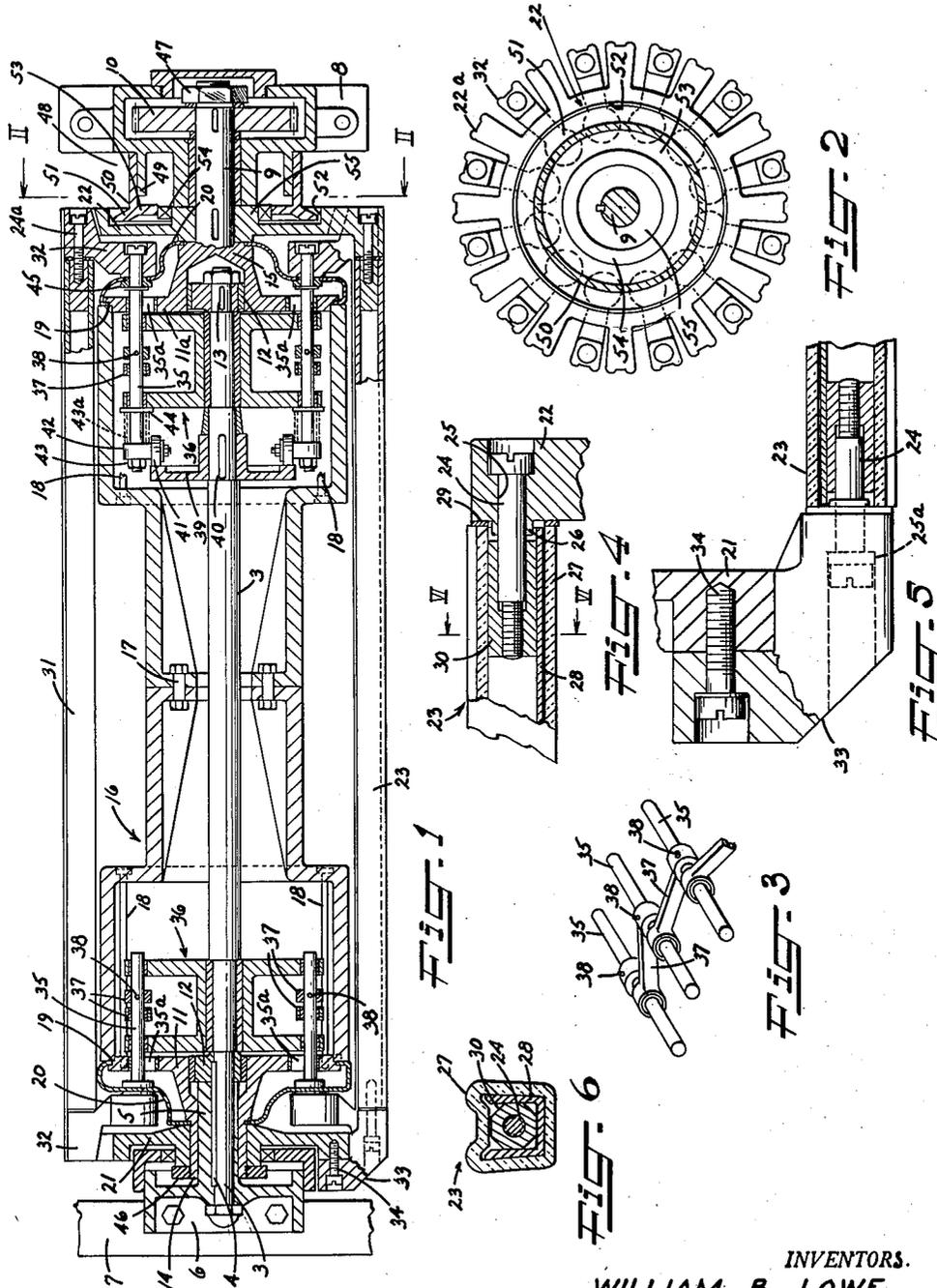


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THREAD-ADVANCING REEL  
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## THREAD-ADVANCING REEL

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This invention relates to thread-advancing reels and particularly to reels of this type which are protectively sealed against the entrance of liquids into the bearings and driving connections during the liquid treatment of yarns as they proceed in a helical path over the bars of the reel.

