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E. SOLLID

2,361,068

ARCHERY BOW

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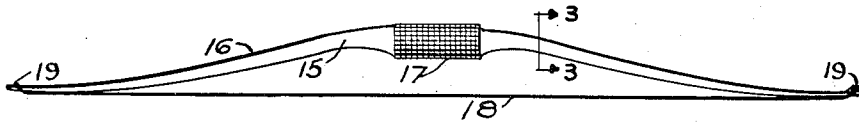


FIG 1

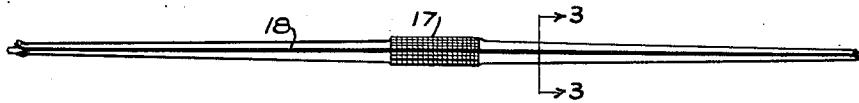


FIG 2

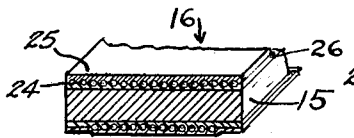


FIG. 5

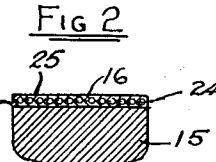


FIG 3

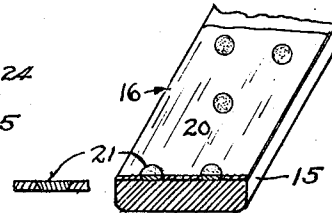


FIG. 4

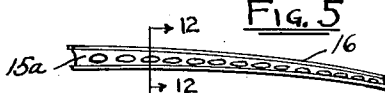


FIG 11

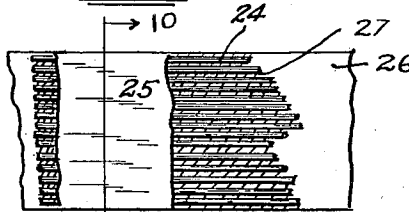


FIG 6

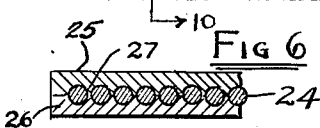


FIG 10



FIG 9

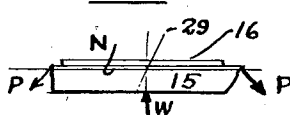


FIG. 13

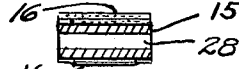


FIG. 12

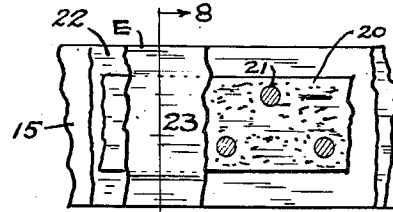


FIG. 7

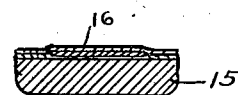


FIG 8

ERIK SOLLID
INVENTOR.

BY

Martin E. Anderson
ATTORNEY

UNITED STATES PATENT OFFICE

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ARCHERY BOW

Erik Sollid, Denver, Colo.

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7 Claims. (Cl. 124—23)

This invention relates to improvements in archery bows.

Bows for archery are, as a rule, constructed almost entirely from some tough, straight grained wood, such as yew or hickory, and are carefully shaped. The backs of the bows are formed from the white wood which is the toughest, while the convex or belly sides are formed from the heart wood which is the least flexible, but the most resilient. The bows are nearly always formed with a handgrip which is quite rigid, and from which the limbs extend in opposite directions forming cantilever beams. The backs become quite convex when the bows are bent in shooting and tend to fail due to the breaking of the fibers and eventually splitting. And this is true even when the greatest care is taken to have the surface of the back exactly follow the grain.

It is evident that if bows could be so constructed that the wood would all be under compressive strain while the tensional strains would be resisted by a metal member secured to the back there would be little tendency for the fibers to break or split.

It is also well understood that the lighter the limbs are, other things being equal, the better the bows, heavy limbs have a corresponding amount of inertia and momentum, both of which are objectionable.

It is an object of this invention to produce a bow that will have a greatly increased driving power per unit weight.

Another object is to produce a bow of such construction that the greater portion of the wood will be under compression when the bow is bent.

A further object is to produce a backing that can be applied to bows either during the manufacture or any time thereafter, and which can also be used in connection with other articles of manufacture.

I am aware that patents have been granted for bows having backs provided with some tough material, such as animal skin, sinew, bark, and silk fibers, which, no doubt, were important advances. All of the materials mentioned are quite extensible and their moduli of elasticity are quite small and as a result they are not very effective in moving the neutral axis towards the backs of the limbs. If the backing material has a large modulus of elasticity compared to the wood to which it is attached, it causes the neutral axis to move toward the rear of the limbs and increases the areas under compression. If the backing were formed from material having a modulus of infinity, then all of the wood would be under compressive strains.

