Oct. 8, 1963 C. J. ZWICKEY 3,106,400

ARCHERY ARROWS

Filed Aug. 29, 1960

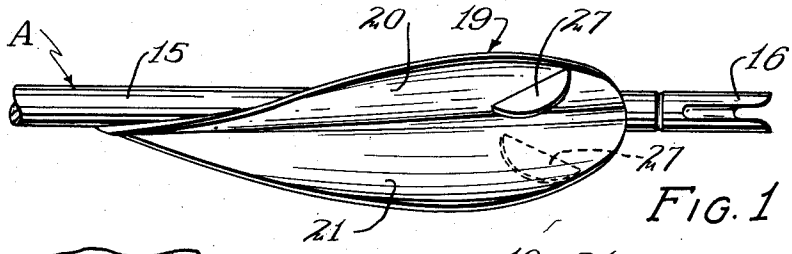


FIG. 1

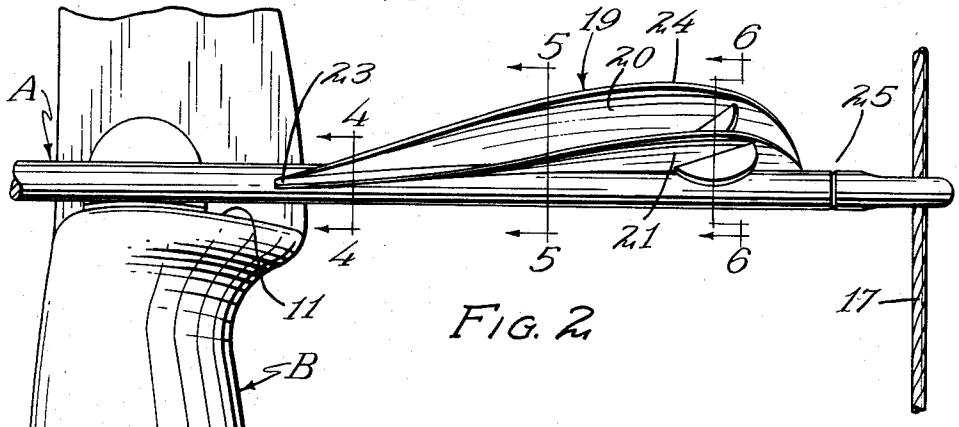


FIG. 2

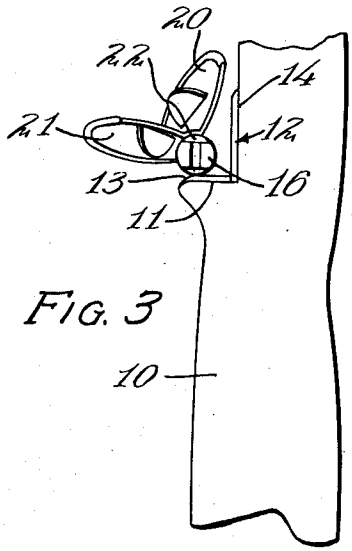


FIG. 3

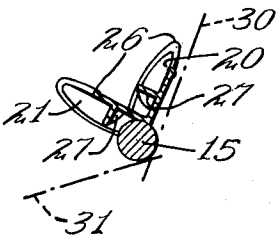


FIG. 6



FIG. 4

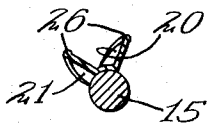


FIG. 5

INVENTOR

Clifford J. Zwickey

BY Robert M. Dunning

ATTORNEY

United States Patent Office

3,106,400
Patented Oct. 8, 1963

3,106,400

ARCHERY ARROWS

Clifford J. Zwickey, 107 12th Ave. NE.,
North St. Paul, Minn.

Filed Aug. 29, 1960, Ser. No. 52,530
8 Claims. (Cl. 273—106.5)

This invention relates to improvements in an archery arrow and deals particularly with a stabilizing vane structure used upon a trailing end of the arrow shaft.

