United States Patent

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[54] **ARROW SHAFTS WITH PLASTIC VANES AND METHODS OF FLETCHING**
11 Claims, 13 Drawing Figs.

[52] **U.S. Cl.** ..... **273/106.5 C**

[51] **Int. Cl.** **F41b 5/02**
[50] **Field of Search** ..... 273/106.5, 106.5 C

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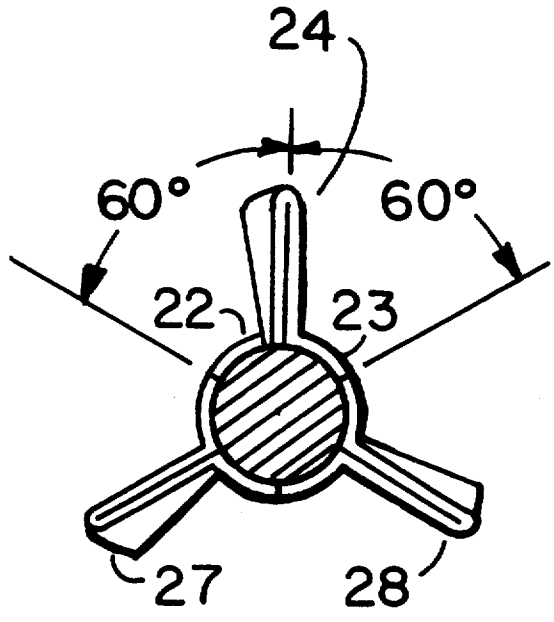
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Primary Examiner—Richard C. Pinkham
Assistant Examiner—Paul E. Shapiro
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ABSTRACT: An archery arrow is equipped with vanes made from a sheet of adhesive backed plastic material, each vane being formed from a section of a sheet of adhesive backed plastic material which is folded, so that both sides of the fold are bonded together by the adhesive, except for strips at the ends thereof, by which the section is bonded to the arrow shaft, thereby providing vanes which are sufficiently flexible to bend and sufficiently resilient to return to shape after bending due to aerodynamic and mechanical forces normally encountered when the arrow is used.

The strips at the end of the folded sheet form flaps. The flaps of adjacent vanes are placed in abutting relationship so that when N vanes are used each vane subtends an arc of 360°/N about the periphery of the arrow shaft. The method of making and affixing the vanes includes the steps of cutting a section from a sheet of plastic material having an adhesive on one side, protected by a nonadhesing backing; removing the center portion of the backing to leave two edge strips; folding the section along the edges of the two strips to form flaps; folding the section along its centerline with the adhesive side in to form a double thickness vane; removing the remaining edge strips of backing and securing the vane to the arrow shaft.



