

July 14, 1959

E. B. PIERSON ET AL

2,894,503

ARCHERY BOW

Filed Aug. 4, 1955

2 Sheets-Sheet 1

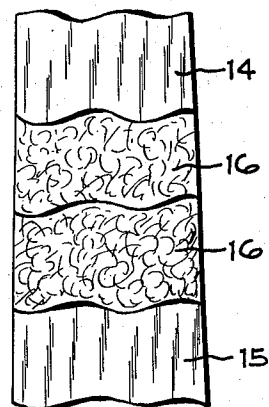
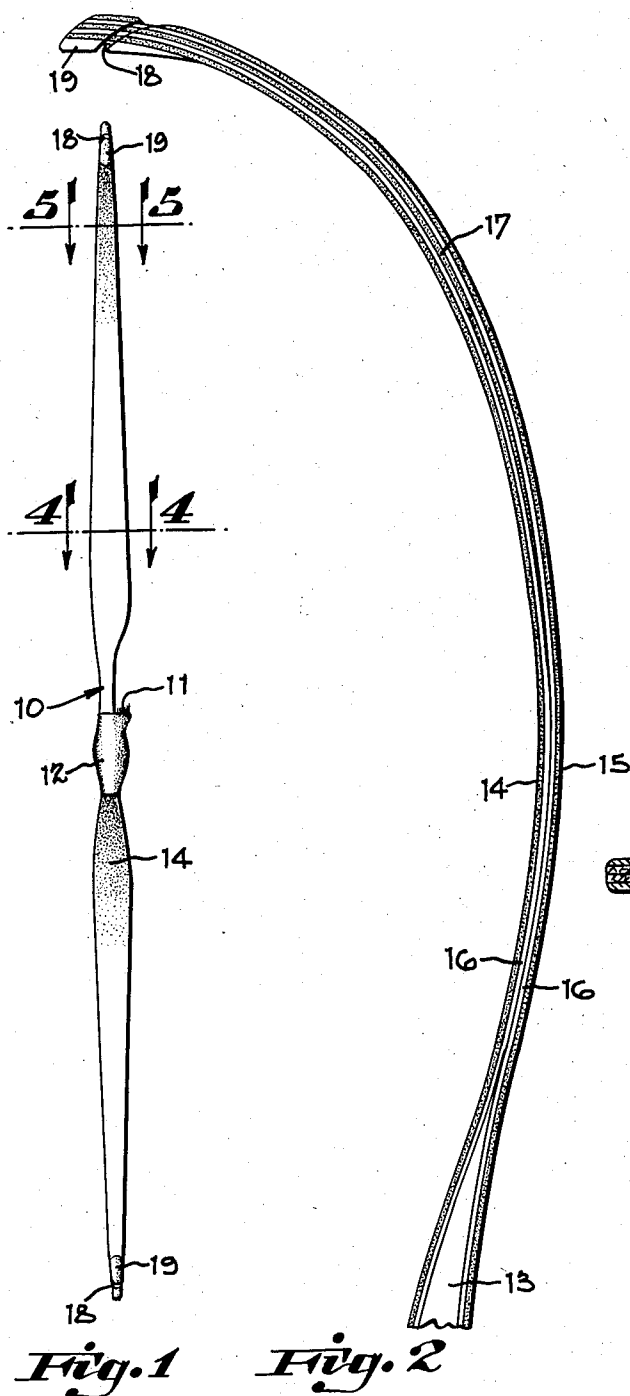