It is an object of the invention to provide a construction of thread-advancing reels which is protected against corrosion but avoids the necessity, even in reels of long axial extent, for incorporation of long cylindrical, flexible boots of rubber or like material which are not only expensive to manufacture but have a greater proportion of the area thereof exposed where it is subject to damage by piercing and other mechanical action, as well as by corroding influences. It is a further object of the invention to provide a thread-advancing reel comprising two cage-like sets of interdigitating bars, the bars of one set being actuatable individually relative to those of the other set to advance the thread axially of the reel, which is characterized by flexible sealing members adjacent the ends of the reel through which the actuating means extends to points of securement with the movable bars, and end spiders for supporting the other set of bars (to which they are individually secured at their ends) located outside the sealing members to protect them from mechanical injury. Another object is to provide an improved form of bar and mounting system therefor. Other objects and advantages of the invention will be apparent from the drawing and the description thereof hereinafter.

In the drawing, which is illustrative of the invention, Figure 1 is a longitudinal sectional view through one embodiment of the invention,

Figure 2 is a transverse section on line II—II of Figure 1,

Figure 3 is a pictorial view of a detail,

Figures 4 and 5 are enlarged views of details partly in section, and

Figure 6 is a section on line VI—VI of Figure 4.

In general, the reel comprises a frame member, such as a fixed shaft, upon which the reel members or cages are rotatably mounted. One reel member is a rigid member, that is the bars which are spaced circumferentially about the periphery of such member are held together in fixed relationship by a rigid structure. The other reel member comprises a plurality of circumferentially spaced bars which when mounted in the reel assembly alternate with the bars of the rigid member. The second member may be called the actuatable member since it comprises bars which are mounted for axial reciprocation during the

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rotation of the reel member when in operation. The bars of the actuatable member have outer thread supporting peripheral surfaces which are disposed in a cylinder and the reel member as a whole rotates about the axis of this cylinder. The axis of the actuatable reel member is offset from, though parallel to, the axis of rotation of the rigid reel member so that during rotation of the reel members the periphery of the bars of one set intercepts the periphery of the bars of the other set. During rotation of the reel, the turns of thread are transferred from the rigid reel member to the actuatable reel member repeatedly and while the turns are carried by the bars of the actuatable member, these bars are slid forwardly to advance the thread toward the discharge end of the reel. When the bars of the actuatable member recede within the periphery of the bars of the rigid member, the actuatable bars are shifted back in preparation for the next forward stroke.

More specifically, the rigid reel member of the present invention comprises a protective enclosure or shell surrounding which the circumferentially spaced thread-carrying bars are disposed. The shell is carried by spaced supporting members in the form of webs, plates, or the like located radially within the shell. One such web is provided adjacent or at each end of the shell and, if desired, in a long reel additional intermediate webs may be provided for reinforcing the span of the shell. Outer webs, plates, or spiders are provided for supporting the bars of this reel member. The bars are individually secured to the outer segments of the spiders.

The actuatable reel member comprises at least two axially spaced radially extending supporting elements, such as discs, spiders, webs, or the like which are rotatably mounted on the fixed shaft. Each of the radially extending supporting elements is provided with a plurality of guideways extending therethrough in a direction parallel to the shaft and means is provided for rigidly connecting these supporting elements so that their corresponding guideways are in alignment. The actuatable bars are individually secured at their ends to axially and radially inwardly extending lugs or fittings and a rod parallel to the bar is secured to a corresponding lug of each such bar. Such rods extend through the corresponding guideways of the supporting members. Means is provided between the supporting members for reciprocating the rods at the proper portion of the reel periphery during each cycle of revolution. Means is also provided for interconnecting

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the actuatable rods to prevent relative rotation therebetween while permitting relative reciprocation.

The rods referred to extend through at least one of the supporting members of the rigid reel member and sealing means is provided adjacent and outside each member that is penetrated by the rods between that member and the outer spider which carries the bars.

As shown in Figures 1 to 4, the fixed shaft 3 is keyed at 4 to an eccentric sleeve 5 which projects from the web of the bearing 6 secured to the frame member 7. A frame member 8 on the other side of the reel structure is adapted to receive a driving shaft 9 provided with a gear 10 by which it may be driven. Any other suitable driving means may be provided at this end of the reel.