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SHEET 1 OF 2

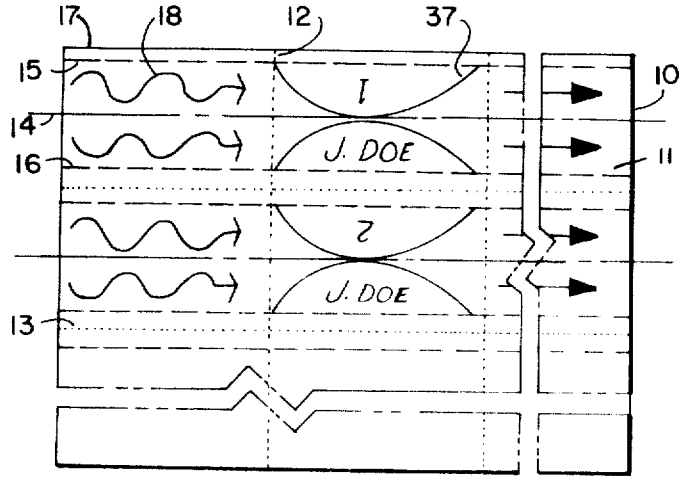


FIG 1

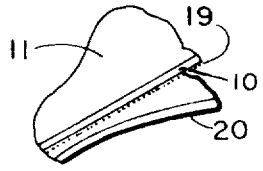


FIG 2

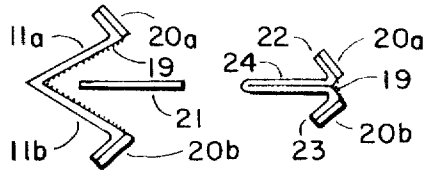


FIG 6 FIG 7

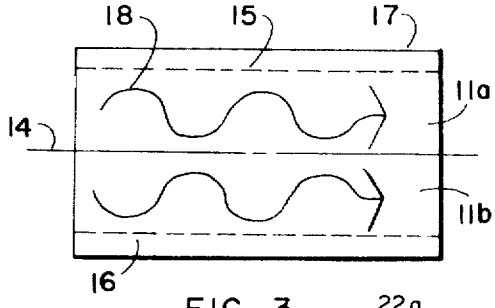


FIG 3

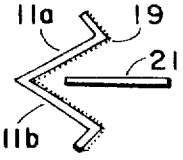


FIG 4

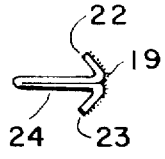


FIG 5

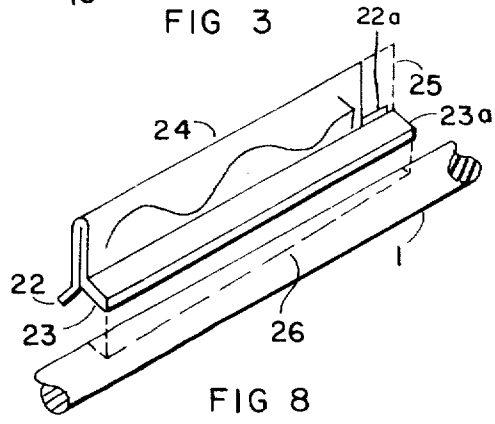


FIG 8

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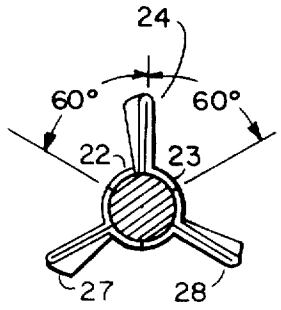


FIG 9

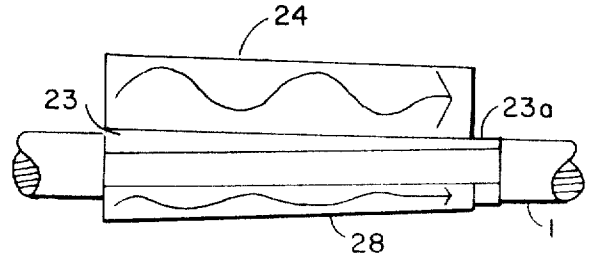


FIG 10

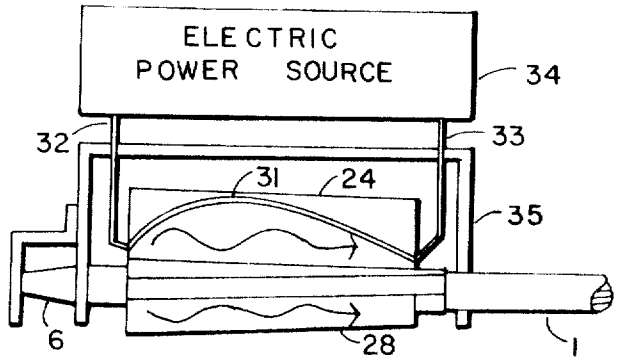


FIG 11

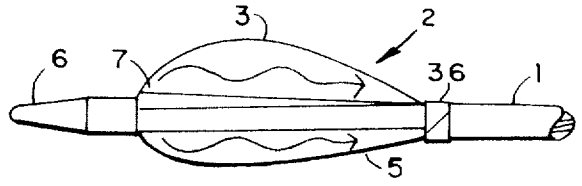


FIG 12

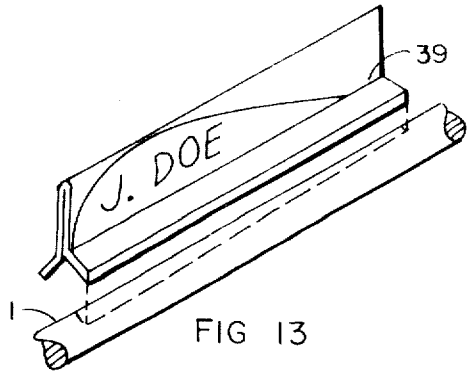


FIG 13

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ARROW SHAFTS WITH PLASTIC VANES AND METHODS OF FLETCHING

This invention relates to methods and means for making archery arrows, and particularly to the fletching of archery arrows.

