June 4, 1957 L. F. KNIGHT 2,794,961

DETACHABLE JOINT FOR A MAST OR THE LIKE

Filed June 26, 1952

FIG. 1.

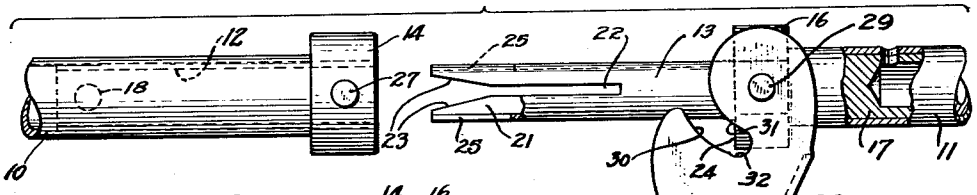


FIG. 2.

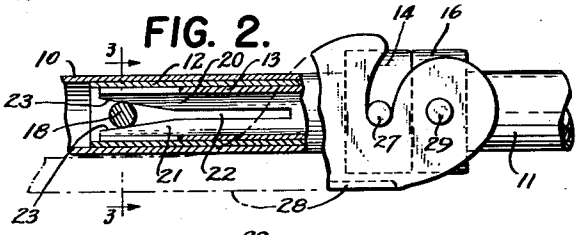


FIG. 3.

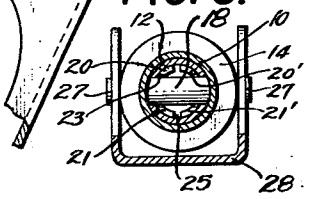


FIG. 4.

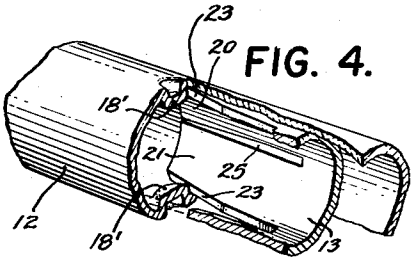


FIG. 5.

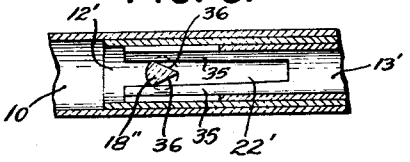


FIG. 6.

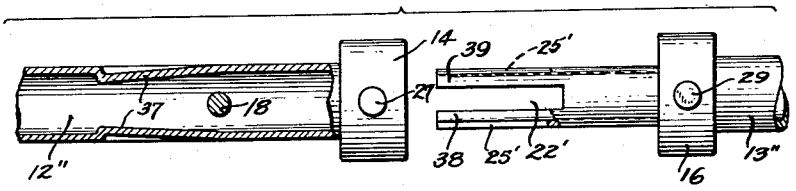


FIG. 7.

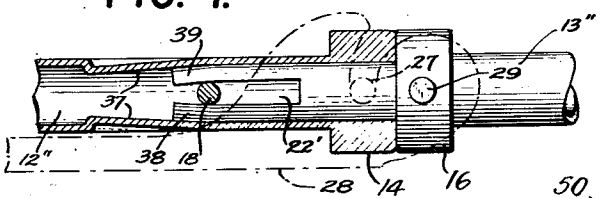
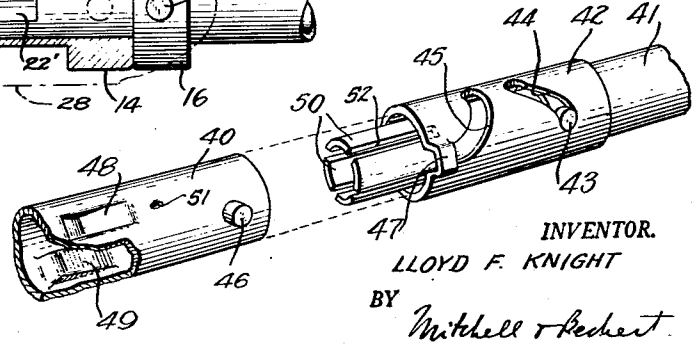


FIG. 8.



