July 10, 1945. F. W. CHAMBERLAIN 2,379,881

STIFFENING MATERIAL

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FIG. 1.



FIG. 2.

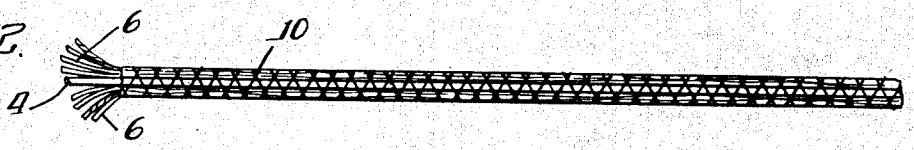


FIG. 3.

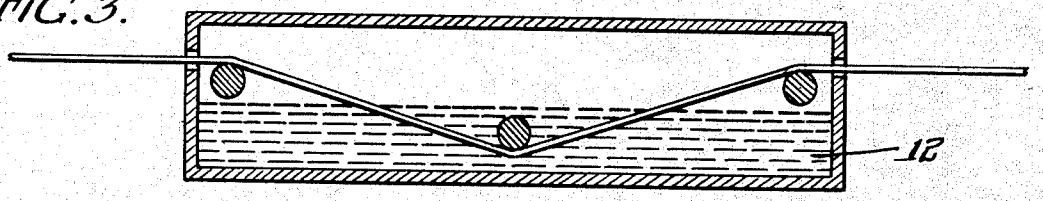


FIG. 4.

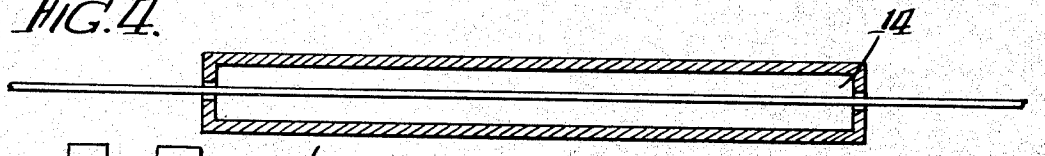


FIG. 5.

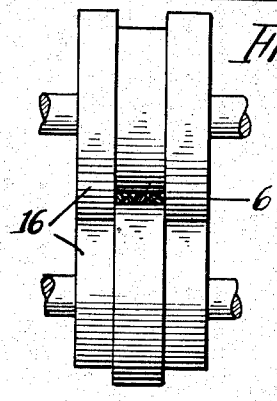


FIG. 6.

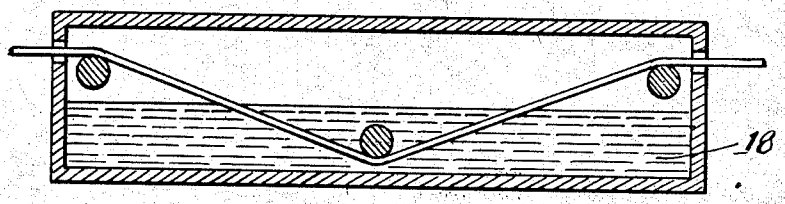


FIG. 7.

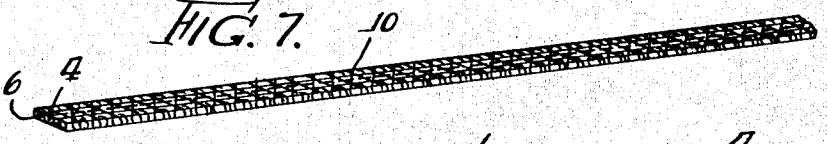


FIG. 8.

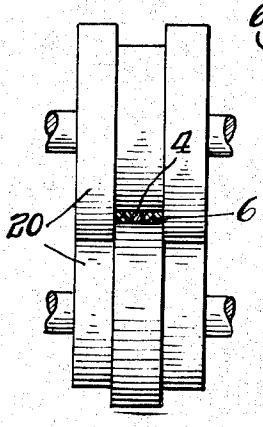


FIG. 9.



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FIG. 10.

