Dec. 17, 1957 H. C. STOCKFLETH 2,816,766

COMPOSITE METAL-BLADED PLASTIC-BODIED ARROWHEAD

Filed March 14, 1955 3 Sheets-Sheet 1

Fig. 1

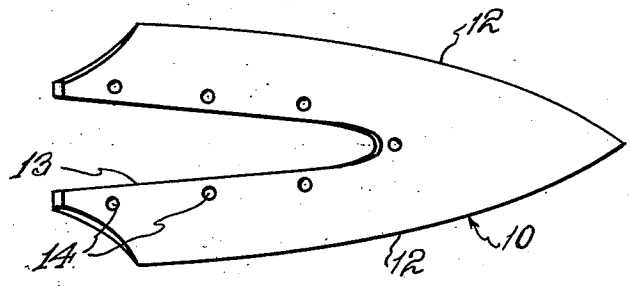


Fig. 2

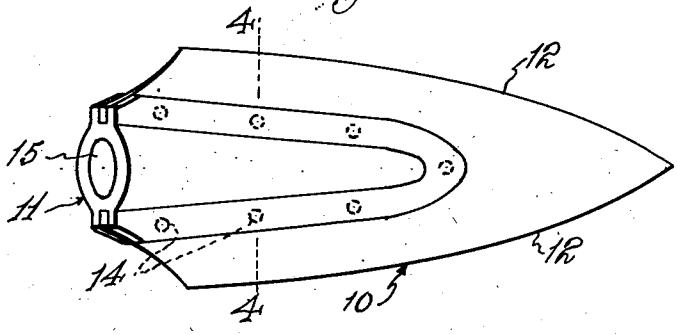


Fig. 3

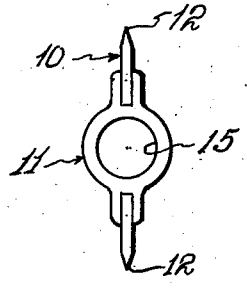
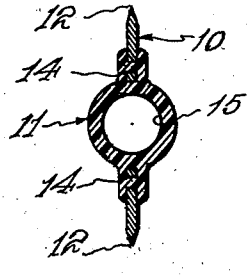


