentric surface 210 is designed and located with respect to the pivot axes of pawl 2 and locking part 7 so that, when these parts are clamped together, a toggle joint effect will be produced between them whereby a very great force will be generated and a very secure clamping action attained. If desired, this clamping action may be further increased by providing the locking range I of the part 7 or the eccentric surface 210 or both with a knurling or the like.

The manner in which pawl 2 may be moved to the inactive position and the manner in which the back rest may be locked in the desired position are the same as already described with reference to FIGURE 4.

In order to limit the extent of the pivoting movement of the adjustable arm 6 relative to the fixed arm 1, the locking part 7 is provided with an end stop 22 which will engage with the eccentric surface 210 of pawl 2 when arm 6 is pivoted, for example, to an angle at which it extends parallel to the fixed arm 1.

In the event that, under the load to which the joint is subjected when the camping cot or the like is in use, the pressure occurring upon the eccentric surface 210 or upon the rivets 3 to 5 might become excessive, the locking part 7 may be designed in the form of a clamping ring 7a, as illustrated in FIGURE 7, which frictionally engages a journal disk 23 which is rigidly secured to the fixed arm 1 of the joint by rivets 24.

When the adjustable arm 6 is locked in a certain position and is then subjected to a load, the eccentric surface 210 of pawl 2 will exert upon the clamping ring 7a a considerable force which will tighten the clamping ring in the direction toward its slot 25 and will thereby clamp the clamping ring 7a securely to the journal disk 23.

According to a further modification of the infinitely variable joint as illustrated in FIGURES 8 and 9, the locking part 7 on arm 6 may consist of two conical surfaces 27 which are bent outwardly at a certain angle to
each other, while the tooth-shaped parts 28 of pawl 2 are bent to a corresponding wedge shape and are adapted to engage between the conical surfaces 27 and to be firmly wedged thereon. If position of the conical surfaces 27 and 28 may also be reversed so that, as illustrated in FIGURE 10, pawl 2 will have a pair of outwardly tapered walls 29 which may fit over two inwardly inclined wedge surfaces 27a. Since the manner of operation of these last two embodiments of the invention according to FIGURES 8 and 10 is exactly the same as that of the joints according to FIGURES 5 to 7, they require no further explanation.

Although my invention has been illustrated and described with reference to the preferred embodiments thereof, I wish to have it understood that it is in no way limited to the details of such embodiments, but is capable of numerous modifications within the scope of the appended claims.

Having thus fully disclosed my invention, what I claim is:

1. An adjustable joint, especially for reclining chairs, folding cots, and the like, having two arms pivotally con-
        nected to each other, the first of said arms having a lock-
        ing part with a certain locking range thereon, a locking
        member pivotally connected to the second arm and adapted to be moved to an active position in locking en-
        gagement with said locking part and to an inactive position
        in which it is substantially disengaged from said locking
        part, a control lever pivotally mounted on said first
        arm, continuously engaged friction means operatively con-
        necting said lever to said first arm to exert a force on said
        lever tending to take along said lever with said first arm
        when said first arm is pivotted relative to said second arm,
        one of said first arm and locking member having means
        thereon for moving said locking member to said inactive
        position when said first arm is pivotted to one end position
        relative to the second arm, means on said control lever
        and locking member for maintaining said locking member
        in said inactive position when said first arm is pivotted in the
        locking direction, and means on said control lever and
        locking member for moving said locking member to the
        active position when said first arm is pivotted in the direc-
        tion opposite to said locking direction.

2. An adjustable joint as defined in claim 1, in which said
        locking part on said first arm has a plurality of ratch-
        et teeth within said locking range thereof, and in which
        said locking member forms a pawl having at least one
        locking tooth adapted to engage with said ratchet teeth.

3. An adjustable joint as defined in claim 1, in which said
        locking part on said first arm has a substantially cy-
        lindrical surface within said locking range thereof, and
        in which said locking member forms an eccentric adapted
to engage with and to press upon said cylindrical surface
to lock the two arms in the adjusted position to each other.

4. An adjustable joint as defined in claim 1, further
        comprising means for pivotably connecting said two arms
to each other comprising a journal rigidly secured to said
        second arm, said locking part on said first arm forming a
        clamping ring substantially enclosing and normally
        pivotable about said journal and having within said lock-
        ing range a substantially cylindrical surface, said locking
        member forming an eccentric adapted to engage with and
to press upon said cylindrical surface and thereby to
tighten said clamping ring on said journal to lock said
two arms in the adjusted position to each other.

