Jan. 16, 1945. S. E. BUTLER 2,367,196

LOCKING DEVICE FOR TELESCOPING MEMBERS

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Fig. 1.

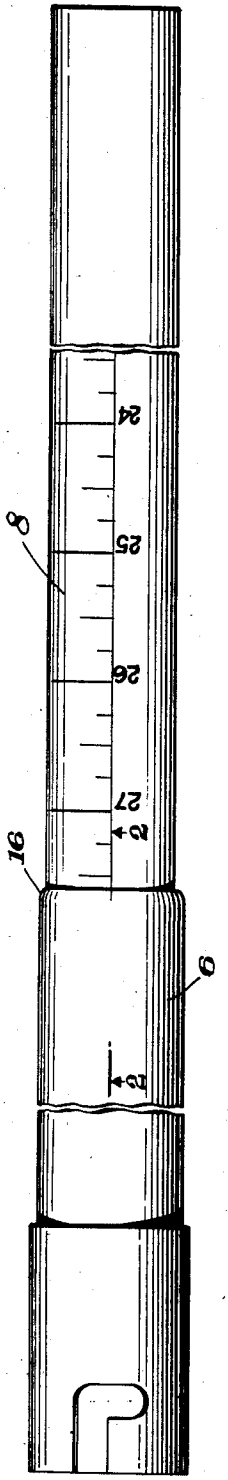

Fig. 2.

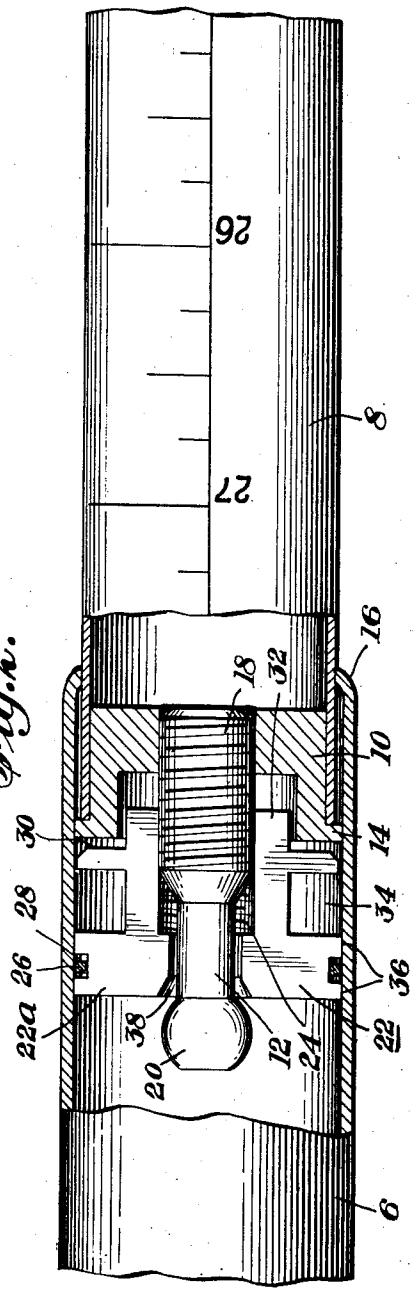

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Fig. 3.

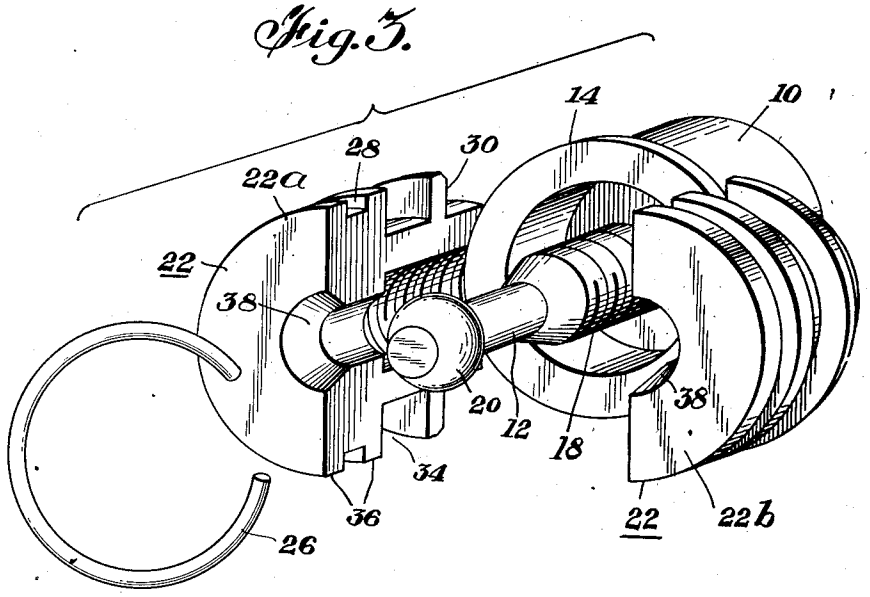
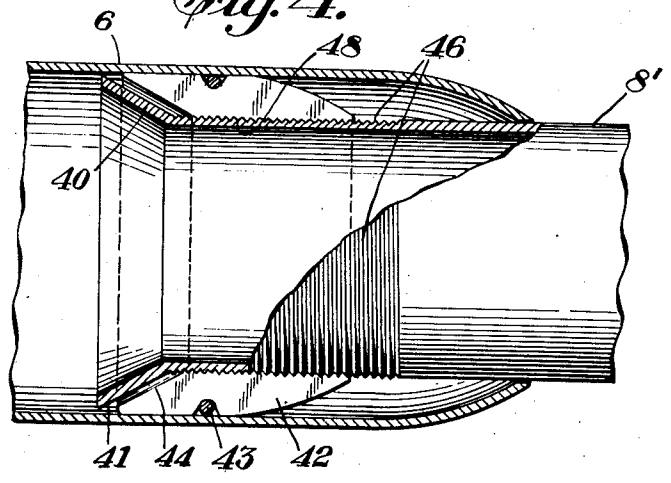