Archery arrows have for innumerable years been provided with guide vanes which have been normally formed by fletching feathers to the arrow shaft. Feathers have been almost exclusively used to form the vanes of arrows due to the fact that vanes formed of feathers tend to create sufficient drag upon the arrow shaft to stabilize the arrow during its flight. Furthermore, such feathers, being relatively soft and flexible, will flex upon striking the bow or the archer's hand and thus will not materially interfere with the direction of travel of the arrow. Obviously, these feather vanes become frayed from repeated use and the effectiveness of the vanes is decreased and a drag upon the arrow tending to slow the speed of the arrow is increased. Attempts have been made to substitute smooth surfaced vanes for the feathered vanes to provide the desired planing surfaces. In many instances, these smooth surfaced vanes of lesser resilience than feathers, which have been usually dynamically balanced about the axis of the arrow shaft, often do not provide the desired drag and they often retard the arrow's flight and increase its oscillations by striking the bow or the archer's hand and accordingly do not provide the desired result.

It is an object of the present invention to provide an archery arrow with a stabilizing vane structure normally made of relatively smooth surface material and which is dynamically unbalanced relative to the axis of the arrow shaft. As will be described, this dynamically unbalanced structure is designed to provide initial stability in the arrow's flight and also to avoid interference from the bow or the archer's bow hand when the arrow is released. The vane structure of the arrow is particularly designed for use with a conventional long bow, and is most useful for purposes such as field practice and game hunting, wherein improvements relating to cost, uniformity, ease of attachement, imperviousness to moisture, durability in rough usage and maximum cast of the arrow are most urgently needed. While the present vane structure may be made of relatively rigid inexpensive material such as impregnated paperboard, the vanes are preferably formed of resilient plastic material such as a vinyl plastic so as to reduce the chance of injury to the arrow if the vanes strike an object during flight.

While for many years, arrows have been fletched with feathers to produce vanes of the desired shape and form, the process of fletching arrows is costly and time consuming. However, due to the fact that the symmetrically arranged vanes, when shot from the bow, must pass in close proximity with the side of the bow, or with the arrow plate, the arrow rest, or the archer's bow hand, it has been thought necessary to provide vanes which would flex as readily as feathers, and no substitute has been considered particularly practical. Vanes have usually been arranged projecting radially from the arrow shaft and spaced either 90° apart or 120° apart. As a result, it is inevitable that certain of the vanes will contact some part of the bow or archer's hand when the arrow is released. By providing an unusual vane arrangement which is not dynamically balanced, I have avoided this previous difficulty.

While feathered vanes have for years proven to be satisfactory, it is undoubtedly true that the engagement of these vanes with the bow or with the hand of the archer tends to reduce the speed of the arrow. It is also true that the uneven surface of the feathered vanes which make such vanes effective in stabilizing the flight, continue to produce a drag upon the speed of the arrow throughout the length of the flight and the air friction which makes the feathers effective at the start of the flight becomes a detriment after the flight has been stabilized. It is certain of these difficulties which the present invention is designed to eliminate.

It is an object of the present invention to provide a vane structure including two or more stabilizing vanes which are preferably connected together, which are smooth surfaced, and which are on one side only of a plane through the axis of the arrow in preferred form. By confining the vane structure to one side of the arrow shaft, and by properly supporting the arrow relative to the bow, the arrow may be discharged in a manner to provide a minimum of obstruction between the bow or the archer's hand and the vane of the arrow.

While the provision of dynamically unbalanced vane structure would normally be considered impractical, actual tests over an extended period have clearly indicated that arrows provided with such vanes normally travel a truer path and oscillate less than arrows of normal construction equipped with dynamically balanced, symmetrically arranged guidance vanes of plastic material having less resilience than feathers. Furthermore, it has been found that once the arrow is in flight and has been caused to rotate about its axis by the spirally shaped vanes, the vanes cause less drag upon the arrow than do feather fletched vanes. As a result, once the arrow is released, the vanes cause an initial drag which straightens out the arrow until the arrow rotates at proper speed, and at that point, the resistance of the vanes is greatly decreased and the rate of speed of the arrow decreases at a much lower rate.

Another advantage of the present invention resides in the ease with which the vane structure may be applied to the arrow, and the low cost at which such arrows may be produced. By forming or casting the spiral vane structure of vinyl plastic or similar material, the vane structure including two or more vanes of spiral shape, the vane structure may be spirally attached to the arrow shaft through the use of a suitable cement. As a result, the vanes of the arrow may be attached in a single operation to the arrow shaft in a very small proportion of the time required to fletch an arrow with feathers.

