Dec. 12, 1939. W. E. SWEETLAND 2,182,951

ARROW

Filed Jan. 3, 1939

Fig. 1.

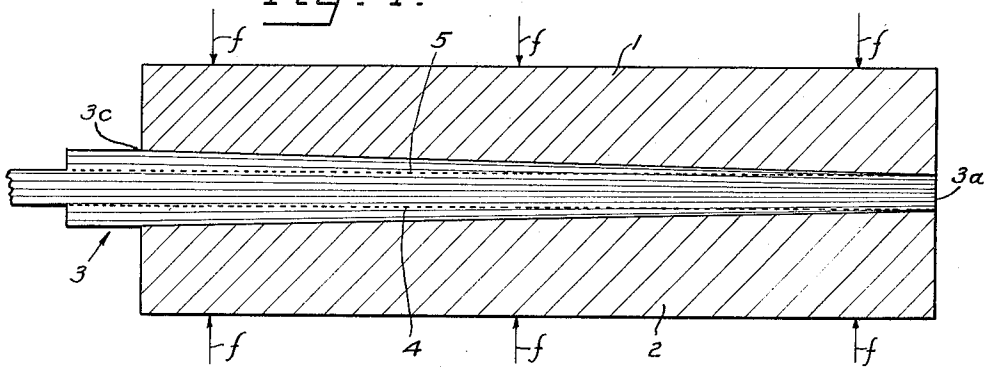
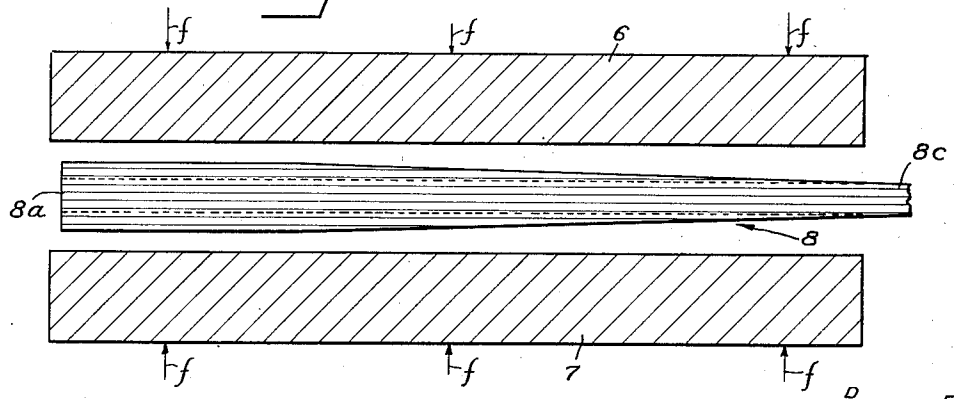


Fig. 2.



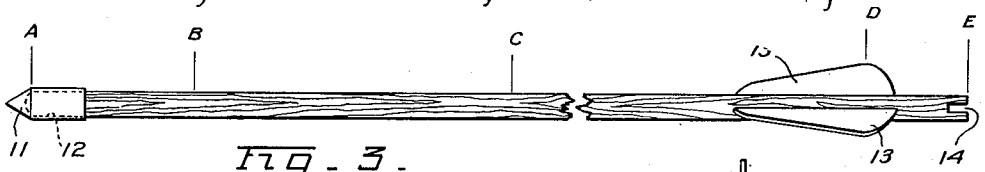


Fig. 3.

Fig. 4.

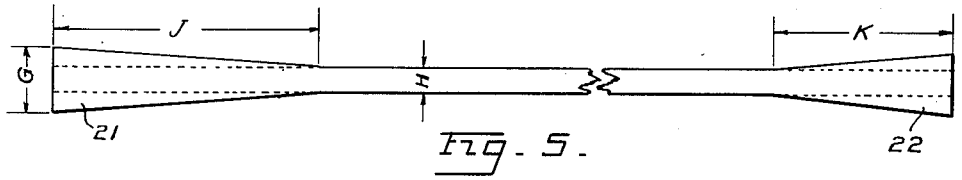
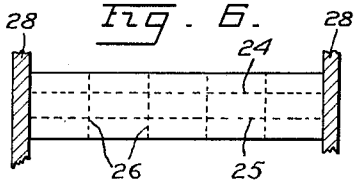


Fig. 5.

Fig. 6.