Fig. 3

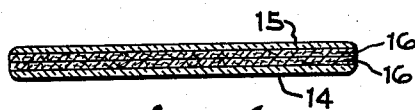


Fig. 4

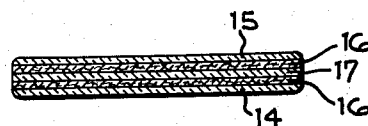


Fig. 5

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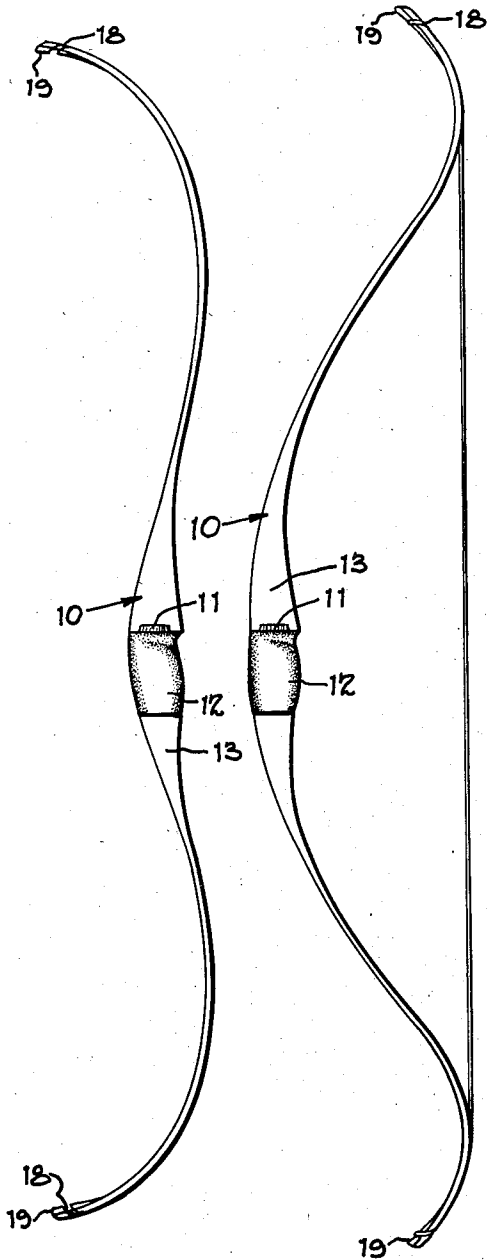


Fig. 6

Fig. 7

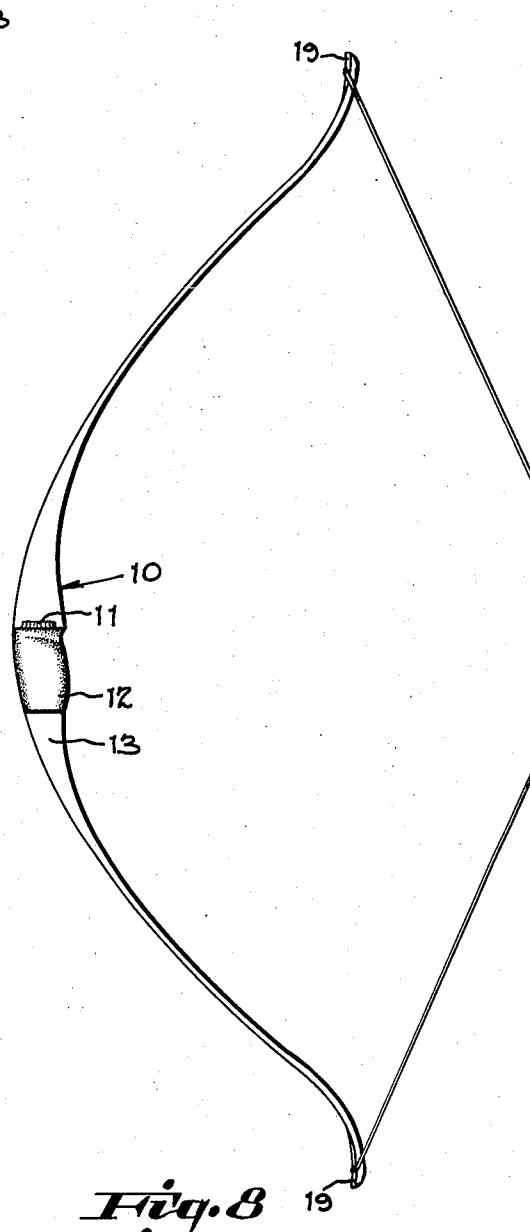


Fig. 8

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ARCHERY BOW

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Application August 4, 1955, Serial No. 526,453

3 Claims. (Cl. 124—23)

This invention relates to archery bows and particularly to a bow stave of improved construction. More particularly, the invention relates to an improved laminated bow stave construction and to the method of fabricating the improved bow stave.

Historically, the bow and arrow is one of the world's oldest weapons and was developed and used even by primitive peoples all over the known world. Before the advent of gun powder, the bow and arrow was used for hunting and for military purposes, but at present the bow and arrow is used primarily for sporting purposes, and great scientific ingenuity has been exercised in improving the quality of bows by refinement of design and utilization of presently available materials. Consequently, the bows which have been known and used in the past have been of varied structural design and have been fabricated from a wide variety of materials.

The bow of the present invention is constituted by an improved laminate which may be formed to provide any conventional or desired bow structure. However, the invention will be described particularly in relation to a pre-set working recurve bow.

As is well recognized in the art, when the bow string is drawn, the back of the bow is placed under tension and the belly of the bow is placed under compression. Hence, there is a tendency to shear the intermediate portion of the bow which resides between the back and the belly of the bow. It is also well recognized that the strength of the bow depends in part upon the spacing of the back section which is under tension and the belly section which is under compression. Hence, efforts have been made to fabricate laminates which were constituted by individual plies, each of which had the characteristics most desirable for the specific function of the ply. For instance, United States patent to Bear, No. 2,665,678, discloses a laminated bow having a Fiberglass back ply of the desired tension characteristics, a metallic belly ply of the desired compression characteristics, and a wooden core between them to absorb the shearing strains and to perform the spacing function.