Heretofore, fletching for archery arrows has been made of feathers and a number of materials which have been substituted for feathers. For example, it has been suggested that the arrow fletching or vanes be made of plastic materials, which are molded into the shape of the vane and then attached to the arrow shaft. Some of the plastic materials that have been suggested include celluloid, polyethylene, vinyl chloride, vinyl acetate. It has been the practice to cut or mold the vane from such plastic material and to mount the vane to prepared slots or devices on the arrow shaft.

One purpose of using the plastic feather substitute is to provide a vane which is mechanically tougher than the feather and is not affected by environmental conditions such as moisture, temperature, etc., as is the feather. The feather substitutes used in the past are superior to the feather in these respects, however, they are not sufficiently flexible or resilient and in some cases must be located on the shaft so that they will not strike the plate or ledge on the archer's bow, when the arrow is launched. If the rigid vane strikes the plate or ledge on the bow when the arrow is launched, the arrow is deflected excessively and the flight of the arrow is not true.

Accordingly, it is one object of the present invention to provide archery arrow fletching which has all the advantages of plastic fletching employed heretofore and in addition is sufficiently flexible so that the vanes bend substantially from aerodynamic and mechanical forces which normally occur when the arrow is launched into flight and which is sufficiently resilient so that after bending, the vanes return to their original shape rapidly.

It is another object of the present invention to provide method and means for fletching archery arrows that does not require slots in the arrow shaft or other devices attached to the arrow shaft to which the fletching vanes are attached.

It is another object of the present invention to provide simple and inexpensive arrow fletching which is mechanically tougher and more moisture resistant than feathers.

It is another object of the present invention to provide methods and means for fletching arrows, with personalized designs on the fletching.

It is another object to provide methods and means for fletching arrows by an archer in the field.

Other features and objects of the present invention will be apparent from the following specific description taken in conjunction with the figures in which:

FIG. 1 is a planned view of a sheet of plastic material from which the fletching vanes are formed;

FIG. 2 shows a section of the plastic material revealing the adhesive and paper backing;

FIG. 3 shows a section cut from the sheet of plastic material for forming an archery arrow vane;

FIGS. 4 and 5 illustrate steps in folding the section to form a vane;

FIGS. 6 and 7 illustrate alternate steps in folding the section to form a vane;

FIG. 8 illustrates how a vane is attached to the shaft;

FIG. 9 illustrates an end view of the shaft, showing three such vanes attached;

FIG. 10 illustrates a side view of the shaft, showing three such vanes attached;

FIG. 11 illustrates one method of shaping the vane;

FIG. 12 illustrates the completed fletching; and

FIG. 13 illustrates an alternate method whereby the vane is shaped before attaching to the shaft.

In accordance with the present invention, the arrow fletching or vanes are made of a flexible plastic material of selected type and thickness such that the vanes will flex substantially due to aerodynamic forces experienced by an archery arrow in flight. Thus the vanes will deform readily when subject to mechanical forces such as occur when the vanes strike the ledge or arrow plate on the archer's bow, and so the arrow will not be deflected substantially from its proper course when this occurs. Another important quality of the material is that it is quite resilient, so the vane return to its original shape immediately after deflecting due to the aerodynamic forces normally experienced in the flight of such an arrow. This return to shape is so rapid that the bent vanes do not alter the flight of the arrow to any observable extent and in fact the arrow flies flatter than an arrow fletched with feathers. In addition, the vane is designed so it can be attached or fletched to the arrow shaft and does not require an accommodating slot or fixture on the arrow shaft by which to attach the vane to the shaft.

