

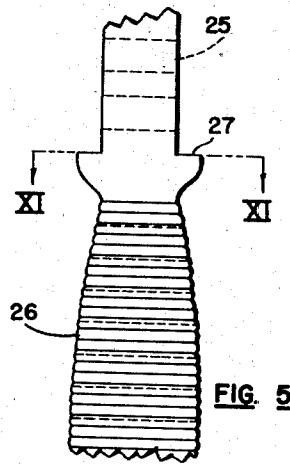
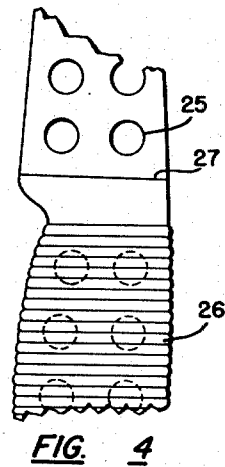
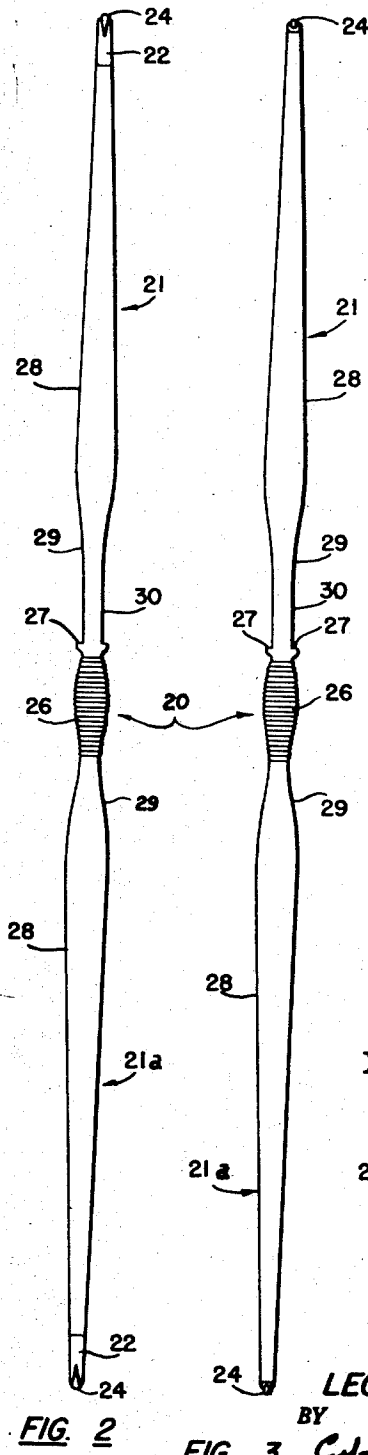
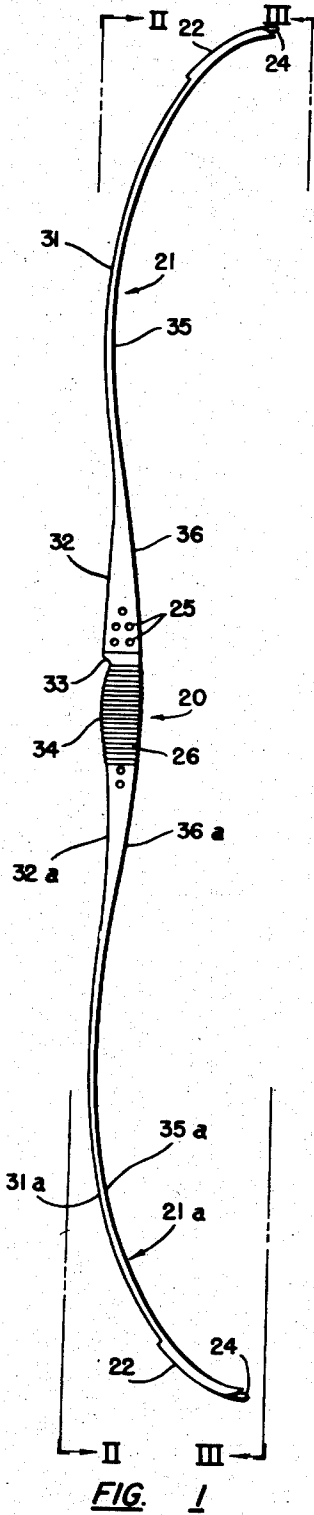
Sept. 21, 1954