INVENTOR.
LLOYD F. KNIGHT
BY Mitchell & Beckert
ATTORNEYS

United States Patent Office 2,794,961 Patented June 4, 1957

2,794,961

DETACHABLE JOINT FOR A MAST OR THE LIKE

Lloyd F. Knight, Levittown, N. Y., assignor to Servo Corporation of America, New Hyde Park, N. Y., a corporation of New York

Application June 26, 1952, Serial No. 295,708

20 Claims. (Cl. 339—75)

My invention relates to clamping means for detachably assembling mast sections or the like to each other.

It is an object of the invention to provide improved clamping means of the character indicated.

Another object is to provide an improved clamp of the character indicated, with means for forcing the clamped elements apart without deforming or destroying any part of the clamp.

A further object is to provide improved clamping means of the character indicated, with means for positively assuring low electrical resistance between elements thus clamped.

It is a general object to meet the above objects with a construction that is inherently simple to make, to assemble, and to operate.

Other objects and various further features of novelty and invention will be pointed out or will occur to those skilled in the art from a reading of the following specification, in conjunction with the accompanying drawings. In said drawings, which show, for illustrative purposes only, preferred forms of the invention:

Fig. 1 is a fragmentary view in partial section showing two elements of a clamping device according to the invention, prior to assembly of these elements;

Fig. 2 is a view similar to Fig. 1, with the parts of Fig. 1 in assembled and clamped relation;

Fig. 3 is a cross-sectional view taken substantially in the plane 3—3 of the Fig. 2;

Fig. 4 is a fragmentary view in perspective and partly broken away illustrating modified clamping elements in assembled relation;

Fig. 5 is a fragmentary view, in partial section, of a further modified construction;

Fig. 6 is a view similar to Fig. 1, but illustrating another alternative construction prior to assembly;

Fig. 7 is a view similar to Fig. 6 and showing the parts of Fig. 6 in assembled relation; and

Fig. 8 is a view in perspective, showing elements of a further alternative construction, just prior to insertion and clamping of the parts.

Briefly stated, my invention contemplates clamping means involving the fit of one member in the bore at the end of another member. Both members have cooperating parts which develop a bind between the members upon forced axially inserted assembly, and axial clamping means are provided to force such assembly. The axial clamping means may include first cam means for forcing the axial assembly, and second cam means for forcibly removing the bind when disassembling the parts. The cooperating parts which develop the bind may include fingers defined by longitudinal slots at the end of one member and engageable with means projecting within the bore of the other member, there being cam means provided, either on the inwardly projecting means or on the fingers, in order to force the fingers into such a deformed position as to develop the bind. The deformation action resulting in the bind may be characterized by such motion as to assure an abrading coaction between the parts

so that, if they are electrically conductive, the clamped joint may be characterized by extremely low electrical resistance between mast or other sections joined thereby.

Referring to Figs. 1, 2, and 3 of the drawings, my invention is shown in application to clamping means for joining two antenna-mast sections 10—11, or the like. The sections 10—11 may both be tubular and of the same or different diameters, depending upon the antenna configuration. The clamping means may comprise a first tubular member 12 having a bore within which a second member 13 may be axially slidably received. In the form shown, the first tubular member 12 is permanently received within the bore of the antenna-mast section 10, as by a force-fit; and if the tubular section 12 is terminated by a collar or flange 14, then I prefer that the force-fit of members 10—12 be to the point at which collar 14 abuts mast section 10, as shown. The other clamping element 13 may also be provided with a collar or flange 16, and with a stem 17 force-fitted in the bore of the other mast section 11, as shown.

In accordance with the invention, the bind between tubular members 12—13 is established by coaction between a radially inward projection on the tubular member 12 and spring fingers on the member 13 inserted therein. In the forms shown in Figs. 1 to 3, the radially inward projection comprises a pin 18, extending diametrically across the bore of tubular member 12. In this connection, prior to force-fitting member 12 in mast section 10, the pin 18 may be relatively loosely inserted through diametrically opposed punched openings in tubular member 12, and after force-fitting the pin 18 will be adequately retained by the mast section 10. In the latter connection, if the pin 18 is of a length slightly to interfere with the bore of the mast section 10, then upon force-fitting the parts 10—12 together, the bore of mast section 10 will be scuffed or scored, so as to establish a good permanent low-resistance contact between pin 18 and the mast section 10, for a purpose which will be made clear.