Fig. 4.



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LOCKING DEVICE FOR TELESCOPING MEMBERS

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11 Claims. (Cl. 287—58)

The present invention relates to locking means for telescoping members.

In numerous arrangements in which telescoping members are utilized, such for example as antennas or adjustable supports such as tripods and the like, it is desirable, after a certain relative position or setting of the members has been reached, to lock the members so that further telescopic movement may be prevented.

The devices now used for accomplishing this result are often complex, bulky, or else fail to give a positive locking action at all times. Furthermore, those employing parts located on the outer surface of one or both telescopic members are unsuited for certain uses such as in antenna structures where radiation would be seriously interfered with.

One object of the present invention, therefore, is to provide a locking device for telescopic members which is simple in design, positive in action, and relatively inexpensive to manufacture.

A further object of the invention is to provide a locking device for telescopic members which is entirely self-contained, that is, all the parts of the device being located within one of the telescopic members.

A still further object of the invention is to provide a locking mechanism for telescopic members which may be operated to locking position by a small angular rotation of either member relative to the other, and which may be returned to unlocked position by a reverse rotation of the same magnitude.

An additional object of the invention is to provide an expansible sleeve carried by one of two telescoping members and to provide camming means for expanding this sleeve upon a selective relative rotation of the members.

Other objects and advantages will be apparent from the following description of preferred forms of the invention and from the drawings, in which:

Fig. 1 is a plan view of an adjustable antenna rod incorporating a preferred form of locking device in accordance with the present invention;

Fig. 2 is an enlarged sectional view along 2—2 of Fig. 1;

Fig. 3 is an exploded perspective view of a portion of Fig. 2;

Fig. 4 is a sectional view of a modified form of the invention illustrated in Figs. 1 through 3.

In the embodiment of the invention illustrated in Figs. 1 through 3 is shown a pair of tubular members 6, 8 arranged in telescoping relation, the latter member being normally partially enclosed within the former. The tubular member 6 is necessarily of hollow design to permit reception of member 8. Member 8 may or may not be hollow as will later become apparent. These members 6, 8 may comprise, for example, portions of an adjustable antenna rod, as illustrated, part of an adjustable tripod mechanism, or they may be utilized wherever a tubular structure of adjustable length is desired. A collar 10 is pressed or otherwise secured within the enclosed end of member 8, and is provided with a flanged portion 14 of extended diameter as shown in Fig. 2, this flanged portion facilitating setting of the collar within member 8 and also providing a suitable stop action against the spun over end 16 of member 6 so as to prevent separation of the two tubular members.

Collar 10 is designed to threadably receive a spindle 12 having a threaded surface portion 18. This threaded surface portion 18 of spindle 12 projects beyond the end of tubular member 8 and on the far end of this spindle is formed a ball-shaped head or knob 20. The spindle is held against rotation within the collar by some suitable method such as soldering. When assembled, the tubular member 8, the collar 10, and the spindle 12 constitute a unit in which there is no relative movement of the parts.