A further feature of the present invention resides in the provision of an arrow having two or more spirally mounted vanes at the rear end of the shaft and including a deflector blade on each vane which preferably is substantially perpendicular to the surface of the vane and which diverges rearwardly and outwardly from the arrow shaft. These deflectors provide a drag effect upon the arrow and also act to direct the flow of air outwardly from the arrow in the same general direction that the vanes project thus exerting forces which counteract the unbalanced centrifugal force of the vanes as they rotate about the axis of the arrow. To experienced archers, it is well known that the need for arrow guidance and stabilizing means differs with variations in arrow weight, arrowhead type, and bow cast. The deflectors may be formed to meet maximum requirements, and may be readily trimmed down in size where the action of the deflector is less necessary. In preferred form, the deflectors are placed near the rear ends of the vanes, although they operate effectively when not so placed.

In some instances, the deflectors may be eliminated, although they do serve a useful purpose. Furthermore, while the preferred embodiment of the structure pro-

vides two vanes, it is possible in some instances that three or more will be employed.

In its preferred form, the vane structure is molded of resilient material in a longitudinally spiralled form, the vanes forming a structure which is preferably generally V-shaped in cross section, with the apex of the V cemented or adhered to the surface of the arrow shaft. Each vane preferably tapers from a point at the front of the vane to the widest portion near the rear of the vane or near the center thereof, and then tapers to a point at its rear end. The vanes are positioned on the shaft so that the widest portion of one vane is substantially vertical or substantially on a plane through the axis of the shaft and through the nock of the arrow. The widest portion of the other vane is substantially horizontal and on the side of the arrow shaft opposite the bow. Arrows used by right handed archers, and which therefore travel on the left side of the bow, have vane structures which are normally spiralled forwardly in a counter clockwise direction. The arrows used by left handed archers, and which are therefore normally held on the right side of the bow, have vane structures which are spiralled forwardly in a clockwise direction. As a result, once the arrow is disengaged from the bow string, the arrows shot by right handed archers tend to rotate in a counter clockwise direction about their axes while arrows shot by left handed archers tend to rotate about their axes in a clockwise direction. The purpose of this arrangement will be later described.

It has long been known that arrows oscillate during their flight. Through the use of high speed photographs, the manner in which the arrow bends or flexes from the time it is released has been studied. In a book entitled "Archery, the Technical Side," by Hickman, Nagler and Klopsteg, printed by the North American Press of Milwaukee, Wisconsin, in 1947 for the National Field Archery Association, an article describing the arrow shaft oscillations was presented. The authorities still disagree to some extent about the cause of the oscillations. It has been shown that as the bow string is released, the bow hand of the archer travels in an irregular path, the bow hand of a right handed archer moving rearwardly and somewhat to the right, then forwardly and further to the right, then irregularly in a left hand direction across the line of aim finally moving rearwardly and to the right. It is also felt that the bow string may be deflected to some extent as it leaves the fingers. Furthermore, there is a tendency for the arrow to bend as it is released due to the "loaded column" effect as the arrow is pushed by the string. In any event, according to the article above mentioned the arrow bends with the center of the arrow bowed toward the right as it is released. This causes the arrow to be pushed against the arrow plate. Secondly, the arrow bends in the opposite direction with the center of the arrow bowed outwardly to the left. This flexes the arrow away from the bow. As the rear of the arrow approaches the bow, the arrow straightens. As the arrow leaves the bow, the center of the arrow bows again to the right with the head and nock moving to the left. The arrow oscillates in this manner until the drag of the vane structure and its air planing surfaces finally straighten the arrow out on its path.

The purpose of this explanation is to explain certain of the advantages of the dynamically unbalanced vane structure. As the arrow is released, the arrow shaft is held from rotation by the nock of the arrow. As the arrow is accelerated, the inertial resistance of the vane exerts a leverage force at the vane side of the arrow shaft in conjunction with the drag force of the baffling surfaces. This tends to reduce the initial curvature of the arrow shaft as described above. Reducing the initial flexing reduces the interference of the arrow with the bow and consequently the pressure between the arow and the bow. As a result, the reverse oscillation described is

also reduced. Due to the position of the vanes, the interference of the vanes by engagement with the bow is almost eliminated. As soon as the arrow nock is released from the bow string, the curvature of the vanes starts to rotate the arrow about its axis. While the drag of the structure causes an initial reduction in speed of the arrow, once the arrow has started rotating at the proper rate, the drag of the vanes is greatly reduced due to their smooth surfaces providing a slow rate of deceleration.

A further feature of the present invention resides in the fact that due to the fact that the vane structure is on the side of the arrow opposite the bow, the vane structure tends to hold the arrow against the bow, thereby properly orienting the arrow more readily.