As to the member 13, opposed fingers 20—21 may be defined by a longitudinal slot 22 extending to the end of member 13; I have shown slot 22 provided in duplicate at diametrically opposed locations. Either the slots 22 or the pin 18 may be formed with cam means to cause a separation of fingers 20—21 upon longitudinal insertion of member 13 in member 12. In the form shown, the cam means is provided by forming the mouths of slots 22 with diverging slopes 23. For ease of assembly, the unstressed maximum spread of the cam walls 23 should be no less than the diameter of pin 18, and, of course, the minimum separation, that is, the width of slot 22, should be definitely less than the diameter of pin 18. I prefer that the axial position of pin 18 with respect to the end of collar 14, and of the divergent mouths 23 with respect to the nearest side 24 of collar 16, shall be such that when collars 14—16 abut, pin 18 will have substantially engaged cam surfaces 23.

In order to provide some leeway in the establishment of a binding fit between the projecting fingers of member 13 and the radially inward projection 18 on member 12, I prefer that additional slots 25 be provided at the end of member 13 at diametrically opposite locations angularly spaced from slots 22. This will result in forming member 13 with four fingers 20—21—20'—21'. Thus, upon forced assembly of the members 12—13 to each other, all four cams 23 will drive all four fingers radially outwardly and angularly with respect to each other. This action may promote a symmetrically developed bind of the two elements 12—13 and, therefore, of the two mast sections 10—11; at the same time, there will have been such abrading contact between the cam

parts that a low-resistance electrical connection of the mast sections is assured.

In accordance with a further feature of the invention, I provide additional clamping elements including parts carried by both mast sections 10—11 for forcibly drawing the described parts together and, when desired, for forcibly removing said parts from bound relation. These clamping elements may include cam-follower means in the form of a pin 27 carried by the collar 14 to cooperate with cam means carried by the other collar 16. In the form shown, the cam means forms part of a handle 28, pivoted at 29, to the collar 16. The cam means may comprise a first cam surface 30 spirally developed with respect to the axis of pivot 29 and engageable with pin 27 upon actuation of handle 28 to force members 12—13 together. Handle 28 may carry a second cam 31 engageable with follower 27 when the parts are in assembled relation to force the parts 12—13 apart upon actuation of handle 28 in the opposite direction. Both cams 30—31 may be opposite walls of the same helically developed slot in the side of handle 28 as shown and, if desired, a small notch or detent 32 may be provided in the cam 30 to retain the pin 27 when the clamp has been set.

In order that the clamping forces may be symmetrically developed, I prefer that the pin 27 be provided in duplicate at diametrically opposite locations on collar 14 and that the cams 30—31 and pivot 29 be likewise provided in duplicate on transversely opposite parts of the handle 28. I have found that if the handle 28 is formed of sheet metal of generally U-shaped section, the pivot points and the cams being on the walls of such section, an adequate clamping may be achieved with low fabricating cost.

In Fig. 4, I show a slight modification of the construction described for Figs. 1 to 3 and, therefore, corresponding parts have been given the same reference numerals. The difference between the two structures is that in Fig. 4 the inwardly projecting means 18' on tubular member 12 is formed as an inward depression which may be stamped out of the body of tubular member 12. Of course, the member 12 does not have to be an insertion in the mast section, so that the depressions 18' at diametrically opposed locations may be formed out of the mast section 10 itself, if desired for simpler fabrication of parts; in this event, part 12 in Fig. 4 may be understood to represent the end of one tubular mast section 10. Fig. 4 illustrates a clamped relation of parts with the fingers 20—21 riding hard against the projections 18' and angularly deflected so as to narrow slot 25; the scuffing necessarily involved in engagement of fingers 20—21 with projections 18' will be understood to assure low electrical resistance in the connection between adjacent mast sections 10—11.

