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ARROW SHAFT CONSTRUCTION

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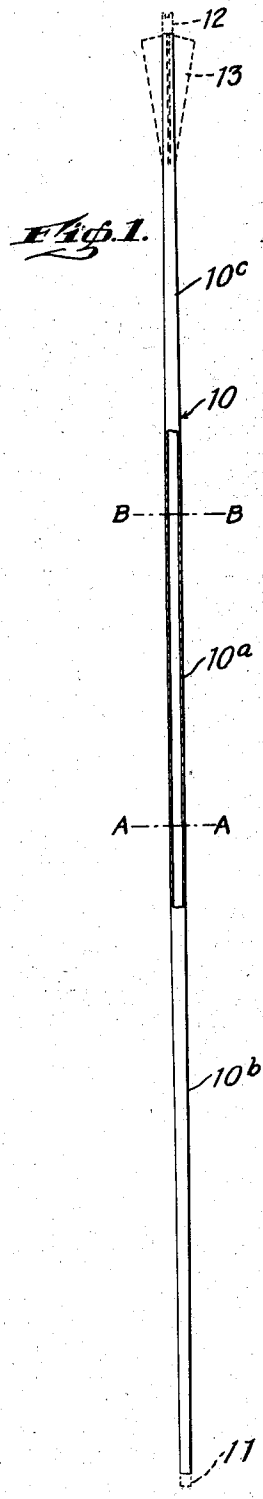


Fig. 1.

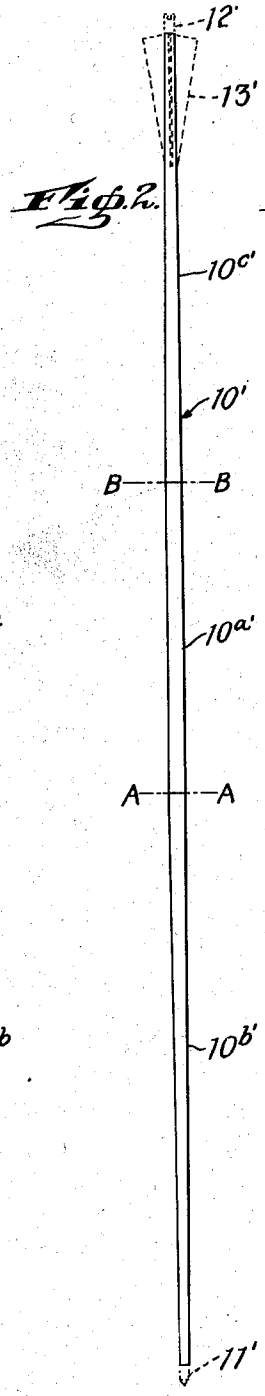


Fig. 2.

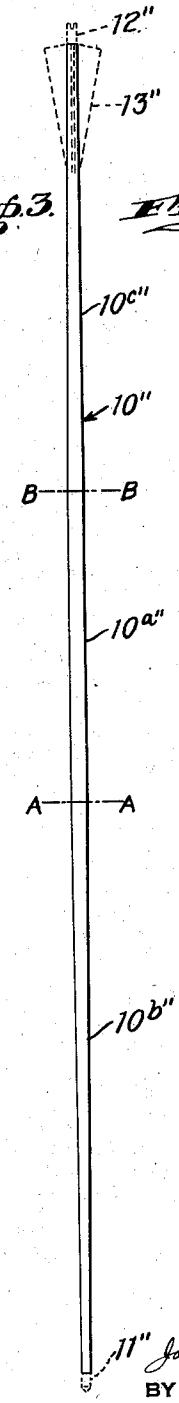


Fig. 3.

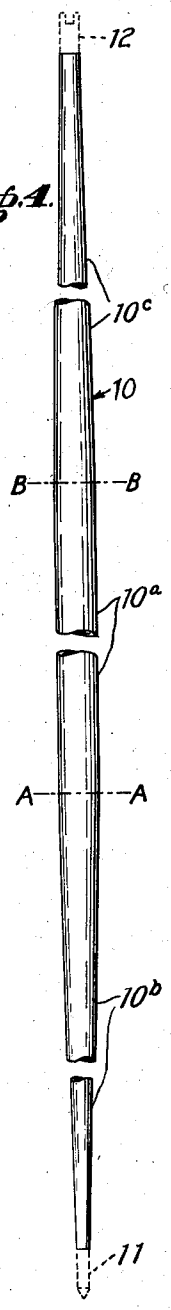


Fig. 4.

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ARROW SHAFT CONSTRUCTION

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5 Claims. (Cl. 273—106.5)

The present invention relates to archery and particularly to the construction of arrow shafts.

Arrow shafts have heretofore been made both of wood and of metal. Wooden shafts warp, however, in response to weather changes and make it impossible to secure uniform accuracy in archery because the flight is affected by the extent and character of the warping. To eliminate the problem of warping metal arrow shafts have been substituted. But the use of metal arrow shafts has produced a host of new problems and difficulties.