Still another feature of the present invention lies in the fact that the vanes may be produced in large quantity at low cost and may be varied in size for arrows of different weights and diameters. Due to the resiliency of the plastic material, the vanes are not subject to gradual deterioration by fraying as are feather vanes. The vanes may also be replaced at a much less cost than for refletching the arrows with feathers. The new arrows are not adversely affected by moisture and are much less susceptible to damage and injury when used in combination with arrow heads which tend to prevent arrow loss by gathering grass and brush, thus tending to cause the arrow to tumble end to end.

These and other objects and novel features of the present invention will be more clearly and fully set forth in the following specification and claims.

In the drawings forming a part of the specification:

FIGURE 1 is a plan view of the rear end of an arrow showing the general construction of the vanes.

FIGURE 2 is a side elevational view of the structure shown in FIGURE 1 when the arrow is applied to a bow.

FIGURE 3 is an end elevational view of the arrow as it leaves the bow.

FIGURE 4 is a sectional view on the line 4—4 of FIGURE 2.

FIGURE 5 is a sectional view on the line 5—5 of FIGURE 2.

FIGURE 6 is a sectional view on the line 6—6 of FIGURE 2.

The arrow is indicated in general by the letter A. Due to the fact that the type of arrowhead used upon the arrow may be varied considerably or may be of any desired type, only the rear portion of the arrow is illustrated so that the figures may be shown on an enlarged scale. In a similar manner, the bow B has also been shown fragmentarily, it being understood that the bow may be of any desired type such as the conventional long bow. The bow B includes a shaped hand engaging portion **10** above which is provided a transverse ledge **11** which supports an arrow plate **12**. The particular arrow plate illustrated is of angular construction and in one flange **13** overlies the ledge **11** and the other flange **14** extends upwardly along the surface of the bow. The bow illustrated is designed for use by a right handed archer. A left handed archer would use a bow having the ledge **11** and arrow plate **12** on the opposite side thereof.

The arrow A includes an elongated shaft **15** which may be of any suitable material. While wood is usually used for such shafts, certain shafts have been produced of aluminum tubing or the like. The rear end of the shaft **15** is provided with a vertical groove **16** which forms the nock of the arrow. The bow string **17** is designed to engage in the nock **16** to propel the arrow.

While the exact shape of the vane structure **19** may be varied, the general shape illustrated has been found very satisfactory and to function effectively. As illustrated in the drawings, the vane structure **19** includes two vanes **20** and **21** which are integrally molded and are connected in generally V-shaped relation in cross section. If desired, a short connecting portion **22** may be provided

between the vanes, this portion being provided with a concave under surface designed to fit the contour of the arrow shaft. This connecting portion may be narrowed to a very narrow width if desired. The connecting portion **22** is adhered to the surface of the shaft **15** at the rear end of the arrow and just forwardly of the nock **16**.

As is indicated in the various drawings, the vanes **20** and **21** taper in width throughout their length, tapering virtually to a point at their forward end as indicated at **23** and flaring to a widest portion **24** which, in the present design, is located about two-thirds or three-fourths of the length of the vane from the forward end thereof. The rear end of each vane also tapers in width to substantially a point **25** at the rear end of each vane. As is also shown in the drawings, the two vanes spiral in a counterclockwise direction toward the forward end of the vane structure. When the vanes are shaped in this manner, the arrow tends to rotate in a counterclockwise direction about its axis after being released from the bow string. Arrows of this type are used by right handed archers. Where the archer is left handed, the vanes preferably spiral in a clockwise direction toward the arrowhead. This causes such arrows to rotate in a clockwise direction about their axes when released from the bow string.

As is indicated in the drawings, the marginal edge of each of the vanes is preferably enlarged as indicated at **26**. This enlarged edge tends to strengthen the outer periphery of the vane structure, and to prevent the damage of the vanes when the vanes come into engagement with an obstruction. Material such as vinyl plastic has been found to be particularly practical and this material may be molded in the proper shape. Vane structures of straight form may also be employed, the vane structures being secured to the arrow shaft in spiral form due to the flexibility of the vanes themselves.