The reel comprises a rigid reel member which comprises two supporting members or webs 11 and 11a which are rotatably mounted by suitable anti-friction bearings on eccentric sleeves 12 which are keyed to the shaft 3 by keys 4 and 13. The web 11 extends from a sleeve 14 which rotates about eccentric sleeve 5. The web 11a may be formed integrally with a hub section 15 from which shaft 9 projects. The rigid reel member also comprises the annular housing made up of the stepped cylindrical sleeves 16 which are joined together by the nuts and bolts 17 and are secured at each end to the webs 11 and 11a by tie rods 18. The ends of the sleeves 16 fit against annular shoulders on the peripheries of webs 11 and 11a. The webs 11 and 11a are recessed or grooved circumferentially at 19 to receive the beaded edge of the flexible sealing membranes 20 provided at each end of the reel. Outer or end plates, webs, or spiders 21 and 22 are provided to protect the flexible membranes 20 from mechanical damage and to support the bars 23 of the rigid cage member. To provide for individual attachment and release of each bar, cap screws 24 (see Figs. 4 to 6) may extend through bores 25, which may be provided in the outer fingers 22a of the spiders, such as spider 22, into threaded engagement with the ends of bars 23. The spiders may be provided with projecting bosses 26 which may fit into complementarily shaped recesses of non-circular outline in the ends of the bars to assure proper orientation of the bars when placed on the reels. When bosses 26 are provided, an auxiliary fastening member or lug 33 may be provided at one end of each bar as shown in Fig. 5. This fastening member is secured to one of the webs, such as 21, by means of a cap screw 34 and to the end of the bar by the same means as that used at the other end of the bar. By loosening screw 34, the member 33 can be moved away sufficiently to free the bar clear of the bosses.

A resilient washer 25a, such as of rubber (see Fig. 5), may be provided at one or both ends of the bars to facilitate the relief of any stresses developed by unequal expansion of the various parts.

While the reel bars may be made of a single piece, either solid or hollow, the specific form of bar shown in Figs. 4 to 6 is of special value because it not only facilitates individual attachment and release of the bars with respect to the reel but also provides a practical way of making long reel bars with a glass thread-carrying peripheral surface. This preferred form of reel bar is formed of an outer non-metallic tube 27 of silica, glass, or other siliceous material or of

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a plastic material, such as a vinyl resin, e. g. methyl methacrylate polymers, polystyrene, polyacrylonitrile or copolymers of acrylonitrile with other vinyl monomers, such as vinyl chloride. The bar may have parallel or sloped sides as viewed in Fig. 6 and may have a troughed thread-supporting peripheral surface. A channel- or trough-shaped metal insert 28, such as of aluminum, fits within the glass tube and is cemented in place, such as by means of a rubber or synthetic rubber cement. This channel 28 is slightly shorter than the glass tube, as shown in Figs. 4 and 5, so that the metal is completely protected when the bar is clamped against a gasket 29, such as of rubber bearing against web 21 or 22 or against a lug 33. The bored fastening lugs 30 are secured within the channel near its ends as by welding. Regardless of the specific construction of the bars 23, the outer surfaces of the spiders 21 and 22 are formed as smooth extensions of the thread-carrying outer surfaces of the bars proper so that the effective length of the reel bars is the entire distance from the end of spider 21 and spider 22.

The actuatable reel member comprises a plurality of bars 31 secured by cap screws 24a between extensions or lugs 32 which project inwardly from each end thereof and between the inner ends of which rods 35 extend. The bars 31 may be of the same construction as, and secured to the extensions 32 in the same way as, bars 23. See especially the preferred construction of Figs. 4 to 6. The outer surfaces of extensions 32 are formed as smooth extensions of the thread-carrying outer surfaces of the bars proper so that the effective length of the actuatable bar system of the reel is the distance between the outer ends of extensions 32 substantially the same length as that of the rigid reel bar system. Auxiliary connections like lugs 33 are unnecessary to provide for individual attachment and release of bars 31 since rods 35 at the left end of the reel are freely slidable to the extent permitted by the space between links 37 thereon. These rods 35 may be square-sectioned and may fit in square bores in the supporting members or "spools" 36 in order to prevent their rotation within the supporting webs of such spools. However, as shown, the rods 35 are round and means is provided for preventing rotation of such rods about their own axes, which means comprises a plurality of links 37 interconnecting each rod with at least one other rod. A link connects each adjacent two rods 35 as shown in Figure 3. A set screw or cotter pin 38 fixes the link with respect to one of the rods but the adjacent rod is not fixed within the terminal sleeve of the link. By providing such links between adjacent rods of the entire set and securing one end of each link to one of the rods while leaving the other end free, the entire set of rods is prevented from rotating about their own axes. Every other link may be omitted if the remaining links are secured by splining at each end with respect to the two rods each link embraces.