In Fig. 5, I illustrate a modification wherein the cam means producing deformation of the fingers 35 (on tubular number 13') are on pin means 18'' (carried by tubular member 12'). For this purpose, wedge-shaped cam surfaces 36 may be cut from pin 18'' and inclined oppositely with respect to an axial plane of the joint. It will be understood that if the width of slot 22' between fingers 35 is less than the maximum separation of cam surfaces 36, then upon axial assembly of the parts, fingers 35 will be spread angularly as well as radially outwardly in the same kind of deforming action as characterizes the bind developed in the structures of Figs. 1 to 4. This bind will also be characterized by low-resistance contact between mast sections.

In Figs. 6 and 7, I illustrate a further modification in which neither the pin 18 of tubular section 12'', nor the walls of slots 22' of member 13'' need be formed with cam surfaces in order to achieve the desired bind. The width, however, of slots 22' preferably substantially coincides with the diameter of pins 18, and the cam action may be achieved by means of one or more localized

wedge-shaped indentations 37 formed out of the body of tubular member 12''. The wedge depressions 37 are preferably located at right angles to the axis of pin 18, so that each of the wedges 37 may act on the two fingers 38—39 adjacent slots 25' in member 13''. The bind will be developed as fingers 38—39 are radially confined by cams 37 against pin 18; and, to an extent permitted by the width of slots 25', fingers 38—39 will be angularly displaced.

In Fig. 8, I show a further modification characterized principally by an alternative means for axially clamping the parts. In the arrangement of Fig. 8, a first mast section 40 is joined to a second mast section 41 by axial clamping means involving a rotatable sleeve 42 carried by the section 41. Sleeve 42 is permitted limited rotary movement by means of a pin 43 engaging slot means 44 on the sleeve 42. Slot 44 may be purely circumferentially extending, but in the form shown it progresses helically about the mast axis. The other end of sleeve 42 may include means, such as a second slot 45 having an opening at the projecting end, to receive pin means 46 carried by the first mast section 40. Slot 45 may also progress helically but in the sense opposite to that of slot 44. If desired, the sleeve parts near the open end of slot 45 may be held together more rigidly if the open end of slot 45 is bridged, as at 47, with an integral part of the sleeve merely outwardly deformed to a sufficient extent to clear pin 46, as will be understood.

The internal gripping parts of the joint may resemble those discussed in connection with Figs. 6 and 7, but in Fig. 8 I have illustrated these parts without utilization of any transverse pin, as at 18 in Figs. 6 and 7. Thus, two opposed internally projecting cam slots 48—49 on member 40 may inwardly and angularly deform finger projections 50 of mast section 41 when the two sections are drawn toward each other. Key means such as a single small inward depression or dimple 51 on member 40 may locate a slot 52 between fingers 50 so that two adjacent fingers 50 may assuredly ride each of cams 48—49 as the joint is set. It will be understood that with sufficiently close radial tolerances between the undeformed fingers 50 and the bore of mast section 40 the deformation accompanying cam action at 48—49 may be so strongly resisted as to assure excellent electric contact between the two mast sections. Final deformation is achieved after pin 46 has entered slot 45 and sleeve 42 rotated until one or both of pins 43—46 rests in a notched or other detent-held position at the adjacent ends of cams 44—45.

It will be seen that I have described ingenious means for not only tightly securing two mast sections or the like together with a minimum of effort, but also for forcibly freeing these sections, as when it becomes necessary to transport masts for erection elsewhere. In all of the forms described there is not only a positive and secure binding relation between the parts, but through novel use of hard abrading action, I assure the best possible electrical contact between adjacent mast sections.

While I have described my invention in detail for the preferred forms shown, it will be understood that modifications may be made within the scope of the invention as defined in the claims which follow.