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ARROW

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3 Claims. (Cl. 273—106.5)

This invention relates to the art of archery and particularly to arrows for use in target practice and hunting. Various woods are used in the manufacture of arrows, Norway pine and Port Orford cedar being among those commonly used. Generally speaking, the woods that have the right characteristics of weight, "spine", etc. are lacking in the necessary hardness to afford the desired durability. Arrows which are made solely of wood such as Norway pine or cedar frequently break behind the point of the arrow, particularly when the arrow strikes a hard object. Continued use also causes these woods to wear and splinter at the nock of the arrow. In present practice these objections to soft wood are overcome by splicing a piece of beef wood or iron wood or other hard wood to the forward end of the arrow with a long tapering splice, and this provides desirable additional weight near the point of the arrow, and gives the arrow greater strength in its most vulnerable part; namely, the part just back of the point. It is also common practice to strengthen the nock of the arrow either by splicing a piece of hard wood on the nock end, or by reinforcing it with a ferrule of some suitable material such as fiber. While these methods of splicing and reinforcing produce a satisfactory arrow, they add greatly to the cost of production. It is one of the objects of my invention to produce an arrow with additional strength where required without the expense of splicing and without the objections which attend the use of glued joints.

Another object of my invention is to increase the weight of the forward end of the shaft so that the center of gravity is forward of the center.

In carrying out my invention I harden either the forward end, or nock end of the arrow, or both, by compression in a manner which will be understood by those skilled in the art by reference to the following description and the accompanying drawing.

The invention possesses other advantageous features, some of which, with the foregoing, will be set forth at length in the following description where that form of the invention which has been selected for illustration in the drawing accompanying and forming a part of the present specification is outlined in full. In said drawing one form of the invention is shown, but it is to be understood that it is not limited to such form since the invention as set forth in the claims may be embodied in a number of forms.

Referring to the drawing:

Figure 1 illustrates one manner in which a billet from which an arrow is to be made, is compressed.

Figure 2 shows an alternate method of compressing the billet.

Figure 3 represents a side elevation of an arrow.

Figure 4 is an end elevation of the nock end of the arrow shown in Figure 3.

Figure 5 shows a side elevation of one form of billet that may be used in carrying out my invention.

Figure 6 shows an end view of the billet shown in side elevation in Figure 5, and shows side plates to prevent bulging of the billet during compression.

Referring in detail to Fig. 1, the numerals 1 and 2 represent in section the upper and lower dies between which the arrow shaft 3 is compressed. The longitudinal lines in the arrow 3 represent the hard grains in the wood and illustrate how these grains are brought closest together at the point of maximum pressure at the right hand end of the billet at 3*a*, and shows how these grains gradually diverge until they reach the point 3*c* where there is no compression and the wood is left in its natural condition. The dotted lines 4 and 5 indicate the outline of the finished arrow. The arrows *f* indicate the direction of the force applied in compressing the end of the arrow.

It will be noted that the dies 1 and 2 have surfaces which converge toward the right hand end so that the pressure which is applied to the billet 3 is graduated, the pressure applied being practically zero at the end 3*c* and reaching its maximum at the end 3*a*. In this view the billet 3*c* is shown after compression with the dies 1 and 2 still in contact with the billet. Before compression the entire portion of the billet compressed was of the thickness indicated at 3*c*. The end 3*a* has been reduced by compression to approximately ½ of the original thickness. The billet 3 may be wide enough for only a single arrow, but I may compress a billet of sufficient width to make half a dozen or more arrows at a time, after which the billet is sawed into square shafts that are afterwards rounded and finished in the usual manner. (Fig. 6 shows the end of a billet to make several arrows).

Figure 2 diagrammatically illustrates how the billet may be tapered before compression in which case the dies 6 and 7 are made with the opposite faces parallel. When this method is used the maximum compression of the shaft 8 takes place at the end 8*a*, while compression is

reduced to the minimum at the end 8c. Compression has not yet been applied to the billet shown in Fig. 2.

In compressing the billets, whether they have the width of a single arrow or a plurality of arrows, I prefer to provide dies that support the sides of the billet to prevent lateral bulging of the wood during compression as will be more fully described later.

The nock end of the arrow is compressed by means similar to those described for compressing the head or forward end of the arrow, except that the length of the shaft compressed for the nock end is shorter than for the head end, and it is therefore desirable to make the taper of the compressed portion somewhat steeper. In this manner I obtain the maximum degree of hardness where the nock is cut in the arrow without extending the hardened portion very far into the shaft of the arrow. In this manner I avoid too much weight at the nock end. Also I may, if desired, use a lower degree of compression at the nock end.

Referring to Figure 3 which shows an elevation of a completed arrow with a portion near the center broken away, numeral 11 indicates the metal tip or point of the arrow which has an opening to receive the forward compressed end of the shaft as indicated by the dotted lines 12. 13 represents the feathers which are secured to the arrow with cement in the usual manner and 14 is the nock to receive the bow string. In this view the arrow has been compressed to the maximum amount desired at or near the point A and the compression gradually diminishes to zero at the point C. Ordinarily there is no compression at all between the points C and D. Compression again commences at the point D and is gradually increased until it again reaches the maximum amount desired at the nock end E. The billet is always compressed in a direction at right angles to the annual rings which form the flat layers of grain in the wood, and the nock E is cut transverse to the grain in order to provide the maximum strength. The point at which arrows most commonly fail is in the region between A and B and this is the region in which the maximum compression and consequently the maximum strength of the forward end of the arrow exists.