Metal arrows should not be substantially heavier than wooden arrows. To keep the weight down tubular metal arrows have been made. It is, however, a requirement that in order that an arrow match any given bow, the natural period of vibration of the arrow should equal a definite percentage of the bow discharge time. This, so that on discharge, the arrow will bend around the bow without hitting it, and without the consequent varying deflection from a true course.

Heretofore, tubular metallic arrows and particularly steel arrows, when made both light enough and stiff enough to impart the proper vibration period to the arrow, have required an extremely thin wall and large diameter, with the result that the arrow has had no resistance to denting or side impact.

Large diametered tubing, too, has reduced the general flight characteristics of the arrow by increasing its resistance to forward flight, by increasing the windage action on and side drift of the arrow, and by reducing flight accuracy. Moreover, to achieve balance, loading of such an arrow or thickening of its walls at predetermined points has been desirable.

An object of this invention is to produce tubular metal arrows in which the objectionable characteristics noted are eliminated.

It is another object of this invention to provide small-diametered, tubular, metallic arrow shafts having increased column strength, low wind resistance, improved balance without requiring loading or wall thickening at any point and fine flight characteristics with consequent improved accuracy.

We have discovered that tubular metal arrows meeting the foregoing requirement can be made by giving the shaft what might be termed "barrel-shape," i. e. a shaft tapered in two directions in a smooth continuous curve. Practically this is achieved by providing the tubular shaft intermediate its ends with a properly located, uniformly diametered portion and with uniformly, oppositely tapered portions extending forwardly and rearwardly of the uniformly diametered portion toward the pile and nock ends of the arrow shaft. If the various portions are properly located in the shaft and properly dimensioned the arrow so constructed has been found to have many advantages. Due to the laws of vibrating bodies the weight saved at the tapered ends decreases the period of vibration so that a smaller diametered more flexible shaft may properly match a given bow than heretofore. Its column strength is increased. Such increased column strength also permits the reduction in the diameter of the arrow and increase of the wall thickness of the arrow thereby increasing the resistance to side impact, cutting down wind resistance and improving the flight characteristics of the arrows. The tapered portions and general barrel shape result in the head on impact being absorbed in the tapered portions with consequent elimination of shaft splitting and bending. The barrel shape facilitates and improves balance of the arrow. Moreover, the shafts, being made of metal and preferably of steel will not warp.

One of the important features of providing arrow shafts with the "barrel" shape is the proper location of the uniformly diametered portion and the proper proportioning of the relative length of this portion and the lengths of the tapered portions. In best practice, the portion tapering toward the pile or tip of the arrow should be longer than that tapering toward the nock end of the arrow, and the uniformly diametered portion should be shorter in length than either of the tapered portions. The exact lengths of these portions depends upon the overall length of the shaft. In all cases the uniformly diametered portion should be shortest in length and the major portion thereof located in the rear half of the total shaft length.

To the accomplishment of the foregoing, and such other objects as may hereinafter appear, this invention consists in the novel construction and arrangement of parts hereinafter described and then sought to be defined in the appended claims, reference being had to the

accompanying drawing which shows, merely for the purposes of illustrative disclosure, preferred embodiments of the invention, it being expressly understood, however, that changes may be made in practice within the scope of the appended claims without digressing from the inventive idea.

In the drawing, in which similar reference characters denote corresponding parts:

Fig. 1 is a vertical elevation, partially in section of one form of arrow embodying the invention;

Figs. 2 and 3 are vertical elevations of modified forms of constructions embodying the invention; and

Fig. 4 is a view on an exaggerated scale of the arrow of Fig. 1 illustrating the various portions of the shaft.

Referring to the drawing and first to Fig. 1, 10 denotes an arrow shaft made of metal tubing and, preferably of steel. This tubular shaft has a suitable pile or point 11 at one end, a suitable nock 12 at the other end and suitable feathering 13 attached suitably to the shaft adjacent its nock end. The pile 11, nock 12 and feathering 13 are conventional and applied in any suitable manner. The tubing preferably is seamless.

Shaft 10 has a uniformly diametered cylindrical portion 10*a* intermediate its ends between the section lines A—A and B—B. Forwardly of the section line A—A, the shaft has a uniformly tapered cylindrical portion 10*b* whose smallest diameter is at the pile end of the shaft. Rearwardly of the section line B—B, the shaft has a uniformly tapered cylindrical portion 10*c* whose smallest diameter is at the nock end of the shaft. The two tapered portions 10*b* and 10*c* merge with the uniformly diametered portion at the section lines A—A and B—B and produce an arrow shaft which has an external form that may be described generally as "barrel-shaped." This shape may be produced in any suitable way as by drawing, rolling or the like. An express feature and requirement is that the wall thickness of the shaft 10 which is small, be uniform throughout the length of the shaft. It is to be noted too, that tapered portion 10*b* is longer than tapered portion 10*c*; that uniformly diametered portion 10*a* is shortest in length and that its major portion is located in the rear half of the total shaft length.