The rods 35 pass through bores 35a in the supporting elements or webs 11 and 11a and through bores in the "spools" 36, the hubs of which are rotatably mounted upon the shaft 3. Means is provided for reciprocating the rods 35 which comprises the cam 39 keyed at 40 to shaft 3. Roller followers 41 are carried on collars or lugs 42 fixed on rods 35 by nuts 43 and springs 43a bearing against the washer 44 urge the followers against the annular cam surface. Instead of a

cam, a skew plate may be mounted upon shaft 3. Rods 35 at the right end of the reel are driven by the cam while those at the left end are free to follow. The flexible sealing membranes 20 are provided with openings to permit the ends of rods 35 to extend therethrough and a washer 45 may be provided adjacent each end of each rod to form a tight joint against lugs 32 with the beaded edge of the flexible membrane where the rod goes through it. The inside circular bead of the flexible sealing membrane at the left end of the reel is clamped between spider 21 and an annular shoulder on sleeve 14 of web 11 by means of a nut 46. The inside circular bead of the other membrane 20 is clamped between spider 22 and an annular shoulder on hub 15 by means of nut 47.

At the discharge end of the reel, a fixed doffing ring 48 is secured, as by threading or press-fitting, on the bearing sleeve 49 and comprises a cylindrical portion 50 and a tapered portion 51, the latter portion being overhung by the shoulder 52 of spider 22 and the discharge ends of the bars of the rigid reel member. The doffing ring comprises an inwardly projecting flange 53 and one or more flexible seals or sealed ball bearings 54 are provided within the annular space between 53 and the outwardly projecting hub 55 of spider 22. Any amount of yarn can be collected on the doffing ring 48 and still the fingers 22a of the spider 22 will prevent any of such yarn from getting back of it and jamming against, and damaging, the sealing membrane 20, which is the most vulnerable part of any reel of this type.

In operation, gear 10 drives shaft 9 which drives the rigid reel member. The rods 35 are carried or pushed around by the inside surfaces of openings 35a in the rigid reel member, thereby driving the actuatable reel member. During rotation, the reel bars 31 alternately project and recede with respect to the periphery of reel bars 23 by virtue of their eccentric axes. When bars 31 protrude they are shifted to the right in Fig. 1 under the action of the cam 39 and when they are retracted within the periphery of bars 23, they are returned by the springs 43a to the left. This motion results in a progressive advance of the thread through a helical path over the reel during rotation thereof.

The exposed parts of the reel may be made of corrosion-resistant materials which do not always have the strength characteristics required of driving members except when made of extremely massive and heavy construction. By the present construction of reel, the drive and bearing members can be made of materials regardless of corrosion-resistance and thereby they can be made of a smaller size to facilitate the construction of a compact and durable reel. Thus, it is only necessary to employ corrosion-resistant materials for the thread carrying bars, the extensions 32, the flexible seals 20, the protective shell 16, the spiders 21 and 22, and the doffing ring 48. The other parts are protected within the seals and flexible membranes and can be made of materials having good structural characteristics from the standpoint of strength and wear-resistance without regard to corrosion. By providing individually releasable and attachable bars, the use of bars made of fragile materials is quite practical since any damaged bar can be replaced without taking the entire reel apart, with resultant saving of time and labor.

It is to be understood that changes and variations may be made without departing from the

spirit and scope of the invention as defined in the appended claims.

We claim:

1. A thread-advancing reel comprising a set of fixed bars rotatable as a unit, a set of movable bars interdigitating with the fixed bars, means for imparting relative motion between the two sets of bars to advance a thread in a helical path from one end to the other of the reel, end supporting members, means for securing each bar to and between a pair of end supporting members in individually releasable and attachable fashion, the outer surfaces of the members being smooth continuations or extensions of the outer surface of the bars attached thereto to provide a continuous thread-carrying surface the entire distance between the ends of the supporting members.