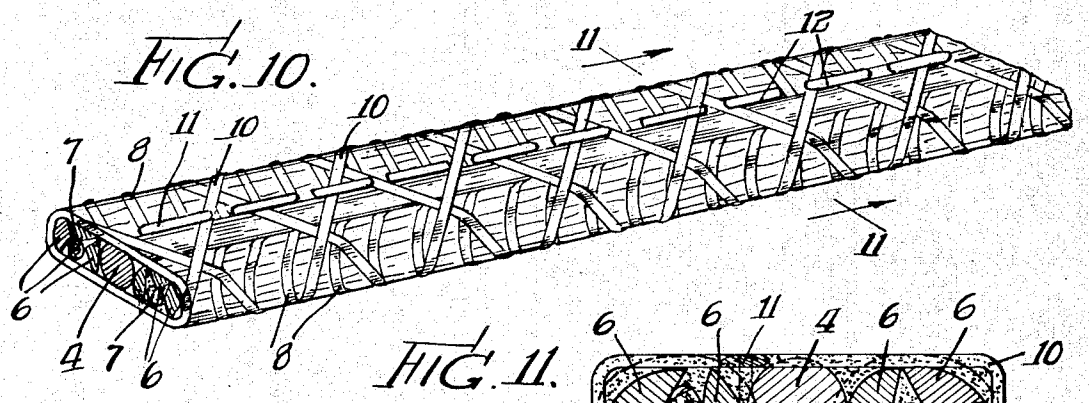


FIG. 11.

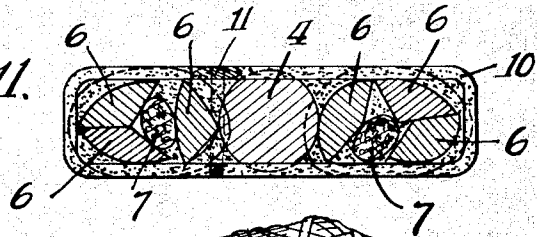


FIG. 12.

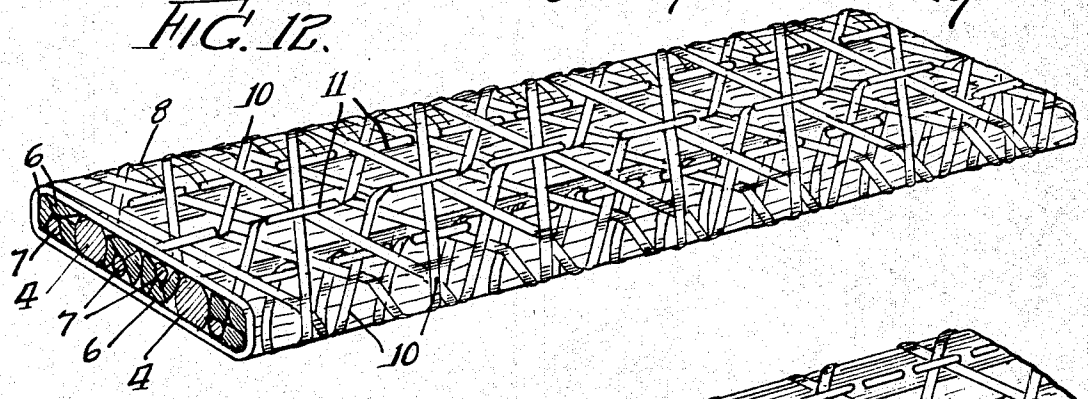


FIG. 13.