The bow of the present invention comprises back and belly plies having the conventionally desired characteristics and a core between them which is particularly adapted both to maintain the necessary spacing of the outer plies and to absorb the shearing stresses. The core of the laminate of this invention comprises a mass of matted glass fibers embedded in synthetic resin. In place of the matted glass fibers, layers of woven glass cloth, preferably cut on the bias, may be employed.

The back ply of the laminae may be constituted by a strip of longitudinally oriented glass fibers embedded in synthetic resin or may be fabricated from any other equally desirable material. The belly ply may be made of any material adapted to withstand the compression; but, preferably the belly ply of the laminate is also constituted by longitudinally oriented glass fibers embedded in synthetic resin. In other words, we have discovered and determined that such materials withstand compression as

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well as tension and may be used for both outer plies of the laminate. Further, the ability of the belly side of the bow to withstand tension as well as compression is very important if the bow string snaps, in which case the tips of the bow fly forwardly with such momentum as to place the belly ply under tension and the back ply under compression.

If desired, nylon or Dacron fiber may be used in whole or in part in place of glass fiber in any of the plies of the laminate, except the core which requires the glass fibers to provide the desired multi-directional rigidity. Preferably, the resins employed in the construction of the bow of this invention are polyester resins throughout, but other resins having similar characteristics may be used. The plies of the laminate are held together by suitable glues and adhesives which are commonly used in the "plastics" industry. Regardless of the exact identities of the materials employed, the primary advantage of the bow of this invention is that the core of the laminate is constituted by fibers embedded in plastic or resin, the fibers being matted or extending in a plurality of directions whereby the core absorbs the shearing stresses to which it is subjected.

In the drawings:

Figure 1 is an elevational view showing the back of a bow, in strung condition, which incorporates the principles of the present invention.

Figure 2 is an enlarged fragmentary side elevational view of the upper limb of the bow shown in Figure 1.

Figure 3 is a fragmentary view of a part of the bow limb in which the laminate is broken away to illustrate the constituent plies thereof.

Figure 4 is a cross sectional view taken on the line 4—4 of Figure 1.

Figure 5 is a cross sectional view taken on the line 5—5 of Figure 1.

Figure 6 is a side elevational view of the bow showing it with the bow string removed.

Figure 7 is a side elevational view of the bow illustrating its configuration when strung.

Figure 8 is a side elevational view of the bow in drawn condition.

The bow which is shown in the drawings is a tournament model having a pull in the range of fifty to sixty pounds at twenty-six inches. The handle section of the bow designated generally at 10 is cut away to provide an arrow rest 11, which is closely aligned with the longitudinal axis. Following conventional practice, the handle section may be formed to provide a grip 12. The upper and lower limbs as shown in Figure 1 taper toward the two tips of the bow stave. Generally the limbs comprise a handle core 13, a ply 14 which is in the back of the bow, a ply 15 which is on the belly side of the bow, and, in the present instance, one or more plies designated 16—16 which comprise the core of the bow. In the preferred embodiment, the ply 14 is constituted by a strip of longitudinally oriented glass fiber embedded in synthetic resin. In the tournament bow illustrated this strip may be .065 inch thick. The ply on the belly side of the bow is also constituted by a strip of longitudinally oriented glass fibers embedded in a synthetic resin and it is slightly thicker than strip 15, being .080 inch thick. The core which is formed of matted glass fibers consists of one or more strips which are joined together and which taper slightly toward the two tips. Each strip is .155 inch thick adjacent to the handle and becomes progressively thinner in the limb area outwardly of the handle. In the ear area the two strips comprising the core are spaced, as shown, by a stiffening ply 17 which may consist of a strip of matted glass fiber or a strip of fiber glass of the same type employed at the belly side and back side of the bow.

The structure of the core of the bow of this invention is of particular importance. The core is constituted by synthetic resin which is reinforced with glass fibers which are matted, or felted, or woven together to extend in a plurality of directions. The fiber may constitute 30 to 75% of the total weight of the core. The resin should be of the type which is characterized by a very low cold-flow so that the core deforms no more than the bending of the bow necessitates.

Preferably, the back, belly and core of the bow are all constituted by strips of reinforced synthetic resin which are secured together by thermally set adhesive to constitute a laminate. Thus, the plies of the laminate are cemented together so securely that there is no greater tendency for shearing to take place at the interfaces of the plies than within the plies. Consequently, great shearing strain can be imposed upon the core without danger of shearing between the tension ply or the compression ply. It follows that a very rigid non-plastic core may be utilized, that is, a core which does not deform to absorb the stresses upon it and hence preserves the full efficacies of the tension ply and the compression ply. A hard polyester resin reinforced by matted fiber glass admirably satisfies these requirements.