Fig. 4



Inventor:
Harry C. Stockfleth

BY Dudley B. Howard

Attorney

Dec. 17, 1957 H. C. STOCKFLETH 2,816,766

COMPOSITE METAL-BLADED PLASTIC-BODIED ARROWHEAD

Filed March 14, 1955 3 Sheets-Sheet 2

Fig. 5

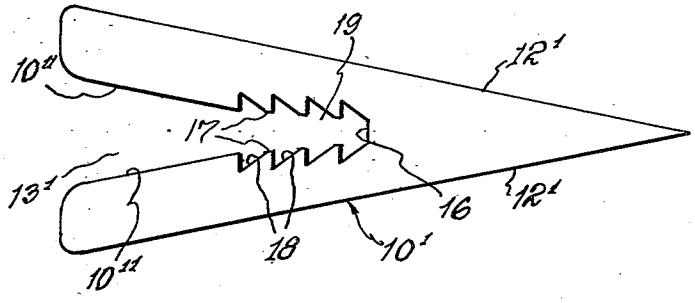


Fig. 8

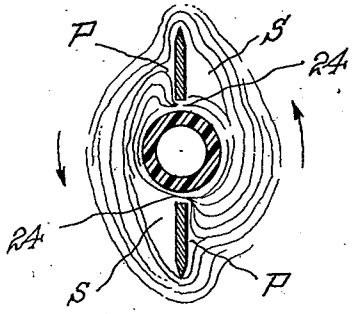


Fig. 7

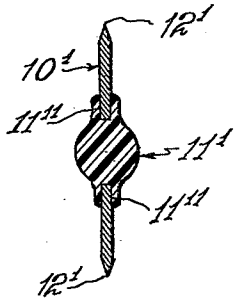
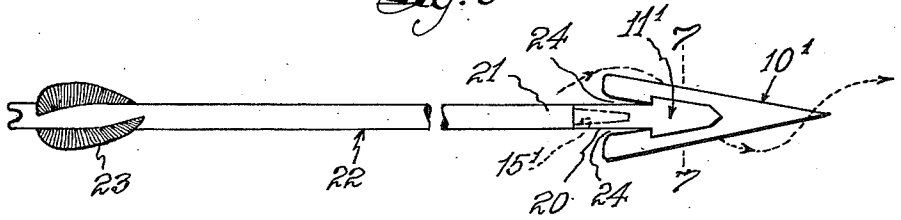


Fig. 6



Inventor:
Harry C. Stockfleth

BY Dudley B. Howard
Attorney.