Each of the vanes **20** and **21** is preferably provided with a small deflector such as **27**. The deflectors **27** project from the vanes **20** and **21** on planes intercepting the adjacent portion of the vane at substantially right angles. While the position and shape of these deflector vanes may vary, they are shown as being sector shaped having arcuate outer edges. The deflectors are preferably arranged with their forward ends relatively near the arrow shaft and their rear ends substantially farther from the arrow shaft. In other words, these deflectors are preferably angled outwardly and rearwardly as indicated. The deflectors are preferably also supported to project from the surface of the vane which is the leading surface during rotation of the arrow. In other words, the deflectors are blades on the surfaces of the vanes which are opposite the surfaces causing rotation. The deflectors are indicated as being near the rear end, of the vanes, as they have been found to be very effective in this position. However, the position of the deflectors may vary to some extent.

The operation of the arrow is believed obvious from the foregoing description. When the arrow is engaged with the bow string, the vane structure is almost entirely to one side of a plane tangent to the arrow shaft and extending vertically, and is almost entirely above a horizontal plane tangent to the lower surface of the arrow shaft. During its initial movement, the arrow is held from rotation by the bow string. However, as soon as the arrow is released, the vanes operate to rotate the arrow shaft about its axis and cause an initial drag upon the arrow which tends to straighten out the arrow quickly. As soon as the speed of rotation of the arrow increases to a predetermined extent, the smooth vanes cause but little drag tending to decelerate the arrow.

In general practice, the entire vane structure is confined within an area between two planes tangent to the outer sides of the arrow shaft and about one hundred twenty degrees apart. In FIGURE 6 of the drawings, the broken lines **30** and **31** indicate approximately the maximum angle occupied by the vane structure. In cross section, the vanes are preferably between ninety and one hundred twenty degrees apart at any point through the length of the vane structure.

In accordance with the patent statutes, I have described the principles of construction and operation of my improvement in archery arrows, and while I have endeavored to set forth the best embodiment thereof, I desire to have it understood that changes may be made within the scope of the following claims without departing from the spirit of my invention.

I claim:

1. In an arrow, a shaft having a forward end and a rearward end, a single vane structure including a base secured to said shaft to extend longitudinally thereof and a plurality of vanes projecting outwardly from said base in a generally radial direction, and in spiraled relation to the axis of the shaft, said vanes confined to one side only of a plane including the axis of said shaft, the other side being free of vanes, said vanes and said shaft encompassed cross-sectionally within a one hundred twenty degree angle with the sides of said angle tangent said shaft.

2. The construction of claim 1 and including an air deflector blade extending angularly from a surface of one of said vanes, said deflector blade diverging outwardly and reawardly with respect to said base.

3. The structure of claim 2 and in which the air deflector blade is on the side of the vane toward which said vane will rotate.

4. An arrow including an arrow shaft, a vertical groove forming a nock in one end of said shaft and extending diametrically across said shaft, a single elongated vane structure including a base secured to said shaft and a plurality of vanes extending outwardly from said base and in longitudinally spiralled relation to said shaft, said vanes confined substantially to one side of a vertical plane tangent to said shaft and above a plane tangent to the lower side of said shaft and spaced an angular distance of one hundred and twenty degrees from the first plane, the other side of said planes being free of vanes.

5. The structure of claim 4 and including a deflector blade extending normal to a surface of at least one of said vanes and diverging rearwardly and outwardly with respect to said base.

6. An arrow including an arrow shaft, said shaft having at one end a vertical groove forming a bow string receiving nock, a single vane structure including a base secured near said end of said shaft and extending longitudinally thereof, a pair of vanes extending from said base in generally V-shaped relation, said vanes extending outwardly from said base in spiral relation to said shaft and being located on one side only of a plane extending through the axis of said shaft, said vane structure confied substantially to one side of a vertical plane tangent to said shaft and above a plane tangent to the lower side of said shaft, and spaced an angular distance of one hundred anl twenty degrees from the first plane, the other side of said planes being free of vanes.

7. The structure of claim 6 and including an air deflector blade extending laterally from the uppermost of said vanes and diverging outwardly and rearwardly with respect to said base.

8. The structure of claim 7 and including an air deflector blade on the other of said vanes and diverging rearwardly and outwardly with respect to said base.

References Cited in the file of this patent

UNITED STATES PATENTS

1,648,376	Blodgett	Nov. 8, 1927
1,748,200	Barnhart	Feb. 24, 1930
2,443,395	Lutins	June 15, 1948
2,525,332	Alger	Oct. 10, 1950
2,887,319	Lay	May 19, 1959

FOREIGN PATENTS

496,381	Great Britain	1938