In the initial fabrication of the bow stave a die is employed which conforms to the shape of the profile shown in Figure 6, with the exception that the die does not have the notch in it which is shown at the grip area, this being added at a later time. The strip of fiber glass which is to constitute the back 14 of the bow is laid down upon the die, then one of the two strips 16, which form the core, is laid on top of strip 14. The handle section 10 of the bow, which may be made of wood or other materials, following conventional practices, is then placed in the center of the die on top of the two strips previously described. The second one of the two core strips 16 is then laid, and if a stiffening ear section is desired, a ply such as the one shown at 17 is interposed between the two core plies. The belly ply 15 is then laid on top of the laminate thus formed. Before each ply is laid in place it is coated with suitable adhesive of the type commonly used in the plastic industry for bonding purposes. A mating die is then brought to bear upon the laminate, which is then subjected to a heat cure to set the adhesive and bond all of the plies into an integral stave blank.

The bow stave may be fabricated from reinforced plastics which have been heat-set or otherwise cured in the form of planar sheets or strips. In such case, the dies bend the materials to the desired form and the setting of the adhesive between the plies of the laminate preserves the configuration which the dies produce. In such case the ply of the laminate are under stress. Alternatively, the fiber and resin may be combined in the die and thermally set or cured therein to provide a bow stave of any desired configuration but characterized by no internal stresses.

After the heat cure the blank may be formed by means such as a band saw to provide the two tapers and the handle profile shown in the drawings. In addition, nocks 18 are formed, and the tips 19 applied; and, if desired, a cover of leather or other grip material may be affixed to the handle.

It will be noted from a comparison of Figures 6 through 8 that the curvature in the central handle portion conforms closely to the curvature of this section when the bow is drawn so as to reduce to a minimum the shear stresses which are placed upon the various plies of the laminate in the areas of the wooden core in the handle section. Actually, the plies of matted glass fibers in the limb portions of the bow become a single core during the curing operation so that the two limbs of the bow may be considered as consisting of only three plies, a back ply, a belly ply and a core. Furthermore, the ear stiffening strip 17 which is interposed between the

two strips 16—16 of matted fiber glass also becomes an integral part of the core so that from the point of view of structure the bow is a three-ply laminate throughout its working area, e.g. the essential feature being the provision of a three-ply laminate having a core in which fibers are disposed at random or extend in a plurality of directions.

As pointed out, the tension ply and the compression ply of the bow may be constituted by any desired materials which have the requisite, pertinent properties, provided these materials may be interfacially attached to the core in a manner which provides a very secure bond. However, it is preferable to constitute the bow limbs of all-plastic laminate for the reason that the ply may be secured together interfacially by known and commonly used plastic bonding cements which impart to the laminate the virtues of an integral structure insofar as shearing is concerned. Consequently, the reinforced plastic core may have a low cold-flow characteristic which could not be used if the danger of interfacial shearing were not precluded by the strength of the interfacial bond between the ply of the laminate. In other words, the strength of the interfacial bond of an all-plastic laminate permits utilization of back, belly and core materials, each of which approximates the ideal more closely than would be possible if the problem of interfacial shearing persisted. Thus, the bow stave of this invention combines the virtues of the integral bow stave and the laminated bow stave but without the disadvantages of either.

As pointed out, the bow staves of this invention may be pre-set with inbuilt tensions and compressions as is conventional in the fabrication of laminated bows, or the bow may be molded in final form from resins and reinforcing fibers so that there are no internal stresses in the finished bow. The latter type of fabrication is considered particularly desirable if the bow is a pre-set, working recurve bow.

Having described our invention, we claim:

1. An archery bow stave comprising a centrally located handle portion, limbs extending from said handle portion one on each side thereof, each limb comprising a laminate including a core constituted by a synthetic resin reinforced by glass fibers extending in a plurality of directions in relation to one another, and back and face strips on opposite sides of the core and attached integrally thereto, said strips constituted by synthetic resin having longitudinal and substantially parallel fibers imbedded therein to stiffen the same, the portion of said core adjacent to said handle being of greater thickness than the individual thickness of either said face strip or said back strip, whereby said core is effective to space said back strip and said face strip and resist shearing forces incident to the bending of said bow stave.

2. The archery bow stave of claim 1 wherein the glass fibers of the core are woven in the form of cloth.

3. The archery bow stave of claim 1 in which the longitudinal fibers reinforcing the back and face strips of the bow are glass fibers.

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