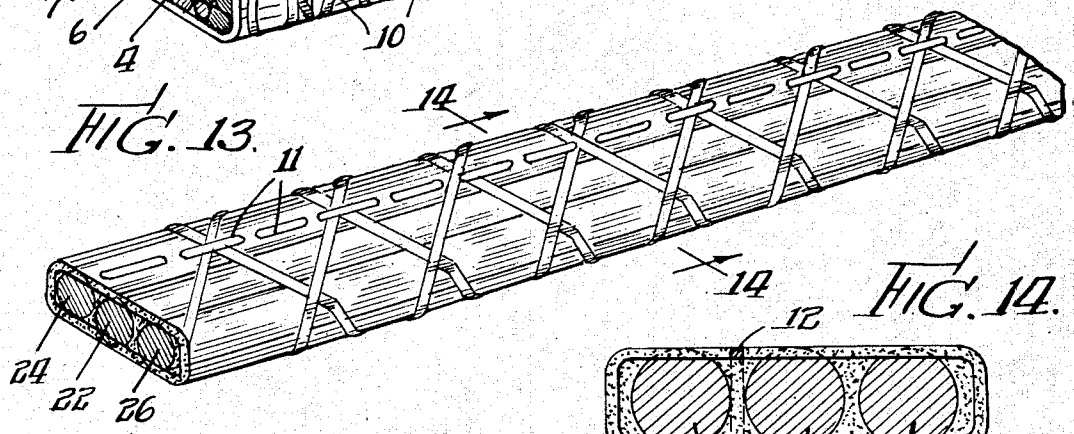
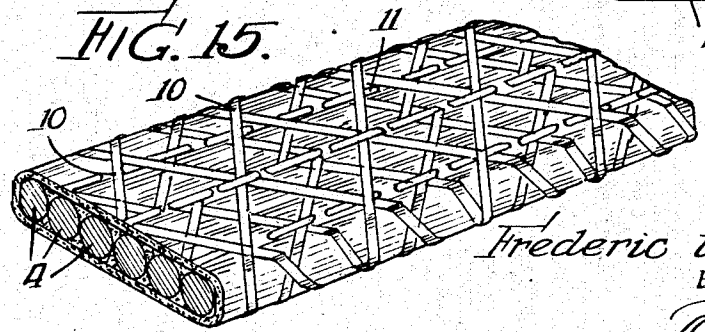


FIG. 14.

FIG. 15.



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UNITED STATES PATENT OFFICE

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STIFFENING MATERIAL

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Application May 27, 1942, Serial No. 444,722

10 Claims. (Cl. 57—140)

This invention relates to stiffening material suitable for various uses, including uses as a substitute for whalebone or metal in corsets, for use in airplanes, in costume jewelry and for other uses which require localized stiffening at one or more zones.

Among the objects of the present invention is to provide a stiffening material formed of a plurality of associated rod-like elements of relatively small cross section permanently assembled together to provide a stiffening material of definite, predetermined shape and dimension and embodying the qualities of resiliency, tenacity, toughness, durability, lightness, cheapness and procurability; to provide a relatively light stiffening material formed of a plurality of elongated cords bonded together in a manner such that the final material is light in weight, markedly resilient, tenacious and tough, has excellent fatigue strength, is resistant to moisture and acids, is odorless, noncombustible, rustproof and extremely durable; to provide these and other objects of invention as will be apparent from the perusal of the following specification when taken in connection with the accompanying drawings, wherein:

Figure 1 is illustrative of the various component parts of which one form of the final stiffening material is made;

Figure 2 is a perspective view of a feather splint rod which comprises one of the ingredients of one form of the stiffening material;

Figure 3 is a view of one of the steps in the processing of the material;

Figure 4 is a diagrammatic showing of the heating step;

Figures 5 and 6 are subsequent views of the process;

Figure 7 is a perspective view of one of the completed stiffening units;

Figure 8 is a view of a further step in the process;

Figure 9 is a perspective view of one of the component parts which forms one type of stiffening material;

Figure 10 is an enlarged perspective view of one of the stiffening material units when the unit includes feather splint rod as one of the structural units;

Figure 11 is a section on the line 11—11 of Figure 10;

Figure 12 is a view of two of the units shown in Figure 10 permanently united to form a doubly wide unit;

Figure 13 is another form of the invention when two types of resinous rods are used;

Figure 14 is a cross section taken on the line 14—14 of Figure 13; and

Figure 15 is a view of a double unit like that shown in Figure 12.

The stiffening material of this invention may be formed in two different ways. First, the stiffening material may be composed of a combination of rods or cords of elastic feather splint bundles and elongated rods of relatively small cross section formed of a vinylidene chloride resin composition which possess tenacity and durability whereby to supplement the elasticity of the feather splint rods to form a very elastic stiffener possessing marked resistance to bending fatigue. In another form the stiffening material may comprise an assembly of elongated rods of relatively small cross section including one or more rods formed of a vinylidene chloride resin composition which possesses marked characteristics of elasticity and one or more rods formed of a different vinylidene chloride resin composition which possesses marked characteristics of tenacity, toughness, and resistance to flexing or bending fatigue. In the latter construction the rods may be assembled in a plurality of ways, one of which is illustrated in the drawings.