Dec. 17, 1957 H. C. STOCKFLETH 2,816,766

COMPOSITE METAL-BLADED PLASTIC-BODIED ARROWHEAD

Filed March 14, 1955 3 Sheets-Sheet 3

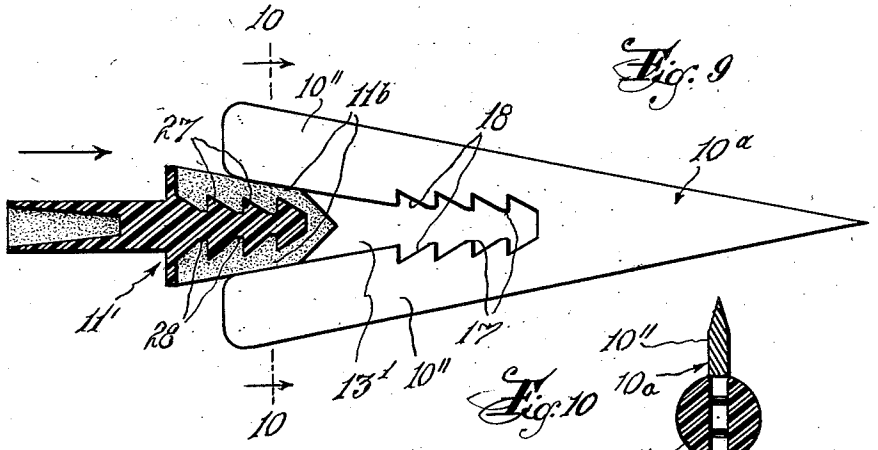


Fig. 9

Fig. 10

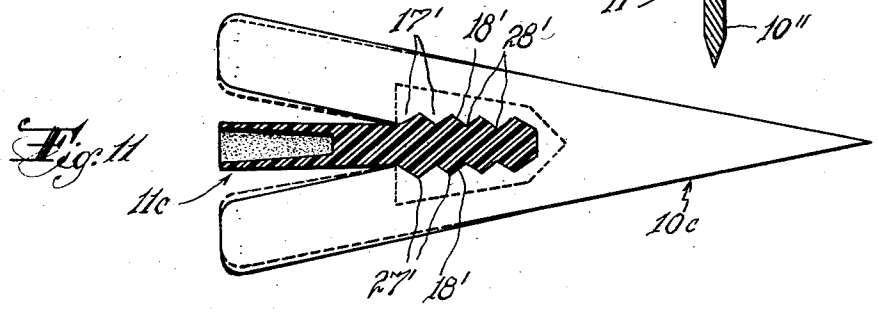


Fig. 11

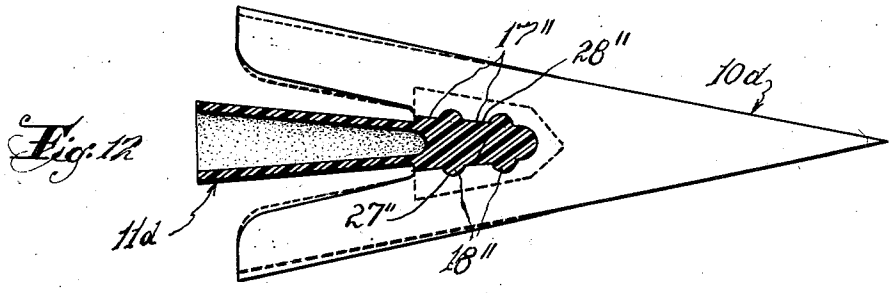


Fig. 12

Inventor
Harry C. Stockfleth

By Dudley B. Howard
Attorney

United States Patent Office

2,816,766

Patented Dec. 17, 1957

2,816,766

COMPOSITE METAL-BLADED PLASTIC-BODIED ARROWHEAD

Harry C. Stockfleth, Chatham, N. J.

Application March 14, 1955, Serial No. 494,058

12 Claims. (Cl. 273—106.5)

The invention relates in general to arrowheads for the shafts of arrows used in archery and has particular reference to those of the broadhead type for hunting live game.

Prior to my present invention and the earlier one disclosed in my co-pending application bearing Serial Number 401,938, filed January 4, 1954, the most popular hunting arrowheads have been made from sheet metal, such as steel. When made in one piece, it is necessary to use thin, untempered steel stock because each head includes, in addition to the tapered impact blade, a thickened axial body, or ferrule, having a rearwardly facing socket to fit the foot of the complementary arrow shaft and the said body must be pressed into shape by stamping process from the sheet metal blank. The use of thin, untempered stock is undesirable for the reason that the impact blade will be too soft for penetration of hard, tough targets. Therefore, it is more recent practice to make the impact blade from comparatively thick, tempered steel plate and to form the socket-containing ferrule separately from suitably thin, soft stock, either in one piece or more than one. The separate pieces are then united by spotwelding or the employment of interlocking joint structure. The principal objection to this latter mode of manufacture is the excessive cost.

With the above-mentioned disadvantages of the arrowheads that are made of sheet metal alone in mind, it has been my primary object to produce an improved arrowhead that will meet all practical requirements and which may be manufactured at greatly reduced cost.

To be more explicit, I have devised an arrowhead that has a plastic ferrule to which is affixed a hard steel impact blade. In accordance with the invention, the impact blade is rigidly united with the ferrule during the molding of the latter in an injection molding machine.

An important advantage which is realized by the use of plastic material in construction of the ferrule is reduction in weight. In a hunting arrowhead, lightness is much to be desired because of increased range and accuracy in flight.

A further advantage of uniting the impact blade and ferrule during the molding process is the true alignment of the axes of both elements. Whenever an impact blade is assembled with the ferrule following separate manufacture of both of these elements, there is great likelihood of alignment error due to reliance on the human agency in the assembling process.

Another object of the invention is to provide an impact blade element of the composite arrowhead which is unusually elongated and sharp-pointed and has wing-like barbs of such construction in relation to the adjacent external side faces of the ferrule that aerodynamic stabilization of the arrowhead in its spinning flight due to the effect of the spirally arranged shaft feathers will occur to prevent windplaning.

A still further object is to provide a broadhead arrow which will offer minimum drag in resistance to spinning flight.

It is also an object to provide a modified form of the invention wherein the metal blade is adapted to be removably attached to the ferrule body by improved snap-on action instead of being permanently united therewith by molding process.

The foregoing and other objects, advantages and features of the invention will be more fully understood as the following specific description is read in connection with the accompanying drawings, in which:

Fig. 1 is a side elevation of the impact blade element of the arrowhead; Fig. 2 is a similar view of the completed arrowhead after the ferrule has been molded onto the blade element; Fig. 3 is a rear elevation of the latter; and Fig. 4 is a cross-section on line 4—4 of Fig. 2.

Fig. 5 is a side elevation of the impact blade alone of a modified form of arrowhead; Fig. 6 is a side elevation of the completed arrowhead with shaft assembled, showing the latter broken away and on a reduced scale; Fig. 7 is a cross-section on line 7—7 of Fig. 6; and Fig. 8 is a diagrammatic cross-section of the arrowhead in flight, showing the stabilizing air-flow induced by the wing-slots.