This invention, broadly expressed, consists in a bow having a backing of steel whose modulus of elasticity is about 30,000,000 pounds per square inch compared to about 1,500,000 pounds per

square inch for yew or hickory, or some alloy having a similarly high modulus. With a backing having such a high modulus of elasticity compared to the wood, the latter is put almost entirely under compression. In any event the neutral axis moves so close to the back that the tensional strains in the wooden portion of the bow become negligible.

A still further object of the invention is to produce a metallic tension or compression bow backing member having its surface treated or processed in such a way that it will form a close bond with a suitable adhesive such as glue or other cement suitable for the purpose.

The above and any other object or objects that may appear as this description proceeds are attained by means of a construction and an arrangement of parts that will now be described in detail and for this purpose reference will be had to the accompanying drawing in which the invention has been illustrated, and in which:

Figure 1 is a side elevation of a bow constructed in accordance with this invention;

Figure 2 is a front plan view of the bow;

Figure 3 is a section taken on line 3—3 Figures 1 and 2;

Figure 4 is a view, partly in sections showing a metal backing in place on the bow, and illustrates a modified form of the invention;

Figure 5 is another cross section showing a further modification;

Figure 6 shows a short length of a bow in rear surface plan view, parts being broken away to better disclose the construction;

Figure 7 is a view similar to that shown in Figure 6 and shows a modification;

Figure 8 is a section taken on line 8—8 Figure 7 similar to that shown in Figure 3, and shows the bow provided with a backing like that shown in Figures 7 and 9;

Figure 9 is a section through the backing assembly shown in Figure 7, and shows the parts to a somewhat enlarged scale;

Figure 10 is a part section through the backing assembly, taken on line 10—10 Figure 6;

Figure 11 is a side elevation of a bow limb constructed in a manner similar to that shown in Figure 5;

Figure 12 is a section taken on line 12—12 Figure 11, and

Figure 13 is a stress-diagram.

In the drawing reference numeral 15 designates the bow proper, which may be made of yew, hickory or any other suitable wood or of some plastic material, and 16 designates the backing which will be described hereinafter in detail. The hand grip has been designated by numeral 17 and the string by 18. The ends are provided with suitable notches or shoulders 19 for forming an attachment with the bow string.

In the drawing several specifically different forms of backing have been illustrated. The simplest being the one illustrated in Fig. 4. A steel plate 20 of substantially the width of the bow and of a thickness of about .018 of an inch or thinner, extends the entire length of the bow to which it is secured by glue or other suitable adhesive. The inner surface of the plate has its surface roughened either by some mechanical means or by etching with a suitable chemical. The reason for roughening the surface is to effect a better bond between the backing and the wood of the bow. If an adhesive is found that makes a satisfactory bond with the smooth metal surface the roughening may be omitted. In addition to having its surface roughened the metal strip may be provided with several holes 21, which may be filled with the adhesive, or fiber plugs may be inserted in the holes. The fiber having the property of forming a strong bond with the adhesive. The holes may have inclined walls if desired. Instead of steel some other suitable metal having the necessary modulus of elasticity may be employed. Any of the alloy steels are suitable, and such other alloys as beryllium copper.

When the bow is bent the backing is subjected to a high degree of tension, and there naturally results a shear stress between the wood and the metal that must be resisted by the adhesive. Since the metal backing has such a high modulus of elasticity it is evident that it is not intended to stretch to any appreciable extent, but to resist tensional forces tending to stretch it, wherefore the wood portion 15 will be compressed. Reference will hereinafter be made to Fig. 13, where the stresses will be explained more fully.

Although the backing shown in Fig. 4 is the simplest it is rather difficult to obtain the necessarily strong and reliable bond and for this reason it is desirable to enclose the metal strip in an envelope, or covering, comprising material that will form a strong bond with the adhesive.

In Fig. 7, a section has been shown, to an enlarged scale, in which a metal strip 20 is laid on a strip 22 of thin fiber, strong paper, woven fabric, wood veneer or plastic. Strip 22 is wider than the metal strip and the latter is covered with a layer 23, of similar material to strip 22. The three pieces being secured to each other by glue or some other adhesive.

It will be observed that since the layers 22 and 23 are wider than the metal strip and the latter is positioned centrally thereof the edges E, are in contact with each other thus forming an envelope.