Figure 5 shows a side elevation of one form of billet that may be used in carrying out my invention. The billet is cut with the end portions tapering outwardly to a greater thickness than the central portion which forms the main shaft of the arrow. In Figure 5 the end 21 represents the portion that will be the forward end of the finished arrow. The dimension G may be approximately double the dimension H and the distance J through which the taper extends may vary to suit the individual requirements of the archer. At the opposite end 22 which becomes the nock end of the finished arrow the same condition exists except that the dimension K is preferably shorter than the dimension J so as to avoid getting too much weight in the nock end of the finished arrow. In the end elevation of the billet shown in Figure 6 the horizontal dotted lines 24 and 25 represent the thickness H to which the billet is ultimately compressed while the vertical dotted lines 26 are lines upon which the billet will be sawed into individual billets after compression, following which the separate units will be made into arrows in the usual manner.

The billet shown in Figure 5 is compressed between flat parallel surfaces which squeeze the billet until it is compressed throughout its entire length into a uniform slab of the thickness H. During compression side plates as indicated at 28 prevent lateral bulging of the slab. The method described lends itself to manufacture in quantity, and produces arrows that have the desired additional strength at the point and nock ends without the necessity of splicing and the frailties of glued joints.

It will be noted that the amount of compression employed and the taper, or the degree to which compression is graduated, may be varied to suit the requirements of the user, and the point of balance of the arrow may be adjusted by varying the amount of taper for compression, especially in the forward end. Usually with a wood such as Norway pine it is desirable to reduce the thickness of the billet from 40 to 50% of the original at the points A and E and the degree of graduation may be varied as desired, but in any event I prefer to diminish the compression gradually away from the points of greatest compression so that there is no sudden jog or offset in the direction of the wood fibers. By compressing in this manner the fibers are not ruptured and the finished arrow has great strength in the places where it is most needed.

It is within the province of my invention to impregnate either or both ends of the arrow with a suitable sealing fluid such as shellac, Bakelite solution, or thin varnish or lacquer before compression to enhance the waterproof qualities of the wood, and this may be forced into the pores under pressure if desired.

If it is desired to impregnate the wood under pressure before compression the arrows may be treated in a pressure tight chamber containing the impregnating fluid to the required depth in the bottom of the chamber. The billets to be treated are then held by suitable means in the upper portion of the chamber above the level of the liquid and the air in the chamber is exhausted by means of a vacuum pump. This removes the air that is occluded within the fibrous structure of the wood and makes the fluid penetrate the wood more readily. After the air is exhausted the ends of the billets are alternately dipped in the fluid while air under pressure is pumped into the upper portion of the chamber thereby forcing the fluid into the pores of the wood. This being accomplished, the billets are removed from the chamber and are ready for compression. In some instances it may be desirable to bake the impregnated arrows either before or after compression in order to dry and solidify or partially solidify the material which forms the non-volatile portion of the treating fluid. Baking is essentially desirable if the fluid used is Bakelite or some similar phenol condensation product, and if desired the entire arrow may be impregnated with such a product.

If it is desired to make an arrow of increased density throughout the entire length thereof, this may be accomplished by using a billet such as is shown in Fig. 5 and placing the billet under compression between suitable dies and continuing the compression after the portions indicated by J and K have been reduced to the thickness H until the dimension H is also reduced to the desired extent. In this manner I obtain an arrow which is of increased weight and density throughout the entire length but which has the ends compressed to a greater degree than the

central portion. Obviously the same idea may be carried out with a billet which is increased in thickness only at the forward end and in this manner an arrow is produced which is heavy and exceedingly strong on the forward end and is also of increased density throughout the remainder of its length.

Heat may be applied to the billets before compression whether the step of impregnation is used or not, the result of warming the wood being to soften the resinous content and render it more amenable to the compression process. In any event the completed arrow is preferably treated with lacquer, varnish or shellac to add to the finish and prevent the absorption of moisture.

It will be understood that where I have used the term "billet" this may apply either to a wide slab of wood out of which a plurality of arrows is to be made or to a narrow strip suitable for a single arrow.

I claim:

1. An arrow comprising a wooden shaft, the forward end whereof is compressed with a degree of compression which diminishes toward the rear end of said arrow.

2. An arrow comprising a wooden shaft, both ends of which are compressed to increase the density thereof, the degree of compression being greatest near the extreme ends and diminishing toward the central portion of said arrow.

3. An arrow comprising a wooden shaft, said shaft being subjected to compression throughout its entire length, a portion of said shaft being compressed to a greater degree than the remainder of said shaft.

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