Fig. 9 is an exploded side elevation, partly in section, of a modification of the form of arrowhead shown in Figs. 5 to 8 in accordance with which the impact blade is adapted to be applied by snap-on action to a pre-molded ferrule body; Fig. 10 is a cross-sectional view on line 10—10 of Fig. 9; Fig. 11 is a side elevational view, partly in section, of another embodiment of the general structural form disclosed in Fig. 9, showing the same in assembled condition; and Fig. 12 is a view similar to Fig. 11 of a still further embodiment.

This is a continuation-in-part of my original application bearing Serial No. 404,410, filed January 18, 1954, and now abandoned.

Referring now in detail to the drawings, wherein like reference characters designate corresponding parts in the several views, Figs. 1 to 4 disclose a simplified embodiment of the invention in which the impact blade **10** is of conventional broadhead form with convex cutting edges **12—12** and is closely joined to ferrule **11** throughout the coextensive portions of both elements.

Impact blade **10** preferably is made from a flat plate of the finest cutlery steel tempered and hardened to a higher Rockwell "C" hardness than found in most other broadheads. At an appropriate time in the course of manufacture of the arrowhead, the lateral cutting edges **12—12** of impact blade **10** are ground to razor sharpness. Opening through its rear edge, impact blade **10** is provided with an axially centered, forwardly tapered notch **13**, which is bordered by plural spaced anchoring recesses in the form of holes **14**.

In order to simultaneously mold ferrule **11** and unite it with impact blade **10**, the latter has its cutting edges **12—12** marginally confined in side grooves of the cavity of the mold of an injection molding machine (not shown). The mold cavity will have the form necessary to mold the streamlined ferrule **11** shown in Figs. 2, 3 and 4. Cutting edges **12—12** of impact blade **10** should be embedded in the mold grooves to such a depth that anchoring holes **14** will be unmasked and thus in open communication with the mold cavity so that molten plastic material may penetrate them freely to create anchoring portions of the ferrule body upon becoming chilled. It is to be understood that the structural details of the mold will conform to conventional practice. In the molding process, impact blade **10** will constitute the "insert" and will emerge from the mold as a functional component part of the finished product, which latter is the composite arrowhead.

The ferrule **11** may be made of any suitable thermoplastic material, but it is preferred to use nylon because of those superior qualities which make it so very well suited for the intended purpose.

"Nylon" is not a trademark but is a generic term for any long-chain synthetic polymeric amide which has recurring amide groups as an integral part of the main polymer chain, and which is capable of being formed into a filament in which the structural elements are oriented in the direction of the axis. In general, nylon is characterized by high rigidity, toughness, abrasion-resistance, strength in thin sections, chemical-resistance, and lightness in weight, when in a solid state, and by heat-resistance, form-stability, and high fluidity at molding temperatures. Unlike most themoplastics, which are amorphous, nylon is a crystalline material and is much harder, but is tough and hornlike rather than brittle. Of special interest in connection with the manufacture of the ferrule body for my composite arrowhead, the high fluidity of nylon at molding temperatures will insure ready penetration and complete filling of the anchoring recesses in the mold insert constituted by impact blade **10**. Moreover, the molding temperatures (350–510° F.) for nylon are so low that there will be no danger of loss of impact blade temper during the molding process. Then too, the shrinkage of nylon upon cooling is so slight that there will be no loosening of the impact blade in its embedded engagement with the ferrule body.

To be more explicit, the particular nylon molding powder which has been chosen for construction of the plastic ferrule body is known in the trade as "FM–10001" (page 12 of 1952 catalogue entitled "Dupont Nylon Molding Powder" published by the E. I. du Pont de Nemours and Co., Inc., of Wilmington, Delaware) and has, among others, the following average physical properties: tensile strength, 73° F., 10,900; modulus of elasticity, 73° F., 400,000; impact strength, Izod, 73° F., 0.4; stiffness, 73° F., 250.000; flexural strength, 73° F., 13,800; hardness, Rockwell, R118; and specific gravity, 1.4.