The arrow shaft is balanced for proper flight and arranged to have the required natural period of vibration, by the relative positioning of the portions 10*a*, 10*b* and 10*c* thereof, by the axial lengths of the portions, by the diameters of these portions and by the wall thickness of the shaft tubing.

In the embodiment of Fig. 1 which shows a man's arrow of standard length, the following physical dimensions for a steel tubing, having a uniform wall thickness of .007 to .010 inch have been found suitable:

	Inches
Overall length of shaft approximately	28
Length of section 10*a* approximately	6
Length of section 10*b* approximately	12⅜
Length of section 10*c* approximately	9⅝
Outside diameter of section 10*a* approximately	.250
Outside diameter at pile end approximately	.200
Outside diameter at nock end approximately	.200

In the embodiment of Fig. 2 which also shows a man's arrow, of shorter overall length, parts corresponding to those of Fig. 1 have the same reference character as in that figure, but are primed. The following physical dimensions for steel tubing having a uniform wall thickness of .007 to .010 inch have been found suitable:

	Inches
Overall length of shaft 10′ approximately	26
Length of section 10*a*′ approximately	6
Length of section 10*b*′ approximately	11
Length of section 10*c*′ approximately	9
Outside diameter of section 10*a*′ approximately	.250
Outside diameter at pile end approximately	.200
Outside diameter of nock end approximately	.200

In the embodiment of Fig. 3 which shows a woman's arrow, parts corresponding to those of Fig. 1 have the same reference characters as in Fig. 1, but are double primed. The following physical dimensions for steel tubing having a uniform wall thickness of .007 to .010 inch have been found suitable:

	Inches
Overall length of shaft 10″ approximately	26
Length of section 10*a*″ approximately	6
Length of section 10*b*″ approximately	11
Length of section 10*c*″ approximately	9
Outside diameter of section 10*c*″ approximately	.235
Outside diameter at pile end approximately	.200
Outside diameter at nock end approximately	.200

It will be seen from the foregoing examples that the uniformly diametered portion 10*a*, 10*a*′ or 10*a*″ in each case is shortest in length, that the forward tapered portion 10*b*, 10*b*′ or 10*b*″ is longest and that the rearward tapered portion 10*c*, 10*c*′ or 10*c*″ is shorter than the first tapered portion but longer than the uniformly diametered portion. It will be noted, too, that minimum diameter of each tapered portion is the same. Also, it will be noted that the maximum external diameter of the shaft is comparatively small, being of the order of ¼ of an inch or less, and that the wall thickness is uniform throughout the length of the shaft.

Arrows made in conformity with these specifications are non-warping, light, true in flight, resistant to impact shock, bending and denting and have the required vibration period. They have better trajectory carrying qualities, are less subject to windage drift, and have improved accuracy.

While specific embodiments have been described herein, it is to be understood that modifications in detail within the scope of the claims is contemplated. There is no intention of limitation to the exact details shown and described.

We claim:

1. An arrow shaft having improved flight characteristics and being highly resistant to impact shock, bending and denting comprising a tubular metallic shaft having uniform wall thickness, and provided in its length with a uniformly diametered portion, and with oppositely tapering portions extending from said uniformly diametered portion, said uniformly diametered portion having substantial length but being shorter than either of said tapered portions.

2. An arrow shaft having improved flight characteristics and being highly resistant to impact shock, bending and denting comprising a tubular metallic shaft having uniform thin wall thickness and provided in its length with a uniformly diametered portion and with oppositely tapering portions extending from said uniformly diametered portion, one of said tapering portions being longer than the other tapering portion, and said uniformly diametered portion being shorter than either of said tapering portions.

3. An arrow shaft having improved flight characteristics and being highly resistant to all deforming forces comprising a tubular metallic shaft having uniform thin wall thickness throughout its length and provided in said length with a uniformly diametered portion, a portion tapering uniformly from said first-named portion toward and to the head end of the shaft and of substantially greater length than said uniformly diametered portion, another portion tapering uniformly from said first-named portion toward and to the nock-end of said shaft and smaller in length than said first-named tapered portion, but substantially greater in length than said uniformly diametered portion, whereby said shaft is generally barrel-shaped in outline.

4. An arrow shaft having improved flight characteristics and being highly resistant to all deforming forces comprising a tubular metallic shaft provided in its length with a uniformly diametered portion of substantial length and with oppositely tapering portions each longer than said uniformly diametered portion and each extending from said uniformly diametered portion in a smooth continuous curve, whereby said shaft is generally barrel-shaped in outline.

5. An arrow shaft having improved flight characteristics and being highly resistant to deforming forces comprising a tubular metallic shaft provided in its length with a uniformly diametered portion, a portion tapering uniformly from said uniformly-diametered portion toward and to the head end of the shaft and of greater length than said uniformly diametered portion, a second portion tapering uniformly from said uniformly-diametered portion toward and to the nock end of said shaft, and also greater in length than said uniformly-diametered portion, whereby said shaft is generally barrel-shaped in outline, the proportionate lengths of said tapered portions being such that more than half of said uniformly diametered portion lies in the rear half of the total shaft length, and said tapered portions merging smoothly with said uniformly diametered portions.

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