L. S. MEYER
ARCHERY BOW

2,689,559

Filed May 15, 1952

3 Sheets-Sheet 1



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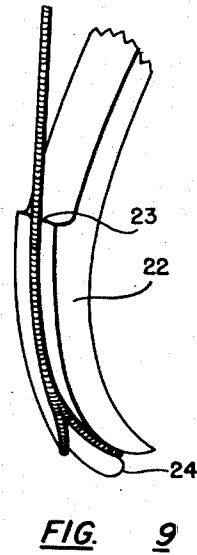
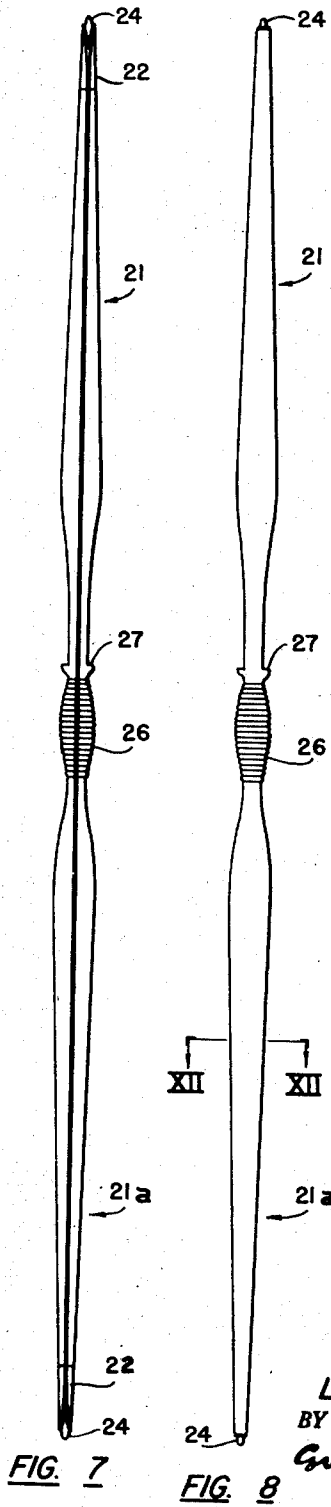
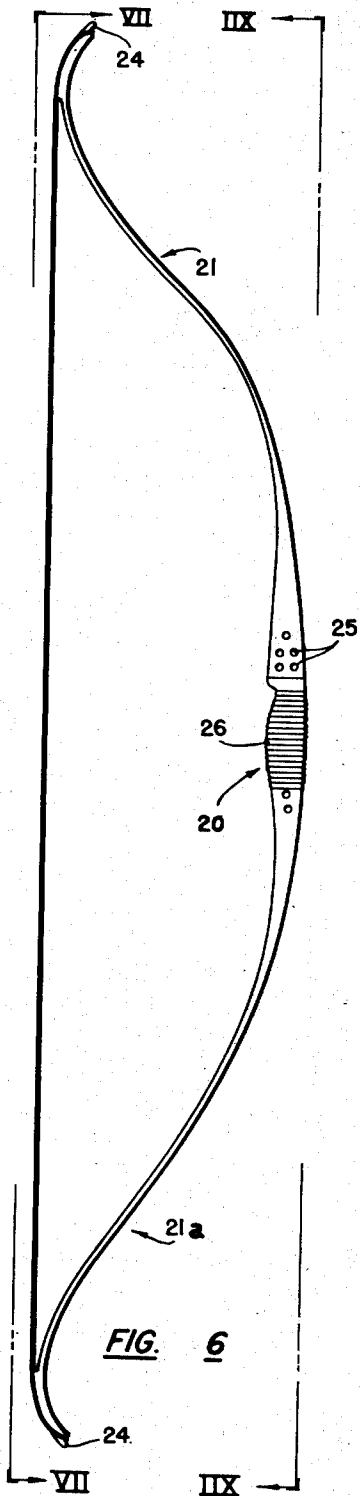
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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