In the molding process, ferrule **11** will be provided with a preferably inwardly tapered socket **15** in its rear end for close-fitting engagement with the foot of an arrow shaft (not shown). It is preferred to give socket **15** an inclusive taper of substantially 10 degrees.

In Figs. 5 to 8, a modified form of arrowhead constructed in accordance with my present invention is shown. In several respects, this embodiment is preferred to the previously described one but the fundamental principle is the same, i. e. a plastic ferrule body with molded-on impact blade. The chief difference is in the form of impact blade **10'**, which is that of a long unusually acute V. The two co-planar cutting edges **12'—12'** are straight and disposed at an inclusive angle of 19 degrees, or at 9.5 degrees in relation to the longitudinal axis. The length from point to base should be three times the width at base. Precise dimensions in accordance with this ratio for any commercial model of hunting head will depend upon the weight of bow to be used, the arrow shaft characteristics such as length, thickness and spine, etc.

An axial notch **13'** is provided in the base end of impact blade **10'** to straddle molded ferrule body **11'** in seated engagement within the groove **11''** formed therein. This notch **13'** should be substantially one-half as long as the blade. For reasons which will be explained later herein, the inner half of notch **13'** is given an inclusive taper of 10 degrees, or 5 degrees on opposite sides of the blade axis, whereas the rear half has an inclusive taper of 19 degrees, thereby presenting inner rear edge portions **12''—12''** paralleling cutting edges **12'—12'** to define therebetween a pair of co-planar sweptback wings **10''—10''**. The bottom of notch **13'** is truncated to form an abutment **16** to resist thrust between blade **10'** and ferrule body **11'** upon target impact. Forwardly raking serrations **17** are formed along the edges of the forward portion of notch **13'** to provide anchoring recesses **18** therebetween into which molten plastic can flow during the molding process to lock impact blade **10'** in its engagement with ferrule body **11'**.

As in the previously described embodiment, nylon is greatly to be preferred in the composition of ferrule body **11'**. In accordance with standard injection molding practices, the mold cavity (not shown) is formed to receive impact blade **10'** as the "insert" in groove-seated condition and to afford the overall shape of ferrule body **11'** disclosed in Fig. 6. As shown, the forward end portion **19** of ferrule body **11'** has an inclusive outside taper of 10 degrees to conform with the shape of the forward portion of notch **13'** in impact blade **10'**. The rearward portion of ferrule body **11'** is cylindrical in form and projects far enough in rear of the base of impact blade **10'** to accommodate a base socket **15'** for attaching engagement with the foot **21** of an arrow shaft **22**. It is preferred to make socket **15'** tapered at an inclusive angle of substantially 10 degrees and to shape foot **21** of arrow shaft **22** accordingly to afford a snug fit. As shown, arrow shaft **22** is provided with the spiral feather fletching **23** usually employed with hunting arrows to cause the arrow to spin in flight. Due to the relative construction of the cylindrical portion **20** of ferrule body **11'** and the rear portion of notch **13'** in impact blade **10'**, long, narrow aerodynamic stabilizing slots **24—24** will be provided between said portion of the ferrule body and the inner edges of wings **10''—10''**.

My theory as to the stabilizing action of slots **24—24** is represented diagrammatically in Fig. 8, in accordance with which, when an arrow equipped with the preferred form of arrowhead is in spinning flight, airflow through slots **24—24** and around the outer cutting edges **12'—12'** is believed to create pressure areas *p—p* in front of wings **10'—10'** and suction areas *s—s* in rear. The ascribed effect of this action is stabilization of the arrow against "windplaning," i. e. lateral deflection due to the influence of cross-wind. A further ascribed beneficial effect of slots **24—24** is the apparent reduction of drag, i. e. resistance to forward motion in flight.