Referring to Figures 1 to 11, the same show a product and the method of making the same wherein the stiffening material is formed by combining cords or rods 2 of feather splint bundles which have outstanding resiliency and flexibility, with cords or small rods 4 formed of vinylidene chloride resin compositions possessing both tenacity and toughness and excellent fatigue strength. Thus is secured an ultimate stiffening material having the proper balance of basic material which not only combines the desirable qualifications of each one of these constituent rods in a manner such that the qualifications of one type of rod supplement and augment those of the other so that in the ultimate there is produced a stiffening material which is at once not only resilient, but also possesses marked characteristics of durability and resistance to bending fatigue, which is not possessed in such marked amount by the feather splint rod material and whereby such stiffening material will serve as an excellent substitute, for instance, for steels in the wearing apparel industry. In making a stiffening material of the type shown in Figures 1 to 11 the feather splint cord or rod is used in conjunction with the vinylidene chloride resinous rod. The feather spling cord or rod is composed of elongated splints or fibers 6 of the quill portion of feathers after they have been stripped, and there

is also a single cotton cord 7 which is included with the splints or fibers and to run longitudinally thereof. This cord 7 acts as a continuous connection between the shorter strip of feather splints or fibers. These splints or fibers and the cotton cord 7 are held together by any suitable flexible tenuous binding material, preferably by a thread or cord 8 which is wound, braided or twisted around the bundles of splints or fibers of the elongated, substantially parallelly disposed, overlapping splints of the quills to provide the feather splint rod. Figure 1 shows these quill portions as being held together by a spirally wound thread 8 to form the flexible feather splint rod or cord. In addition there is used an equal length of rod of relatively small cross section, substantially the same cross section as the feather splint cord, the same being formed of a vinylidene chloride resin composition. In the embodiment shown in Figures 1 to 11 one vinylidene chloride rod is used with each pair of feather splint rods, the resinous rod 4 being placed between the two feather splint rods or cords 6. As thus placed the three assembled rods or cords placed side by side are united by thread windings 10 arranged in crossed formation, somewhat after the manner of braiding but without interlacing, except that these threads may be interlaced if desired. This covering is preferably formed along and between each of the strands of rods, preferably by means of a lock stitch 11 so as firmly to interlock the covering with the strands of feather splint and resinous material, thereby preventing its raveling or disintegration by breaking or cutting. The feather splint rod and the resin rod may be formed of any lengths. They may be continuous lengths if desired, or may be formed of relatively shorter lengths. They are preferably of continuous lengths so that the finished section, as shown in Figure 2, is of a continuous length which adapts it to the glue sizing operation shown in Figure 3 because after the three component rods of the stiffening material have been stitched together in the form shown in Figure 2, the same, as a continuous length and running directly from the stitching machine, is passed by continuous feeding mechanism through the sizing bath 12 of Figure 3. There may be one or more of these baths arranged in succession in the plane of feed of the material shown in Figure 3. Preferably the material is given four immersions in the glue, in any desired manner. From the glue sizing tank 12 the material then passes to a heating station where it is fed through a heating chamber 14 which may be either electrically or steam heated, so as to raise the glue size material to a temperature substantially equal to the boiling point of water. This heating operation dries the glue and likewise softens the exterior of the feather splint material and also the vinylidene chloride material. From the heating operation the sized and heated and stitched assembled rods then pass through a tongue and groove combination rolling die 16 having a base set to square the material as shown in Figure 5 whereby to give it the approximate ultimate shape shown in Figure 7. Following this rolling operation or similar operation, the material is then immersed in a waterproofing material 18 such as any desired waterproofing solution, and thereafter the waterproofed, assembled rod is then passed through a final tongue and groove combination 20 to finally set and square the finished product to the form shown in Figure 7.