When a backing like that illustrated in Figs. 7, 8 and 9 is glued to the back of a bow, a good bond will be had because both surfaces are well adapted to coat with glue or other adhesive. When a back like that just described is glued to the back of a bow the shear stresses will be resisted by the adhesive on both sides of the metal strip 20 and also by the adhesive between the bow and strip 22. With this construction, failure due to the separation of the parts is avoided.

It is well known that cold drawn wire, such as "piano wire" has a greater tensile strength per unit area than rolled metal and besides this it is somewhat more flexible. A layer of wire may be substituted for strip 20 in the embodiment shown in Figs. 7, 8 and 9.

In Figures 3, 5, 6 and 10 a backing employing a layer of fine wires 24, has been illustrated. In the drawing the wires have been shown of consider-

able diameter so as to make it practical to show them clearly, but the diameter may be very small and may be selected so as to obtain the best results. The wires are positioned between two layers 25 and 26 of suitable fibrous material such as mentioned above. The parts being joined to each other by glue or other suitable adhesive. The parts being subjected to pressure of sufficient intensity to cause the fibrous material to conform to the shape of the wires as shown most clearly in Fig. 10. It is contemplated to employ for the layers 25 and 26 thin strips of wood cut parallel with the fibers. These strips are steamed or softened by urea or other means, and subjected to pressure during the gluing operations whereupon the wood will shape itself to conform to the surface of the wires. It will be observed that the wires are spaced sufficiently to allow the wood surfaces to come into contact along lines 27.

When a backing like that shown in Figs. 6 and 10 is used, good bonds are assured as glue co-operates very well with wood. The surfaces of the wires may be roughened as above explained.

In some instances it may be desirable to provide the bow limbs 15 with holes 28 and to provide the inner surface with a backing strip for resisting compression. Such a construction is indicated where a cheap soft wood is employed or where the bow is made of a plastic material like that indicated by 15a in Fig. 11.

In Fig. 13 the stress line 29 shows that when the body 15 is subjected to bending forces P, resisted by an opposing force W the tension will be resisted almost entirely by the backing strip and the entire body of the wood portion will be subjected to compression. The neutral axis N will be positioned either between the bow and the backing or so close to the back of the wood 15, that the tensional stresses in the wood are negligible.

Instead of using only a single layer of wires the backing may have two or more layers as shown at 16 in Fig. 12. This will cause the neutral axis to move further towards the back than if only one strip is used.

Whenever the word "glue" is employed it is used in its broad sense as an adhesive and is intended to cover all suitable adhesives.

The word "plastic" is used in its present sense as referring to a synthetic product such as synthetic urea formaldehyde and any other suitable plastics now available or to be hereafter discovered.

When a construction like that shown in Figs. 5 and 11 is employed the body may be of any suitable material and wood having cross grains and knot holes can be used. Steel is believed to be highly suitable for this purpose and has therefore been used as an example and the modulus of elasticity has been given for comparison. Any metal having a higher modulus of elasticity than the body embodies the invention but the best results are obtained when the metal is similar to steel in this respect.

When the bow is made of wood or of a synthetic plastic the wires or the metal strip may be secured directly to the back of the body, as shown in Fig. 4, and if desired a cover like 23 can then be secured in place.

Having described the invention what I claim as new is:

1. An archery bow having an elongated body, a continuous steel tension member extending the entire length thereof, adhesively secured to the back of the body along its entire length, and a

covering of fibrous material for the tension member, adhesively secured thereto and to the body.

2. An archery bow having a wood body and a continuous steel tension member extending the entire length thereof, said tension member comprising a steel element embedded in and adhesively secured to a covering of fibrous material, the tension member extending substantially the entire length of the bow and adhesively secured to the back thereof throughout its entire length.

3. An archery bow having a wood body and a continuous metal tension member extending substantially the entire length of the bow and adhesively secured thereto throughout its entire length, the metal having a modulus of elasticity of approximately twenty times that of the wood, and a covering of fibrous material for the tension member, adhesively secured thereto and to the bow.

4. A backing for a wooden archery bow comprising a continuous metal tension member embedded in and adhesively secured to a covering of fibrous material.

5. A backing for a wood archery bow comprising a continuous steel ribbon embedded in and adhesively secured to a covering of fibrous material.

6. A backing for an archery bow comprising a continuous metal tension member embedded in and adhesively secured to a covering of fibrous material.

7. An archery bow having an elongated body, a continuous steel tension member extending the entire length thereof, adhesively secured to the back of the body along its entire length, and a covering of shear transmitting material adhesively secured thereto and to the body.

ERIK SOLLID.