A sleeve or nut 22 having an end portion 32 is provided with an internally threaded bore 24 engaging the outer threaded surface 18 of spindle 12, and this sleeve is split diametrically as best shown in Fig. 3 into two segments 22a and 22b. Sleeve 22 is proportioned so that the outer cylindrical surface thereof engages the inner surface of tubular member 6 as indicated at 36. This engagement is in the form of a normally slidable frictional relationship of these surfaces with respect to a relative axial movement of the two tubular members 6 and 8, and in the form of a normally non-slidable frictional relationship of the surfaces with respect to a relative rotary movement of the tubular members. In other words contact surfaces 36 normally permit the sleeve 22 to be slid longitudinally within member 6, but will not normally permit sleeve 22 to be rotated with respect to member 6. Therefore, any relative rotation of members 6 and 8 will produce a corresponding relative rotation of sleeve 22 and spindle 12, and since these members are in threadable engagement the sleeve will travel along the spindle.

With the sleeve 22 in its normal longitudinally spaced apart position from head 20, a rotation of either tubular member 6 or 8 relative to the other

will change the spacing between the sleeve and head, inasmuch as sleeve 22 rotates with member 6 due to the frictional contact therewith of surface portions 36, and spindle 12 is secured to and rotates with member 8. The direction of rotation of members 6, 8 may be chosen so that the sleeve will travel toward, and finally engage, head 20 of the spindle.

The bore of sleeve 22 has a beveled edge 38. Engagement between the ball-shaped head 20 of spindle 12 and this beveled edge 38 will result in a camming action of the head against the sleeve, and the segments 22a and 22b will be spread apart or expanded radially outward against the inner surface of tubular member 6. The outward expansion of segments 22a and 22b will terminate the normally slidable frictional relationship of surfaces 36 of the sleeve axially of tubular member 6, and the sleeve, together with the other tubular member 8, will be locked in place against any longitudinal movement relative to member 6 until such time as a reverse relative rotation of the members releases sleeve 22 from its engagement with head 20 and unlocks the mechanism.

It will be noted that only a very small relative angular rotation of the members 6, 8 is required to either lock or unlock the mechanism, although the amount of rotation obviously depends on the camming angle between head 20 and beveled edge 38 of sleeve 22, and also on the number of threads per inch of spindle 18.

To prevent the end portion 32 of sleeve 22 from becoming wedged or jammed within collar 10, a shoulder 30 on sleeve 22 is provided so as to contact shoulder 14 on collar 10 prior to such time as engagement between the collar and portion 32 would otherwise be made. Due to the flat surface contact of shoulders 30 and 14, no jamming between sleeve 22 and collar 10 can occur.

Inasmuch as a removal of inner member 8 from outer member 6 for inspection of the locking mechanism or other reason may result in the segments 22a and 22b becoming disassociated from the other elements of the device, a retaining ring 26 positioned in an annular slot 28 of split sleeve 22 is provided to hold the segments together.

An annular recess 34 may be cut into sleeve 22 primarily to reduce the weight of the sleeve. However if desired the sleeve may be formed to omit this cut-out portion 34.

In Fig. 4 is shown a modification of the locking device of Figs. 1 through 3. In this modification the enclosed end of inner member 8' is flared outwardly as shown at 40, thereby forming a frustro-conical surface portion 41. A split sleeve 42 having an internally threaded bore 48 is held together by a retaining ring 43 having an action similar to the retaining ring 26 in the device shown in Figs. 1 through 3. Split sleeve 42 also has a frustro-conical surface portion 44 designed for engagement with the surface portion 41 of flared end 40. A section of the outer surface of tubular member 8' is threaded as shown at 46 to engage the threaded bore 48 of sleeve 42.

The principle of operation of the device of Fig. 4 is similar in several respects to that of the mechanism of Figs. 1 through 3. The surface portion 44 of split sleeve 42 is normally spaced apart longitudinally from surface portion 41 of tubular member 8'. The outer cylindrical surface of sleeve 42 engages the inner surface of member 6, being in normally slidable frictional contact with respect to a relative axial movement of members 6 and 8', and in normally non-slidable frictional contact with respect to a relative rotary movement of the tubular members. Upon a selective relative rotation of members 6 and 8', surface portions 41, 44 will be brought into engagement, and the split sleeve 42 will be spread radially outward or expanded against the inner surface of tube 8' to terminate the normally slidable frictional engagement of the sleeve axially of tubular member 6 to thereby lock the members 6 and 8' in position against relative longitudinal movement.

It should be noted that in the modification of Fig. 4 it is possible to construct the member 8' as a hollow tube having an unobstructed junction with tube 6. This permits the telescoping members to be utilized in situations where a closed or blocked passageway through the members could not be employed.

While I have described above the principles of my invention in connection with a specific mechanism, and particular modifications thereof, it is to be clearly understood that this description is made only by way of example and not as a limitation on the scope of my invention as set forth in the objects of my invention and the accompanying claims.