FIG. 12 illustrates one end of an archery arrow shaft 1 to which are attached the fletching 2 consisting of three plastic vanes 3, 4, and 5, symmetrically arranges on the shaft and the nock 6 at the end of the shaft, which is engaged by the bowstring when the arrow is launched.

The fletching vanes 3, 4 and 5 in FIG. 11 are each attached to the shaft 1 by a pair of flaps on each vane, such as flap 7 on vane 3. One suitable way of fastening the flaps to the shaft is to bond them with an adhesive or a cement. The flaps are preferably extensions of the vane and are bonded to the shaft 1 so that the flaps on each vane are symmetrical relative to the plane of the vane. This insures not only proper fastening but the support of the vane by the flaps and fixes the normal vane position with the plane of the vane substantially defined by radial lines from the shaft.

The plastic material from which the vanes are made is preferably sufficiently flexible so that the vanes will bend easily when subject to the normal aerodynamic and mechanical forces which occur when the arrow is launched. Thus, when the vanes encounter the bow they will not deflect the arrow. In addition, the vanes must be resilient so that after deflection they rapidly return to their normal position to provide proper aerodynamic guidance of the arrow in flight. This is insured if the plastic material is a polyester film such as Scotchcal and the total thickness of a vane is on the order of 0.004 to 0.020 inches.

Scotchcal is a product of Minnesota Mining and Manufacturing Company identified more generally as a photosensitive polyester film, which is a thermosetting resin that is tough, flexible, and resilient and moisture proof. Thus, Scotchcal quite readily meets the objectives of the present invention and provides archery arrow fletching having substantial advantages over other plastic fletching used in the past and over the turkey feather fletching that is so well known. For examples, the Tensile modulus of Scotchcal, which is a measure of its resilience is 5 to 10 times greater than that of a thermoplastic resin and the tear (initiation) strength of Scotchcal which is indicative of its flexibility, is approximately 2,000 lbs./in.

A few other plastic materials having tensile modulus and tear initiation strength comparable with Scotchcal, could be used and provide some of the advantages of Scotchcal to arrow fletching. Thermoplastic resins in this category include polystyrene, polymers, copolymers and polypropylene, and thermosetting resins in this category include Dupont's Mylar, Melamide, and silicone cast resins.

None of the plastic materials used in the past for arrow fletching have been entirely satisfactory because when vanes of sufficient strength have been made from these materials, the vanes would not be sufficiently resilient. Thus, it has been necessary in the past to place the plastic fletching vanes on the shaft at positions so designed that they would not strike the bow when the arrow is launched and these positions are invariably less desirable from an aerodynamic standpoint.

Another advantage of a polyester film is that it can be made in thin sheets which are photosensitive, and so individual and personalized designs can be made on a sheet of polyester film,

from which the fletching is formed, so that these designs decorate and identify an individual's arrows.

Turning next to the FIGS. 1 through 13, there is shown a number of views depicting the steps in fletching an arrow, to provide the fletching 2 consisting of the vanes 3, 4 and 5, shown in FIG. 12.

The process or method of fletching the arrow shaft 1 can begin with a sheet 10 of, for example, Scotchcal, such as shown in FIG. 1. The photosensitive side 11 of the sheet is first exposed to images and then developed to provide the series of designs and lines such as shown in FIG. 1. The dotted lines, such as 12 and 13, define a series of equal size rectangles on the sheet, each of which is a section from which a single vane is made. The dot-dash lines 14 define the centerline of each section and the dash lines, such as 15 and 16, define folding lines, the purpose of which will be discussed below.

In each of the sections of the sheet 10, such as section 17, designs are produced on each side of the centerline 14. These designs such as the serpentine arrow 18 may be decorative and/or personalized to indicate the owner of the arrow or the club to which the owner belongs, etc.

The sheet 10 is preferably adhesive backed, with an adhesive such as 19 on one side, covered with protective backing paper 20 which does not bond to the adhesive and peels off readily.