In connection with foregoing process it is found that the glue sizing causes the thread to adhere to the fibers of the feather splint rods and vinylidene chloride rod and also fills up the small interstices between the splints or fibers in the feather splint rods so that when the latter is thoroughly cooled and dried it unites very firmly with the splints or fibers of the feather splint rods and connects the thread very tightly to it also. Frequently when the rods of pulled feather splint and vinylidene chloride are passed through the heating chamber the heating is sufficient to soften the sizing, and also the quills or splints and vinylidene chloride rod sufficiently to make them pliable and easy to bend. In addition, by heating the vinylidene chloride rod in the manner set forth, when the finished material is passed through the tongue and groove rolling operation the binding and stitching cords will be slightly imbedded in the surface of the somewhat softened vinylidene chloride rods so that on cooling, the threads will be slightly imbedded in the surface of the rods whereby to hold the same in assembled position. Furthermore, after the feather splint and vinylidene chloride material cools it regains all of the desirable qualities that it had prior to heating. In addition, the heating step, followed by the rolling steps of Figure 5, the waterproofing step of Figure 6, and the final rolling step of Figure 8, causes the quill or splints in the feather splint bundles, the vinylidene chloride rods, the stitching and the sizing and the waterproofing material all to be crowded together into an elongated blade-like form so that the constituent parts are united to provide a continuous blade or cord of apparently one integral material and the fact that the materials are wound or stitched does not appear except on close inspection. The manner in which the threads are imbedded or pressed into the softened surface of the vinylidene chloride rods is shown in Figure 9. This imbedding action prevents any possible dislodgment of the rods relative to the remaining portions of the stiffening material.

Figure 10 is a perspective view of one of the sections composed of a vinylidene chloride rod intermediate two feather splint rods, the same being stitched and bound and sized and waterproofed in the manner hereinbefore set forth. Figure 12 is a view showing two of the sections shown in Figure 10 stitched together to form a stiffening material of double width.

Figures 13, 14 and 15 show another form of stiffening material wherein the elongated rods are all formed of vinylidene chloride resin compositions but wherein some of the rods differ in characteristics from the others. For instance in Figures 13 and 14 the central resinous rod 22 is selected by reference to toughness, tenacity and resistance to flexing fatigue, while the other two rods are selected by reference to their elasticity or resilience. One of the advantageous features of vinylidene chloride resins is that their properties may be varied by varying the polymerization or copolymerization reaction by which they are formed. For example, according to one procedure vinylidene chloride resins are produced which have marked qualities of pronounced resilience and elasticity and according to another the resins produced are characterized by toughness, tenacity and resistance to flexing fatigue. In all such instances these rods are resistant to acid and moisture, are waterproof, are odorless, are light, are capable of taking permanent, numerous colors, are durable and rustproof. In the illustration shown in Figure 13 central rod 22 of such

type of resin is selected as one having marked toughness, tenacity and resistance to flexing fatigue and the two outside rods 24 and 26 are likewise selected of a type of vinylidene chloride resin possessing resiliency and elasticity, preferably comparable to that of the feather splint rods, so that by assembling rods 22, 24 and 26 in wrapped and stitched formation, as described heretofore, and then by processing them in the manner shown in Figures 1 to 8 inclusive, a stiffening material is provided, the base materials of which are formed wholly and completely of vinylidene chloride resin compositions. In Figure 15 the double width sections of two of the sections of Figure 13 are shown as stitched together by an interlocking stitch in the manner hereinbefore described. In the construction set forth in Figures 13, 14 and 15 the treatment is identical to that shown in connection with Figures 1 to 8 inclusive. The strands of vinylidene chloride rods are approximately size .050 and the feather splint cords or bundles are of comparable cross section.

In certain other stiffening materials it may be desirable to provide the two outside rods of each triplet as formed of a vinylidene chloride resin composition having toughness, tenacity and resistance to fatigue, whereas the intermediate rod of the three is formed having a predominant characteristic of resiliency and elasticity and may be a feather splint rod or a rod formed of a vinylidene chloride resin composition having such properties. In this latter instance the stiffening material so formed would be less resilient but have more pronounced characteristics of resistance to bending fatigue. By varying the number of rods any adjusted combination of these characteristics may be provided for the stiffening material.