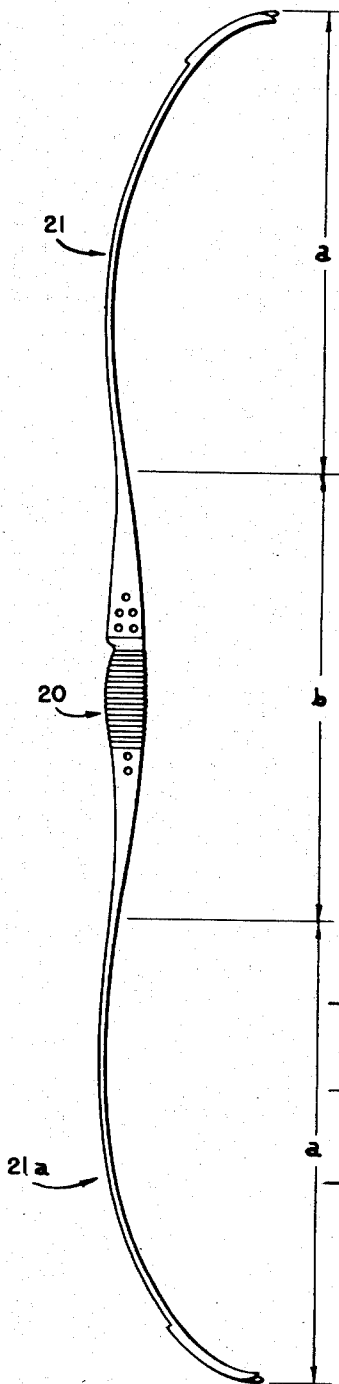


FIG. 10

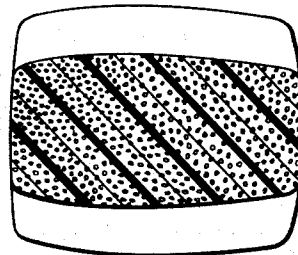


FIG. 11

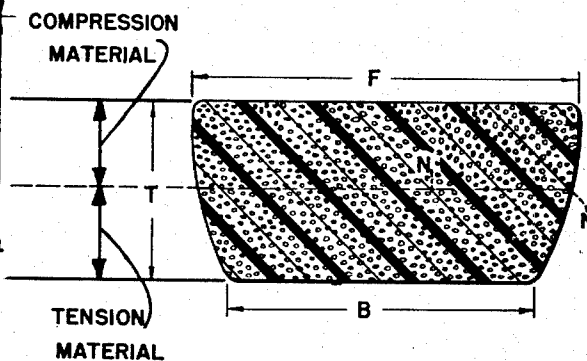


FIG. 12

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UNITED STATES PATENT OFFICE

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ARCHERY BOW

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Application May 15, 1952, Serial No. 287,835

9 Claims. (Cl. 124—24)

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My invention relates to an archery bow. It has to do, more particularly, with an archery bow which is molded as a single piece from fiber-reinforced plastic.

Archery bows have been formed in the past from a number of different materials such as wood, metal, etc. and these materials have also been used in laminated form in bows. It is very expensive and very difficult to form a proper bow from metal due to the inherent difficulties in fabricating metal. It is almost impossible to cast a good bow from metal and, consequently, good bows from metal must be formed by rolling or forging operations. The fatigue properties of metal, such as spring steel, are not too good. On the other hand, although it is fairly simple to fashion a bow from wood, such material has certain undesirable properties for a bow. It does not have sufficient elasticity; it is not sufficiently dense and, therefore, is easily marred or cut and has relatively poor fatigue strength (creep at high stress) and its properties vary with temperature changes which variation is undesirable in a bow.

I have found that an ideal material for forming an archery bow is fiber-reinforced plastic. I prefer to use a thermosetting resin and glass fibers or glass yarn. The bow can be molded from this material as a single unit. To obtain the most desirable results, the glass fibers are arranged parallel to one another and parallel to the longitudinal axis of the bow. In using a bow it is understood that the face of the bow (the side towards the archer) is in compression and the back is in tension. To compensate for this difference in forces, I use different types of resin at the face and back of the bow which are selected to more adequately resist the respective forces to which the face and back of the bow are subjected. Furthermore, the relative areas of the face and back of the bow are different to compensate for the difference in forces to which the face and back are, respectively, subjected. The design of each limb of the bow is such that vibration or shock waves are dampened when the bow is used and this is especially important with this reinforced resin material which has a high density. The glass fiber-reinforced plastic which I use in the bow does have a high density (usually 1.75) which is higher than any of the usual materials except metals which makes it extremely durable and prevents marring or cutting of the bow; it has a high strength-weight ratio; a high degree of elasticity; exceptionally good fatigue properties; exceptionally good and

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substantially uniform properties over a wide temperature range; and good color properties, the color extending completely through the material.