5. An adjustable joint as defined in claim 1, in which said
        locking part on said first arm and said locking member
        form two elements, one of said elements having two
        outwardly tapered walls extending at a certain angle to
each other, and the other element having a part of a
corresponding conical shape adapted to enter between and
to be wedged against said tapered walls of said first
        element to lock said two arms in the adjusted position
to each other.

6. An adjustable joint, especially for reclining chairs,
        folding cots, and the like, having two arms, pivot means
        for pivotably securing said arms to each other, the first
        of said arms having a locking part with a certain locking
        range thereon, a locking member pivotally connected to
        the second arm and adapted to be moved to an active
        position in locking engagement with said locking part, a
        bushing on said pivot means, a control lever pivotally
        mounted on said bushing, continuously engaged friction
        means operatively connecting said lever to said first arm
to exert a force on said lever tending to take along said
        lever with said first arm when said first arm is pivotted
        relative to said second arm, said bushing having a length
        substantially determining the strength of the friction pro-
        vided by said friction means substantially independently
        of the tension at which said pivot means are pivotted to said
        arms to each other, means on said first arm for moving
        said locking member to said inactive position when said
        first arm is pivotted to one end position relative to said
        second arm, means on said control lever and locking
        member for maintaining said locking member in said
        inactive position when said first arm is pivotted in the
        locking direction, and means on said control lever and
        locking member for moving said locking member to the
        active position when said first arm is pivotted in the direc-
        tion opposite to said locking direction.

7. An adjustable joint, especially for reclining chairs,
        folding cots, and the like, having two arms pivotally con-
        nected to each other, the first of said arms having a lock-
        ing part with a certain locking range thereon, a locking
        member pivotally connected to the second arm and adapted
to be moved to an active position in locking en-
        gagement with said locking part and to an inactive position
        in which it is substantially disengaged from said locking
        part, means secured to said locking part at the front end
        of said locking range thereof, as seen in the locking direc-
        tion, for shifting said locking member to said inactive
        position when said first arm is pivotted to one end position
        relative to the second arm, a control lever pivotally
        mounted on said first arm, continuously engaged friction
        means operatively connecting said lever to said first arm
to exert a force on said lever tending to take along said
        lever with said first arm when said first arm is pivotted
        relative to said second arm, means on said control lever
        and locking member for maintaining said locking member
        in said inactive position when said first arm is pivotted in the
        locking direction, and means on said control lever and
        locking member for moving said locking member to the
        active position when said first arm is pivotted in the direc-
        tion opposite to said locking direction.

8. An adjustable joint, especially for reclining chairs,
        folding cots, and the like, having two arms pivotally con-
        nected to each other, the first of said arms having a lock-
        ing part with a certain locking range thereon, a locking
        member pivotally connected to the second arm and adapted
to be moved to an active position in locking en-
        gagement with said locking part and to an inactive position
        in which it is substantially disengaged from said locking
        part, a control lever pivotally mounted on said first arm,
        continuously engaged friction means operatively connect-
        ing said lever to said first arm to exert a force on said
        lever tending to take along said lever with said first arm
        when said first arm is pivotted relative to said second arm,
        means on said lever for moving said locking member to
        the inactive position when said first arm is pivotted in the
        locking direction, and means on said control lever and
        locking member for moving said locking member to the
        active position when said first arm is pivotted in the direc-
        tion opposite to said locking direction.

9. An adjustable joint, especially for reclining chairs,
        folding cots, and the like, having two arms, pivot means
        for pivotably securing said arms to each other, the first
of said arms having a locking part with a certain locking range thereon, said locking part having two parallel walls spaced from each other, a locking member pivotally connected to the second arm and adapted to be moved to an active position in locking engagement with said locking part and to an inactive position in which it is substantially disengaged from said locking part, a control lever pivotally mounted on said first arm and having a hook-shaped part extending partly around said locking member, continuously engaged friction means operatively connecting said control lever to said locking member to move the same in the direction toward its inactive position. (References on following page)

10. An adjustable joint, especially for reclining chairs, folding cots, and the like, having two arms pivotally connected to each other, the first of said arms having a locking part with a certain locking range thereon, a locking member pivotally connected to the second arm and adapted to be moved to an active position in locking engagement with said locking part and to an inactive position in which it is substantially disengaged from said locking part, a control lever pivotally mounted on said first arm and having a hook-shaped part extending partly around said locking member, continuously engaged friction means operatively connecting said control lever to所述 locking member to exert a force on said lever tending to take along said lever with said first arm when said first arm is pivoted relative to said second arm, a control lever pivotally mounted on said second arm and having a hook-shaped part extending partly around said locking member, continuously engaged friction means operatively connecting said control lever to said locking member to move the same in the direction toward its inactive position. (References on following page)
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