After forming the lines and images on the sheet 10, the sections such as section 17 are cut out and a single section, such as section 17, shown again in FIG. 3, is treated as follows: The backing paper 20 is peeled off the section 17 and the section is folded along the centerline with a piece of backing paper 21 or material which will not stick to the adhesive 19 inserted into the fold as shown in FIG. 4. THe section is then folded along lines 15 and 16 to define the flaps 22 and 23 and then the backing paper 22 is removed. The fold is then completed and the adhesive 19 on the inside of the fold contacts, so that the two sides 11*a* and 11*b* contact, bonding them together to form the vane blank 24 with the two flaps 22 and 23 projecting along one edge. The unshaped vane blank is then ready for shaping and/or attaching to the arrow shaft.

If the vane blanks are stored for future use it may be preferred to leave backing paper on the flaps. This is accomplished as illustrated in FIGS. 6 and 7. In this case backing paper 20 only is cut along the dashlines 15 and 16 and then the center strip of the backing paper is peeled off the section, leaving the end strips of backing paper 20*a* and 20*b* still on the section. The section 17 is folded along the centerline 14 with the piece of backing paper or material inserted into the fold as shown in FIG. 6. Once the crease has been made along the line 14, the piece 21 is removed, the fold is completed as shown in FIG. 7, bonding the two sides 11*a* and 11*b* together to form the vane blank 24. FOlds are then made along the lines 15 and 16 to define the flaps 22 and 23, the adhesive sides of which are still covered with backing paper strips 20*a* and 20*b* respectively. The unshaped vane blank can then be stored without danger of spoiling the adhesive on the flaps until it is ready for attaching to the arrow shaft.

As shown in FIG. 8, the unshaped vane may be cut at one end so that the flaps 22 and 23 extend beyond the front end of the vane blank 24. The use of these extensions 22*a* and 23*a* of the flaps 22 and 23, respectively, will be explained below. After the backing strips 20*a* and 20*b* are stripped off the flaps, the vane blank is then fletched to the arrow shaft 1.

Fletching of the vanes to the shaft is preferably accomplished with a tool made for this purpose by which the vanes are aligned to define a helix along the shaft, so that in flight they cause the arrow to spin on its longitudinal axis. In accordance with this method, the vanes are attached one after another or even simultaneously if possible, to the shaft 1 before the vanes are shaped or further processed. In FIG. 8, the broken lines 26 outline the projection of the flaps on the shaft 1, to show the position of the flaps when attached by the adhesive to the shaft defining a helix along the shaft. This produces a spin in flight.

FIG. 9 shows three such uncut vanes attached to the shaft 1 as viewed down the axis of the shaft. Quite clearly, the width of the flaps 22 and 23 are such that they subtend a total angle from the axis of the shaft of no more than 120°, thus, when three such vanes are attached to the shaft, the flaps abut and need not overlap if properly cut and fastened to the shaft. This arrangement also insures that once the first vane is fletched to the shaft with the proper twist the other two uncut vanes 27 and 28 when attached with their flaps properly abutting the flaps of vane 24, will define identical helices. This allows fletching arrows in the field with relative ease and without fletching tools.

After the unshaped vanes are attached to the shaft, the vanes are shaped. For this purpose, a device sometimes called a feather burner, such as shown in FIG. 11 may be used. The feather burner consists generally of a resistance ribbon 31 made of nichrome wire formed in the shape desired for the fletching vanes. The ribbon is supported by electrical leads 32 and 33 which connect to electric power source 34, which energizes the ribbon 31, heating the ribbon so that it will burn through the plastic material the fletching vanes are made of.

The cutting ribbon is 31 is positioned relative to a frame 35 holding the arrow so that when the arrow is inserted into the frame and rotated, the fletching vanes, one after another are burned to produce the desired fletching vane shape. Thus, the unshaped vanes 23, 27 and 28 are formed into shaped vanes 3, 4 and 5 in FIG. 12. After fletching the vanes and shaping as described above, or in any other fashion, the ends such as 22*a* and 23*a* of the flaps on each vane (shown in FIG. 8) are covered by wrapping a strip of tape 36, which may be of Scotchcal or any other suitable material, around these ends. The tape prevents the ends of the flaps from being lifted during use and generally protects the front end of the fletching which is normally subject to considerable wear and tear when the arrow is used. It is the front end of the fletching which is most inclined to be lifted when the arrow is used and the tape 36 wrapped around the ends of the flaps prevents this.