I claim:

1. Clamping means joining two mast sections or the like, comprising a first member having a bore and including angularly localized inwardly projecting contact means rigidly carried by said first member and extending transversely within the bore of said member, a second member of generally cylindrical shape and inserted in the bore of said first member and including a plurality of longitudinally projecting angularly spaced elongated finger contact means at the end thereof inserted in the bore of said first member and defining elongated slots between adjacent finger-contact means, an adjacent two of said finger-contact means being aligned near one of said slots for contact with one of said inwardly projecting contact

means and being aligned to avoid contact with said inwardly projecting means near another of said slots, and means including a cam associated with one of said contact means and coacting with the other of said contact means upon longitudinal insertion of said second member in said first member and producing circumferential and radial deformation of said finger means.

2. Clamping means according to claim 1 in which said cam is on said finger means.

3. Clamping means joining two mast sections or the like, comprising a first member having a bore and including inwardly projecting contact means rigidly carried by said first member and extending transversely within the bore of said member, a second member of generally cylindrical shape and inserted in the bore of said first member and including a plurality of longitudinally projecting angularly spaced finger contact means at the end thereof inserted in the bore of said first member, whereby said finger means may define therebetween a corresponding plurality of longitudinally extending slots, and means including a cam associated with one of said contact means and coacting with the other of said contact means upon longitudinal insertion of said second member in said first member, the circumferentially distributed locations of said last-defined means being confined essentially to the locations of some of said slots to the exclusion of other of said slots, whereby resulting deformation of said finger means may be characterized by circumferential and radial components.

4. Clamping means according to claim 1, in which said inwardly projecting means comprises a pin rigidly secured at diametrically opposite points to said first tubular member and extending diametrically across the bore of said first member.

5. Clamping means joining two independent and completely separable mast sections or the like, comprising a first tubular member including a radially inward projection formed out of the body of said first tubular member and projecting radially inward of the bore thereof, a second tubular member inserted in the bore of said first tubular member and including at the insertion end thereof a plurality of angularly spaced longitudinally extending fingers, means including a first cam carried by one of said members and coacting with the other of said members and in circumferentially deforming relation with said fingers upon longitudinally inserted assembly of said members, and clamping elements carried by both said members and including a second cam drawing said tubular members axially toward each other upon a first actuation of said clamping elements.

6. Clamping means according to claim 5, in which said first cam is on said radially inward projection and is poised for interception of one of said fingers upon insertion of said second tubular member into said first tubular member.

7. Clamping means according to claim 5, in which said first cam is one one of said fingers and is poised for interception of said radially inward projection upon insertion of said second tubular member into said first tubular member.

8. Clamping means according to claim 5, in which said clamping elements include cam means forcing said tubular members axially apart upon a second actuation of said clamping elements.

9. Clamping means joining two mast sections or the like, comprising a first tubular member including a pin rigidly carried by said member and extending diametrically across the bore thereof, a second tubular member inserted in the bore of said first tubular member and having first and second angularly spaced pairs of diametrically opposed longitudinal slots at the insertion end, corresponding edges of the walls of one of said pairs of slots near the end thereof being tapered to define divergent mouths for said one pair of slots for coaction with said pin upon assembly of said tubular members to each other, whereby upon such assembly the other pair of slots will be converged as the fingers between slots are circumferentially deformed.

10. Clamping means joining two mast sections or the like, comprising a first tubular member including a pin rigidly carried by said member and extending diametrically across the bore thereof, a second tubular member inserted in the bore of said first tubular member and having two diametrically opposed longitudinal slots at the inserted end, the thickness of said pin at the radii of engagement with said slots being in excess of the unstressed width of said slots, said pin including within the bore of said first tubular member a cam surface inclined with respect to a plane including the axis of said first tubular member and aligned with the wall of one of said slots, whereby upon forced insertion of said second tubular member in said first tubular member, the fingers defined by said slots may be spread apart in a circumferential and radial deformation to bind said members together.

11. Clamping means according to claim 10 to which said pin includes two cam surfaces similarly inclined but in opposite senses and on opposite sides of said plane including the axis of said first tubular member.

12. Clamping means, comprising two independent and completely separable tubular members assembled upon insertion of the end of one in the bore at the end of the other, said members having cooperating parts which bind upon forced inserted assembly of said members, and clamping elements forcing and retaining said assembly and comprising detachably engageable parts carried on both said members and including a first cam axially drawing said members together upon actuation thereof, and a second cam axially forcing said members apart upon actuation thereof.