I claim:

1. The combination of two tubular members in telescoping relation, said members being capable of relative rotary movement, camming means rigidly secured to the inner of said members, radially expansible means carried by said inner member in normally longitudinally spaced apart relation from said camming means, and means responsive to a selective relative rotary movement of said members for bringing said camming means into contact with said expansible means, whereby the latter will be expanded radially by said camming means against the outer of said members.

2. The combination of claim 1 wherein said expansible means is formed with a threaded bore, and wherein said means for bringing said camming means into contact with said expansible means includes a threaded spindle engaging said threaded bore.

3. The combination of two tubular members in telescoping relation, said members being capable of relative rotary movement, camming means rigidly secured to a first of said members, radially expansible means rotatably carried by said first member in normally longitudinally spaced apart relation from said camming means, and in contact with the second of said members, said expansible means and the second of said members being in normally slidable frictional engagement with respect to a relative axial movement of said members, and in normally non-slidable frictional engagement with respect to a relative rotary movement of said members, and further means responsive to a selective relative rotary movement of said members for bringing into engagement said camming means and said expansible means, whereby the latter will be expanded radially by said camming means against the second of said members.

4. In a locking device, a first hollow tubular member, a second tubular member arranged in telescoping relation within said first member, a threaded spindle secured to and projecting axially beyond one end of said second member, said spindle being enclosed within said first member, camming mean carried by the projecting end of said spindle, a split nut threadably engaging said spindle, and means responsive to a selective relative rotation of said members for

causing said nut to travel along said spindle and into engagement with said camming means, whereby said nut will be spread apart by said camming means and forced against the inner wall of said first member.

5. A locking device according to claim 4 in which said split nut comprises a circular sleeve split radially into a plurality of segments, so that the expansion of said sleeve against said first member as a result of its engagement with said camming means tends to widen the split between said segments.

6. In a device in which two rotatable tubular members arranged in telescoping relation can be temporarily locked together so as to preclude telescopic operation, the combination of radially expansible means carried by the inner of said members in normally slidable contacting relation longitudinally of the outer of said members, and means rigidly secured to the inner of said members in normally spaced apart relation longitudinally of said first-mentioned means and operative upon a selective rotation of either member with respect to the other for radially expanding said first-mentioned means against said outer member to thereby terminate the slidable contacting relation of said first-mentioned means longitudinally of said outer member.

7. A locking mechanism for a pair of tubular members arranged in telescoping relation comprising a threaded spindle secured to and projecting axially beyond one end of the inner of said members, said spindle being enclosed within the outer of said members, a knob formed on the projecting end of said spindle, and a split nut threadably engaging said spindle and frictionally engaging said outer member, said nut and said spindle being designed for axial movement relative to one another upon a selective relative rotation of said members without disturbing the frictional engagement between said nut and said outer member.

8. A locking mechanism as defined in claim 7 in which said split nut is formed with an annular groove, in combination with a retaining ring in said groove.

9. Mechanism for locking together two hollow tubular members positioned in telescoping relation, the inner of said members having a threaded outer surface portion adjacent the enclosed end thereof, said enclosed end being flared outwardly, comprising a split nut encircling said inner member, normally longitudinally spaced from the flared end thereof, and threadably engaging said threaded portion, said nut being normally in frictional contact with said outer member, whereby said nut will engage and be expanded by the flared end of said inner member upon a selective relative rotation of said members.

10. In combination, a first tubular member, a second tubular member enclosed at least partly in telescoping relation within said first mentioned member, the enclosed end of said second tubular member being formed with a sloping outer surface portion of extended diameter, said second member being threaded on that portion of its outer surface adjacent said sloping end portion, and an outwardly expansible nut threadably engaging said outer threaded surface of said second member, normally free of said sloping portion, and in slidable frictional engagement axially of said first member, whereby a selective relative rotation of said tubular members will cause said nut to contact said sloping portion to be thereby expanded outwardly against said first member to thereby terminate the said slidable frictional engagement of said nut axially of said first member.

11. An adjustable antenna rod comprising a pair of rotatable tubular members arranged in telescoping relation, and mechanism for temporarily locking together said tubular members so as to preclude telescopic operation, said mechanism including radially expansible means carried by the inner of said tubular members, said expansible means being in frictional contact with the outer of said members and in normally slidable engagement longitudinally thereof, and means rigidly secured to the inner of said members in normally longitudinal spaced apart relation from said expansible means and operative upon a selective relative rotation of said tubular members for radially expanding said expansible means against said outer member to terminate the slidable engagement of said expansible means longitudinally of said outer member.

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