The various steps described above for making what has been found to be a very useful arrow fletching may be varied somewhat and yet still produce the same desirable structure. For example, the design lines and the fold and cut lines on the sheet of polyester film may be imprinted by other techniques than the one described herein, or they may be omitted. The technique described herein which makes use of photosensitive polyester film is advantageous but not required in all applications.

As an alternate step, the unshaped vane 24 such as shown in FIG. 10, may be cut or formed into the desired shape before it is attached to the shaft 1. For this purpose, cut lines such as 37 may be produced on the sheet shown in FIG. 1 as a guideline for cutting out each of the vanes before it is attached to the shaft. The vanes may be cut along lines such as 37 at the same time the ends of the vanes are cut as in FIG. 8 to produce the extensions 22*a* and 23*a* of the flaps. This is illustrated in FIG. 13. As shown in FIG. 13, the uncut vane is cut along the lines 37 and 39 which are produced on the photosensitive side of the sheet of Scotchcal when it is first exposed. The vane is most easily cut along these lines before it is attached to the shaft 1 and eliminates the necessity of using a feather burner to shape the vanes.

It is to be understood that while only a few embodiments of methods and means of practice of the present invention are shown herein, these embodiments are made by way of example only. Other arrangements and modifications may occur to those skilled in the art and may be used without departing from the spirit and scope of the invention.

What I claim is:

1. Arrow fletching comprising,

a plurality of plastic vane members attached to the arrow shaft,

the attachment being made by a flap along one edge of each vane member, with the flaps for attaching each vane member abutting each other around the circumference of

the shaft, so that the position of each flap on the arrow shaft is determined by the position of each other of the flaps.

2. Arrow fletching as in claim 1 and including,

two of said flaps on each plastic vane member, the two flaps on each member extending in opposite directions from the same edge of the vane member, and in which there are

N vane members, the width of the flaps on each vane member being such that they subtend an angle from the longitudinal axis of the arrow shaft, which is substantially 360°/N.

3. Arrow fletching as in claim 2 in which, each vane and attaching flaps is formed of a continuous sheet of said material.

4. Arrow fletching as in claim 3 and in which, said sheet of material is covered with adhesive on one side and the vane and flaps are formed by folding the sheet.

5. Arrow fletching as in claim 4 and in which, said vane member is at least twice the thickness of said flaps.

6. Arrow fletching as in claim 4 and in which, said sheet of material is a polyester film coated with adhesive.

7. Arrow fletching as in claim 6 and in which, said polyester film is photosensitive on the side opposite said adhesive and is exposed to an image, producing a design thereon.

8. A method for fletching an arrow comprising the steps of

cutting a section from a sheet of plastic material having an adhesive on one side covered with a nonadhering backing material.

removing said backing material from said section,

folding the section with the adhesive clad side of said material on the inside of said fold,

folding said section along lines along the edges of opposite sides so that the plastic material adjacent said folds define flaps, and

affixing said flaps by the adhesive thereon to the shaft of the arrow.

9. A method as in claim 8 and before affixing said flaps including the additional steps of

cutting the folded part of said secton so that said flaps extend beyond the folded part,

then affixing said flaps to the arrow shaft and wrapping material about the shaft at the position of the flap extensions.

10. A method as in claim 8 and in which, the sheet of material from which the section is cut is photosensitive on the side opposite the adhesive side thereof and is first exposed to a pattern which produces on said photosensitive side cutting lines, folding lines and identification designs.

11. A method for fletching an arrow comprising the steps of:

cutting a section from a sheet of plastic material having an adhesive on one side covered with a nonadhering backing material,

removing only a part of said backing material so that two edge strips of said backing material remain along opposite edges of said section,

folding said section along the edges of said edge strips of backing material so that the plastic material adjacent said folds define flaps,

folding the section with the adhesive clad side of said material on the inside of said fold,

removing said edge strips of backing material and affixing said flaps by the adhesive thereon to the shaft of an arrow.