13. Clamping means according to claim 12, in which one of said parts is a radially extending pin carried by one of said members, and in which both cams are carried by the other of said members and are defined as opposite walls of a cam slot engageable with said pin.

14. Clamping means according to claim 13, in which said one part includes a further pin diametrically opposite said first pin, and in which two further cams carried by said second part and corresponding to said first two cams engage said second pin.

15. Clamping means according to claim 3, and clamping elements comprising two diametrically opposite cam followers carried by one of said members, and a handle pivotally carried by the other of said members on a transverse axis and including a first two transversely opposed cam elements engageable with said cam followers, said cam elements and followers coacting with said handle in one direction to draw said members together, and a second two transversely opposed cams coacting with said cam followers upon actuation of said handle in the opposite direction to force said members apart.

16. Clamping means according to claim 15, in which the pivot for said handle comprises two pin projections extending radially outwardly of said second member, and in which said handle comprises a single piece of sheet metal bent into generally U-shaped cross-section, parts of the walls of said U-section being pivoted to said pins.

17. Clamping means, comprising a first member having a bore at one end, a second member separate and independent of said first member and having an end slidingly inserted in said bore, said members having cooperating parts which bind upon inserted assembly, and clamping elements comprising outwardly projecting cam-follower means carried by one of said members, and a rotatable sleeve retained against axial separation from the other of said members and having a bore of a size to receive insertion of said first member, the projecting end of said sleeve including means engageable with said cam follower means, said sleeve further including cam means cooperating with one of said cam-follower means

and of said axial-retention means to draw said members together upon rotation of said sleeve in one direction and to force said members apart upon rotation of said sleeve in the opposite direction.

18. Clamping means joining two mast sections or the like, comprising a first tubular member including inwardly projecting means rigidly carried by said first tubular member and extending transversely of the bore of said member, and a second tubular member inserted in the bore of said first tubular member and including a plurality of longitudinally projecting angularly spaced finger means at the end thereof inserted in said first tubular member, whereby elongated slots are defined between said finger means, said inwardly projecting means including a cam coacting with the other of said means at one of said slots to the exclusion of another of said slots upon longitudinal insertion of said second member to produce circumferential and radial deformation of said finger means.

19. Clamping means joining two mast sections or the like, comprising a first tubular member including inwardly projecting contact means formed out of the body of said first tubular member and extending transversely of the bore of said member, a second tubular member inserted in the bore of said first tubular member and including a plurality of longitudinally projecting angularly spaced finger contact means at the end thereof inserted in said first tubular member, and means including a cam associated with one of said contact means and coacting with the other of said contact means upon longitudinal insertion of said second member in said first member to produce circumferential and radial deformation of said finger means.

20. Clamping means joining two separate and independent mast sections or the like, comprising a first tubular member including inwardly projecting means rigidly carried by said first tubular member and extending transversely of the bore of said member, and a second tubular member inserted in the bore of said first tubular member and including a plurality of longitudinally projecting angularly spaced finger means at the end thereof inserted in said first tubular member, whereby slots are defined between adjacent fingers, there being a greater number of slots than engaged by said inwardly projecting means, whereby slot spaces not engaged by said inwardly projecting means may provide room in which said finger means may be displaced with a circumferentially directed displacement component, and a cam on one of said means coacting with the other of said means to produce a deformation of circumferential said finger means upon longitudinal assembly of said members.

References Cited in the file of this patent

UNITED STATES PATENTS

377,237	Cole	Jan. 31, 1888
586,029	Hall	July 6, 1897
745,679	Schultze	Dec. 1, 1903
1,481,392	Schawrow	Jan. 22, 1924
1,512,895	Kraft	Oct. 21, 1924
1,827,188	Burgess	Oct. 13, 1931
1,849,101	Livergood	Mar. 15, 1932

FOREIGN PATENTS

6,258/01	Great Britain	Mar. 25, 1901
271,166	Great Britain	May 20, 1927
712,107	France	Sept. 25, 1931