2. A thread-advancing reel comprising a set of fixed bars rotatable as a unit, a set of movable bars interdigitating with the fixed bars, means for imparting relative motion between the two sets of bars to advance a thread in a helical path from one end to the other of the reel, a pair of end supporting members rigidly connected together, means for securing said fixed bars to and between the end supporting members in individually releasable and attachable fashion, the outer surfaces of the members being smooth continuations or extensions of the outer surface of the bar proper to provide a continuous thread carrying surface the entire distance between the ends of the supporting members, and movable means for supporting the movable bars.

3. A thread-advancing reel comprising a shaft, a set of fixed bars, a set of movable bars interdigitating with the fixed bars, means for imparting relative motion between the two sets of bars, means for securing each movable bar between a pair of inwardly projecting members at the ends thereof in individually releasable and attachable fashion, the outer surfaces of the members being smooth continuations or extensions of the outer surface of the bar proper to provide a continuous thread-carrying surface the entire distance between the ends of the members, rods secured to the members and extending parallel to the corresponding bars within the space encompassed by the set of bars, means for supporting the rods comprising two axially-spaced radially-extending elements rotatably mounted on the shaft, said elements having aligned openings slidably receiving the rods and having an inside contour corresponding in size and shape to the outside contour of the rods, means for preventing rotation of the rods on their own axes, and means mounted on the shaft for reciprocating the rods.

4. A thread-advancing reel comprising a fixed shaft; a rigid reel member rotatably mounted on the shaft having a protective shell surrounded by circumferentially spaced bars, spaced supporting members inside the shell and secured rigidly thereto adjacent the ends thereof, outer spider members rigidly secured to the supporting members, and means for securing said bars to and between the spider members in individually releasable and attachable fashion; a second reel member rotatably mounted on the shaft on an axis offset from that of the rigid member and comprising a plurality of movable bars alternately disposed with respect to the bars of the rigid member, means for securing each of the movable bars between a pair of inwardly projecting members at the ends thereof in individually releasable

and attachable fashion; rods secured to the inwardly projecting members and extending loosely through apertures in the supporting members, means for supporting the rods comprising two axially-spaced radially-extending elements rotatably mounted on the shaft between the supporting members secured to the shell, said elements having aligned openings slidably receiving the rods and having an inside contour corresponding in size and shape to the outside contour of the rods; means for preventing rotation of the rods on their own axes, means mounted on the shaft between the supporting members for reciprocating the rods, and a flexible sealing membrane having openings therein through which the rods extend, each membrane being disposed adjacent and outside of one of the supporting members but inside of the adjacent spider member and being secured at its outer periphery between the shell and such supporting member, at its inner periphery to the hub of such supporting member, and having the rims of the openings thereof tightly clamped to the adjacent inwardly projecting members around the rods.

5. A reel as defined in claim 4 in which the outer surfaces of the spider members and of the inwardly projecting members are smooth continuations or extensions of the outer surfaces of the bars secured therebetween to provide a continuous thread-carrying surface the entire distance between the ends of the spider members and the inwardly projecting members.

6. A reel as defined in claim 4 in which the contours of the rods and of the bores are non-circular.

7. A reel as defined in claim 4 in which the means for preventing rotation of the rods on their own axes comprises a plurality of links interconnecting each rod with at least one other rod, each link being fixedly secured to a separate rod and being pivotally connected to another rod.

8. A thread-advancing reel comprising a fixed shaft; a rigid reel member rotatably mounted on the shaft having a protective shell surrounded by circumferentially spaced bars, spaced supporting members inside the shell and secured rigidly thereto adjacent the ends thereof, outer spider members rigidly secured to the supporting members, and means for securing said bars to and between the spider members in individually releasable and attachable fashion; a second reel member rotatably mounted on the shaft on an axis offset from that of the rigid member and comprising a plurality of movable bars alternately disposed with respect to the bars of the rigid member, means for securing each of the movable bars between a pair of inwardly projecting members at the ends thereof in individually releasable and attachable fashion, rods secured to the inwardly projecting members and extending loosely through apertures in the supporting members, means for supporting the rods comprising two axially-spaced radially-extending elements rotatably mounted on the shaft between the supporting members secured to the shell, said elements having aligned openings slidably receiving the rods and having an inside contour corresponding in size and shape to the outside contour of the rods, means for preventing rotation of the rods on their own axes, means mounted on the shaft between the supporting members for reciprocating the rods, and a flexible sealing membrane having openings therein through which the rods extend, each membrane being disposed adjacent and outside of one of the supporting members