By "vinylidene chloride resin compositions" I mean any resin compositions having a vinylidene chloride resin base or consisting of a vinylidene chloride resin or a mixture of different vinylidene chloride resins and by "vinylidene chloride resin" I mean simple polymers of vinylidene chloride or modified polymers, such as copolymers or interpolymers, or other types of modified polymers of vinylidene chloride, for example, a resinous material formed by polymerizing vinylidene chloride in the presence of another polymerizable material such as vinyl chloride or in the presence of an unpolymerizable material. Moreover, the vinylidene chloride resin compositions may include plasticizers, coloring materials and other compounding ingredients. Also while vinylidene chloride resin compositions have been found to give excellent results in the stiffening materials described herein and are thus preferred, it will be understood that it is within the scope of the invention to substitute for the vinylidene chloride resin compositions either wholly or in part, other resins or resin compositions possessing analogous properties.

It is thought that the invention and numerous of its attendant advantages will be understood from the foregoing illustrative description and it is obvious that numerous changes may be made in the form, construction and arrangement of the several parts without departing from the spirit or scope of the invention or sacrificing any of its attendant advantages, the form herein described being a preferred embodiment for the purpose of illustrating the invention.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. A stiffening material comprising overlapping splints of quills of feathers secured together in substantially parallel overlapping relation to provide a cord or rod-like elongated element and an elongated tough rod formed of a vinylidene chloride resin composition, said resinous rod being resistant to flexure fatigue and said rods being suitably bound together, sized and shaped to desired cross section.

2. A stiffening material comprising at least three elongated rods of relatively small cross section juxtaposed in spaced, substantially, parallel relation and having superficial grooves, thread-like flexible tenuous binding means lying in the grooves and binding the rods together, said rods and enveloping binding means carrying a coating of sizing to produce a shape of desired cross section to the stiffening material, at least one of the rods being resilient and at least two of the rods being tough, tenacious and resistant to flexure fatigue.

3. A stiffening material comprising elongated rods disposed in spaced, substantially, parallel relation and bound together by thread-like material, the interstices between said rods and said thread binding material being filled with sizing and with certain of the threads being somewhat imbedded in the outer portions of the rod-like material, said rod-like material being composed wholly of a vinylidene chloride resin composition and said material possessing inherent resiliency and inherent toughness and resistance to flexure fatigue.

4. A stiffening material including substantially parallelly disposed rods of relatively small cross section interbound by cords, the interstices between the rod-like material being filled with sizing and said material being shaped to predetermined cross section, certain of said rods being markedly flexible and resilient and other of said rods being tough, tenacious, and possessing resistance to flexure fatigue, said rods being formed of vinylidene chloride resin compositions.

5. A stiffening material comprising at least three substantially parallel rods of relatively small cross section bound together by a thread, sized and shaped to predetermined cross section, all of said rods being formed of vinylidene chloride resin compositions, the central rod possessing inherent flexibility and resilience and the other rods possessing inherent toughness and resistance to flexure fatigue.

6. A stiffening material composed of a plurality of substantially parallel rods, flexible tenuous material binding the rods together, the interstices of the tenuous material and rods being filled with sizing and said rods, tenuous material and sizing being shaped to desired cross section, one of said rods being a vinylidene chloride resin composition and having portions of the tenuous binding material somewhat imbedded in the exterior surfaces thereof, said stiffening material being flexible, resilient, tough and resistant to flexure fatigue.

7. A stiffening material of elongated strands of different types of vinylidene chloride resin compositions shaped to desired cross section, certain of the strands possessing inherent resilience and flexibility and certain of the strands possessing toughness and resistance to flexure fatigue, said strands being suitably compacted and maintained in compacted, substantially integral relation.

8. A stiffening material including elongated

bodies of vinylidene chloride resin composition of relatively small cross section and disposed in substantially parallel relation, at least one of said bodies being markedly flexible and resilient, and another of said bodies being a tough, tenuous, vinylidene chloride resin composition resistant to flexure fatigue.

9. A stiffening material including elongated bodies of relatively small cross section disposed in substantially parallel relation, at least one of said bodies being markedly flexible and resilient, and the other of said bodies being a tough, tenuous, vinylidene chloride resin composition resistant to flexure fatigue.

10. A stiffening material including a plurality of elongated rods disposed in substantially parallel relation suitably bound together, sized and shaped to provide an elongated body of relatively small cross section, one of said rods being markedly resilient, and another of said rods being markedly less resilient than the first mentioned rod, said second mentioned rod being tough and possessing inherent resistance to flexure fatigue, one of said rods being composed of synthetic resin.

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