The preferred embodiment of my invention is illustrated in the accompanying drawings wherein:

Figure 1 is a side elevational view of a bow made according to my invention.

Figure 2 is a face view of the bow of Figure 1 taken substantially along line 2—2 of Figure 1.

Figure 3 is a back view of the bow taken substantially along line 3—3 of Figure 1.

Figure 4 is an enlarged side view of the center section of the bow showing part of the hand grip and the associated arrow rest.

Figure 5 is a back view of the structure of Figure 4.

Figure 6 is a view similar to Figure 1 but showing the string in place on the bow.

Figure 7 is a face view of the bow taken along line 7—7 of Figure 6.

Figure 8 is a back view of the bow taken on line 8—8 of Figure 7.

Figure 9 is an enlarged view of one of the string nocks and brush nocks on the end of the bow.

Figure 10 is a diagram showing the arrangement of the different types of resin in the bow.

Figure 11 is a transverse section taken substantially along line 11—11 of Figure 5.

Figure 12 is an enlarged transverse section taken along line 12—12 of Figure 8.

The bow of my invention is formed in the shape shown in Figure 1. It is molded in this shape in a mold under pressure. The materials used, as indicated, are reinforcing fibers and resin. The fibers are preferably, of glass and are disposed longitudinally of the bow substantially parallel with the longitudinal axis thereof. The arrangement of the glass fibers embedded in the resin is illustrated in Figure 11. The resin which I preferably use is of the polyester type.

It will be noted from Figures 1 to 3 that the bow is molded with the central heavy center handle section 20 and with the two oppositely extending limbs 21 and 21a.

The limbs 21 and 21a are each of modified S shape so as to dampen vibration and shock waves when the bow is used, it being understood that each limb functions as a cantilever beam and the more complicated the shape of the beam, the less vibration there will be transmitted to the handle section 20. This is especially important with the high density material of which my bow is composed, the density being at least 1.75. The bow is of the shape shown in Figure 1 before the

string is applied thereto. At the outer end of each limb 21 and 21a of the bow there is formed an integral string and brush nock 22 which functions in the usual way. This nock is shown best in Figure 9, being in the form of a bulge which is formed on the face side of the limb of the extreme end thereof and having a straight string channel or groove 23 extending the length thereof and merging with a Y-shaped channel at the extreme end thereof where the string loop is to fit over the retaining projection 24.

The central handle section 20 is of heavy rigid construction but is provided with transverse holes 25 to reduce weight. This section is shaped to fit the hand and may be wound with suitable tape or material 26 for a hand grip. Directly above the hand grip there are formed on the right and left hand sides of the bow, the ledges or shoulders 27 which form arrow supports so that the bow can be used by a right or left handed archer. It will be noted from Figures 2 and 3 that the sides 28 of each limb 21 and 21a of the bow are straight and are not parallel but converge towards the outer end thereof. As the sides of each limb 21 and 21a approach the central section 20, they converge as indicated at 29. Directly above the arrow rests 27, the converging sides of the upper limb continue as straight and parallel surfaces as indicated at 30 to provide substantially flat guide surfaces with which the sides of arrows may contact when they are resting on the ledges 27. The sides of the lower limb 21a are exactly the same as those of the upper limb 21 except that the straight arrow guide surfaces 30 are not provided below the hand grip 26.

Before flexing the bow to apply the string, it is in the shape shown in Figure 1; at this time the face side of the upper limb includes the continuous convex curve 31 which joins with the reverse or concave curve 32 which terminates at a shoulder 33 directly above the hand grip 26, the shoulder aiding in preventing slipping of the bow downwardly through the hand. The face side of the lower limb 21a is similarly formed with the convex curve 31a which merges with the concave curve 32a that merges with the convexly curved face surface 34 of the hand grip 26. The back surface of the limb 21 is provided with a continuous convex curve 35 which will be parallel with the curve 31 and which will merge with a reverse curve 36 that merges into the hand grip 26. It will be noted that since the curves 31 and 35 are substantially parallel, the other part of the limb 21 is fairly thin and, therefore, very flexible. On the other hand, the curves 32 and 36 are not parallel but diverge so that the thickness of the limb increases towards the hand grip 26. However, there is a gradual increase in thickness so that there is a gradual decrease in flexibility to the rigid handle section. The back surface of the lower limb 21a is similarly formed with the continuous curve 35a that merges with the intercontinuous curve 36a that joins with the hand grip 26.