An added advantage of molding the ferrule body onto the impact blade is the assurance of a perfectly round cross-section shaft-fitting socket **15'**, unlike the sockets of elliptical or otherwise distorted cross-section encountered in metal ferrules which have been spot-welded or otherwise applied to the blades.

The modified form of impact blade is of such form and degree of hardness that it has high penetration power. At the same time, the nylon ferrule body will withstand all the shocks and pressure of penetration without becoming separated from the blade. Due to the lightness of the ferrule body, the blade can be made of maximum thickness and weight within the requirements for a properly balanced arrow.

In Figs. 9 to 12, three embodiments of an improved structural modification of the general type of arrowhead disclosed in Figs. 5 to 8 are represented. In accordance with the general modification, instead of molding the plastic ferrule body onto the metallic impact blade while the latter is mounted in the mold as an "insert," the ferrule body is pre-molded. As depicted in Figs. 9 and 10, impact blade **10*a*** is identically the same in structure as the blade **10'** of Fig. 5. Its forwardly tapered axial notch **13'** is provided along each marginal edge of the forward portion thereof with similar forwardly raking serrations **17** whose tops lie in a straight line and which have rearwardly presented inclined wedging faces and is also provided with similar rearwardly raking intervening recesses **18**. Ferrule body **11'**, however, is provided along the bottoms of its grooves **11*b*** with molded serrations **27** having forwardly presented inclined wedging faces and intervening recesses **28** corresponding in shape, size and tops aligned to the respective serrations **17** and recesses **18** of the impact blade **10*a*** in order that, when the disassembled ferrule body and impact blade are positioned in axial alignment of the blade with grooves **11*b*** of said body as shown in Fig. 9 and moved toward each other in the direction of the arrows, the serrations of the

ferrule body will wedge the serrations of the impact blade apart sufficiently to permit the respective serrations of both arrowhead components to ride over the others and drop into the respective recesses thereof for interlocking engagement. This snap-on action is permitted by the inherent resiliency of the wings 10''—10'' of impact blade 10'. To facilitate snap-on action, or reverse snap-off action whenever it is desired to disassemble the arrowhead for replacement of a defective component, mechanical means (not shown) may be employed in addition to the radial wedging action of the colliding serrations to spring wings 10''—10'' apart. Actually, it is my practice to predetermine the extent and depth of the respective serrations and recesses so that the wings of the impact blade will be still under slight outward compression in the plane thereof after assembly with the ferrule body in order that the inner edges of the blade notch that receives the ferrule body will be under constant tension and thereby bite into the softer material of said body. In this way, a more rigid and secure joint between blade and ferrule body will be maintained at all times. It may even be practicable to dispense with the interlocking serrations and use straight uninterrupted edges at the areas of juncture between blade and ferrule body because of the effective gripping action of the blade wings. Moreover, there is an added advantage of this construction. The cutting edges of the impact blade are rendered slightly concave lengthwise, which increases their target penetration qualities. This feature should be apparent in Figs. 11 and 12, wherein the normal marginal configuration of the blade wings in un-tensioned condition is represented in broken lines.

In Fig. 11, the respective serrations 17' and intervening recesses 18' of impact blade 10*c*, instead of being forwardly raking as in the embodiment of my invention represented in Fig. 9, have straight wedging side edges or faces of equal extent and equi-angular arrangement to provide oppositely presented inclined wedging faces. The mated interlocking serrations 27' and recesses 28' of ferrule body 11*c* are of corresponding non-raking form, the serrations having oppositely presented inclined wedging faces.

The structure disclosed in Fig. 12 differs from that in Fig. 11 in that the serrations 17'' of impact blade 10*d* have straight axially inclined top edges and rounded intervening recesses 18'' which provide oppositely presented inclined wedging faces for said serrations. The mated interlocking serrations 27'' and recesses 28'' of ferrule body 11*d* correspond in form to serrations 17'' and recesses 18'' of impact blade 10*d* and provide oppositely presented inclined wedging faces.