but inside of the adjacent spider member and being secured at its outer periphery between the shell and such supporting member, at its inner periphery to the hub of such supporting member, and having the rims of the openings thereof tightly clamped to the adjacent inwardly projecting members around the rods, the outer surfaces of the spider members and of the inwardly projecting members being smooth continuations or extensions of the outer surfaces of the bars secured therebetween to provide a continuous thread-carrying surface the entire distance between the ends of the spider members and the inwardly projecting members, said bars comprising a hollow glass tube, a metal channel cemented therein, and fastening lugs secured within the channel adjacent its ends.

9. As an article of manufacture, a reel bar comprising a rigid hollow non-metallic tube, a rigid metal channel cemented therein and extending approximately the full length of the tube, and fastening lugs secured within the channel adjacent its ends.

10. As an article of manufacture, a reel bar comprising a rigid hollow plastic tube, a rigid metal channel cemented therein and extending approximately the full length of the tube, and fastening lugs secured within the channel adjacent its ends.

11. As an article of manufacture, a reel bar comprising a rigid hollow siliceous tube, a rigid metal channel cemented therein and extending approximately the full length of the tube, and fastening lugs secured within the channel adjacent its ends.

12. An article of manufacture as defined in claim 9 in which the tube is glass and the metal channel is slightly shorter than the glass tube.

13. An article of manufacture as defined in claim 12 in which the channel is made of aluminum.

14. A thread-advancing reel comprising a set of fixed bars rotatable as a unit, a set of movable bars interdigitating with the fixed bars, means for imparting relative motion between the two sets of bars to advance a thread in a helical path from one end to the other of the reel, end supporting members, means for securing each bar to and between a pair of end supporting members in individually releasable and attachable fashion, the outer surfaces of the members being smooth continuations or extensions of the outer surface of the bars attached thereto to provide a continuous thread-carrying surface the entire distance between the ends of the supporting members, said bars comprising a hollow glass tube, a metal channel cemented therein, and fastening lugs secured within the channel adjacent its ends.

15. A thread-advancing reel comprising a set of fixed bars rotatable as a unit, a set of movable bars interdigitating with the fixed bars, means for imparting relative motion between the two sets of bars to advance a thread in a helical path from one end to the other of the reel, a pair of end supporting members rigidly connected together, means for securing said fixed bars to and between the end supporting members in individually releasable and attachable fashion, the outer surfaces of the members being smooth continuations or extension of the outer surface of the bar proper to provide a continuous thread carrying surface the entire distance between the ends of the supporting members, said bars comprising a hollow glass tube, a metal channel cemented therein, and

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fastening lugs secured within the channel adjacent its ends.

16. A thread-advancing reel comprising a shaft, a set of fixed bars, a set of movable bars interdigitating with the fixed bars, means for imparting relative motion between the two sets of bars, means for securing each movable bar between a pair of inwardly projecting members at the ends thereof in individually releasable and attachable fashion, the outer surfaces of the members being smooth continuations or extensions of the outer surface of the bar proper to provide a continuous thread-carrying surface the entire distance between the ends of the members, rods secured to the members and extending parallel to the corresponding bars within the space encompassed by the set of bars, means for supporting the rods comprising two axially-spaced radially-extending elements rotatably mounted on the shaft, said elements having aligned openings slidably receiving the rods and having an inside contour corresponding in size and shape to the outside contour of the rods, means for preventing rotation of the rods on their own axes, and means mounted on the shaft for reciprocating the rods, said bars comprising a hollow glass tube, a metal channel cemented therein, and fastening lugs secured within the channel adjacent its ends.

17. In a reel, a reel bar comprising a rigid hollow non-metallic tube, a rigid metal channel

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cemented therein and extending approximately the full length of the tube, fastening lugs secured within the channel adjacent its ends, a supporting element adjacent each end of the tube, means for securing each element to one of the fastening lugs, and a resilient gasket between each element and the adjacent end of the tube.

18. A reel bar mounting as defined in claim 17 in which the channel is slightly shorter than the tube.

19. A reel bar mounting as defined in claim 18 in which each element has a surface which is a smooth continuation or extension of one of the outer surfaces of the bar secured therebetween to provide a continuous thread-carrying periphery over said surfaces.

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