When the string is applied to the bow, it is applied in the manner illustrated in Figures 6 to 9 inclusive. The limbs 21 and 21a are bent reversely from the positions shown in Figure 1 and the loops of the string are slipped over the projections 24. The limbs 21 and 21a will then be retained in this reversely bent position, the string lying in the grooves 23 formed in the nocks 22.

It will be understood that the face side of the

bow when in use will be in compression while its back side will be in tension. For this reason I use different types of resin at the face and back of the bow. At the back, which is in tension, I employ a flexible polyester resin. This polyester will have sufficient extensibility to prevent local cracking during flexure. The back of the bow, which is in tension, is made with a resin which has substantially the same ability to elongate or stretch as the fiber used. In the case of glass fiber the resin used would be designed to have a minimum of 3% elongation. In other words, it will elongate up to a certain amount then come back to its original condition, that is, it will have sufficient elasticity. A suitable resin for this purpose is a blend of Paraplex P-13 plus Paraplex P-43 (which are blends of alkyds and monomeric styrene), for example, 85 parts Paraplex P-43 to 15 parts Paraplex P-13, which are made by The Resinous Products Division of Rohm and Haas Company. On the other hand, at the face, which is in compression, I have found that it is desirable to use a rigid polyester resin which will have greater compressive strength. A suitable rigid polyester resin is composed entirely of Paraplex P-43. The compressive strength of this type of resin can be increased by the use of an inert mineral filler, such as calcium carbonate to about 30% by weight based on the resin. The central section 20 may be of one type of resin preferably that type which will have the greater compressive strength.

The arrangement of the different types of resin in the bow is illustrated by the diagram in Figures 10 and 12. In Figure 10 the end sections indicated by the arrows designated a will be of the two different types of resins. The center section extending throughout the length indicated by b will be of the one type of resin, that is, that type suitable to resist compression.

Throughout the lengths a, the different types of resin will be used at the face and the back of each limb. In Figure 12 the thickness of the limb is indicated by the letter T. The flexible polyester and rigid polyester resins are so arranged that the compressive material will vary from 50 to 75% of T while the tension material will vary from 25 to 50% of T being on opposite sides of the neutral axis N, whose position will vary depending upon the relative amounts of compressive and tension material. In addition, the cross-section of the limb is so shaped that the face has increased compressive strength. The area of the face is greater than that of the back. For example the width of the face is indicated by the letter F in Figure 12 is greater than that of the width of the back which is indicated by the letter B. For example the distance B may be x and the distance F, x plus 10%. Thus, three factors are used for compensating for the fact that this type of resinous material inherently has less compressive strength than tensional strength. These three factors are the use of different types of resins, the use of mineral filler in the face resin, and the increased area at the face.

It will be apparent that the bow made according to my invention will have better characteristics than bows made either of wood or metal. The improved characteristics are not only due to the use of fiber reinforced resin but are also due to the shape of my bow.

Having thus described my invention, what I claim is:

1. An archery bow formed entirely as a single unit consisting solely of thermosetting resins of

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different polyester types reinforced with glass fibers which extend longitudinally of the bow substantially parallel with the axis thereof, said bow having oppositely-extending flexible limbs, each limb of the bow consisting of a rigid polyester resin at the face reinforced with the longitudinally extending glass fibers to more effectively resist compression and a flexible polyester resin at the back reinforced with the longitudinally extending glass fibers to more effectively resist elongation.

2. An archery bow according to claim 1 wherein the compression resin forms 50 to 75% of the cross-sectional area of the bow limbs and the flexible resin forms 25 to 50% of the cross-sectional area of the bow limbs.

3. A bow according to claim 2 wherein the face of each bow limb is of greater area than the back thereof.

4. A bow according to claim 3 which comprises a central heavy handle section and the opposed flexible limbs.

5. A bow according to claim 4 wherein each limb comprises a relatively thin flexible outer portion which is joined to the heavy handle section by means of a portion which gradually increases in thickness.

6. A bow according to claim 5 wherein brush nocks are formed integral on the faces of the outer ends of the limbs.

7. A bow according to claim 6 wherein arrow

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rests are molded on each side surface of the central section above the hand grip thereof.

8. A bow according to claim 7 wherein the heavy handle section is provided with transverse openings to reduce weight.

9. A bow according to claim 4 wherein the opposed limbs are of substantially S form in side elevation.

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