The radial extent of the respective serrations and mated recesses has been exaggerated in the drawings for clearness of illustration, it being understood that these dimensions will have to be appropriately related to the limits of elasticity of the blade structure. The side walls of the grooves in the ferrule body will serve to prevent any buckling tendency of the impact blade during the wing spreading at the time of assembly and thereafter.

It is to be understood that the present disclosure of the invention is an illustrative example and that various changes, modifications and alterations may be made in these structural embodiments which do not constitute departures from the spirit and scope of the invention.

Having thus described the invention, I claim:

1. An arrowhead comprising: a snap-on impact blade of resilient metal; and a ferrule body, said impact blade having an axially extending notch in its base end provided along each marginal edge with lengthwise rows of locking serrations whose tops lie in a straight axially inclined line and which individually have inclined wedging faces and intervening recesses in the edges thereof, said ferrule body being provided with longitudinal grooves provided with bottom walls tapered to correspond with the taper of the blade notch and adapted to slidably fit the edges of said notch, said ferrule body being provided with rows of locking serrations and intervening recesses along the bottoms of said grooves corresponding in form to the impact blade to interlock with the respective recesses and serrations of the said blade when the latter and the ferrule body are forced together axially in a manner to expand the blade notch through wedging action of said serrations.

2. An arrowhead as defined in claim 1 wherein the impact blade is V-shaped and the form of the ferrule body is such as to leave wings projecting laterally in swept-back relation to said ferrule body with stabilizing slots located between said wings and said body.

3. An arrowhead as defined in claim 2 wherein the rear portion of the notch in the impact blade is tapered at a greater angle than the forward portion and the ferrule body is cylindrical to increase the width of the stabilizing slots.

4. An arrowhead as defined in claim 3 wherein the angle of taper of the cutting edges of the impact blade and that of the rear portion of the notch therein are substantially the same to provide parallel sided wings.

5. An arrowhead as defined in claim 1 wherein the serrations of the impact blade are forwardly raking in form and those of the ferrule body are rearwardly raking.

6. An arrowhead as defined in claim 1 wherein each row of serrations of the impact blade have straight axially inclined top edges and the recesses of the ferrule body are rounded to provide inclined wedging side faces for said serrations and thereby facilitate assembly of said blade and ferrule body.

7. An arrowhead as defined in claim 1 wherein the side edges of each serration of the impact blade and ferrule body in each row thereof are oppositely inclined at equal angles to the inclined line in which the tops of said serrations lie.

8. An arrowhead as defined in claim 1 wherein the radial extent of the respective serrations of the impact blade and ferrule body is such that the side portions of said blade bordering the notch therein will be under outward compression when said serrations are interlocked in the intervening recesses, whereby the edges of said notch will be under constant tension and will bite into the ferrule body.

9. An arrowhead as defined in claim 8 wherein the impact blade has V-shaped lateral cutting edges which are individually longitudinally straight when said blade is in untensioned condition and will be longitudinally concave when said blade and the ferrule body are in completely assembled condition.

10. An arrowhead as defined in claim 1 wherein the impact blade is composed of steel and the ferrule body is composed of molded plastic material.

11. An arrowhead as defined in claim 10 wherein the ferrule body is composed of nylon.

12. An arrowhead as defined in claim 1 wherein the serrations of each row of the impact blade have straight axially inclined top edges and the intervening recesses are rounded to provide inclined wedging side faces, and wherein the serrations of the ferrule body are rounded to correspond in form to the recesses of the impact blade and the intervening recesses of said body have straight axially inclined bottom edges.

References Cited in the file of this patent

UNITED STATES PATENTS

1,604,713	Norlund	Oct. 26, 1926
2,005,424	Kindle	June 18, 1935
2,137,014	Brochu	Nov. 15, 1938
2,373,216	Zwickey	Apr. 10, 1945
2,499,029	McElroy	Feb. 28, 1950
2,676,017	Selent	Apr. 20, 1954
2,686,055	Peltz	Aug. 10, 1954