Sept. 29, 1964 W. L. SEARLES 3,150,875

SELF-LOCATING ARROW HAVING BREAKABLE CONTAINER MEANS CONTAINING ARTIFICIAL SMOKE PRODUCING CHEMICALS

Filed Nov. 8, 1962

Fig. 1.

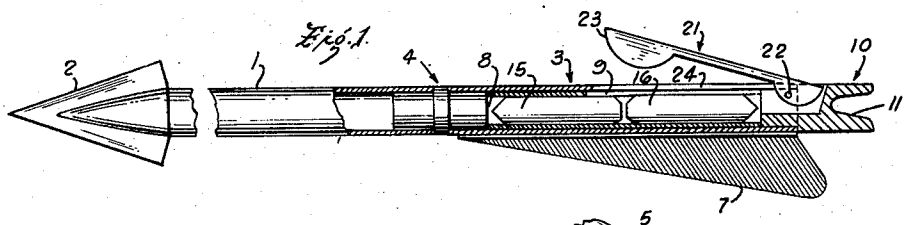

Fig. 5.

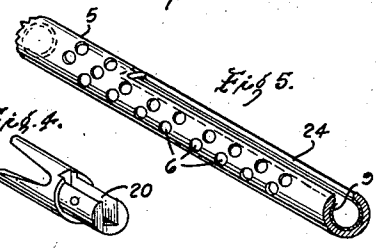

Fig. 2.

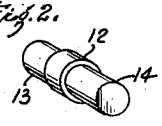

Fig. 4.

Fig. 3.

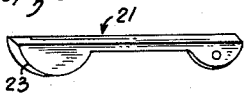

Fig. 6.

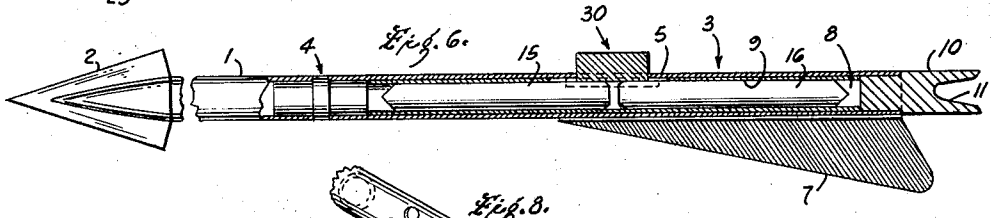

Fig. 8.

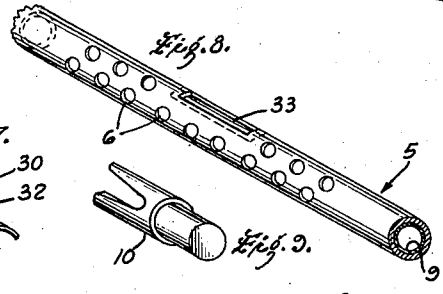

Fig. 7.

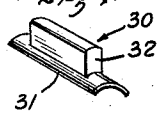

Fig. 9.

Fig. 10.

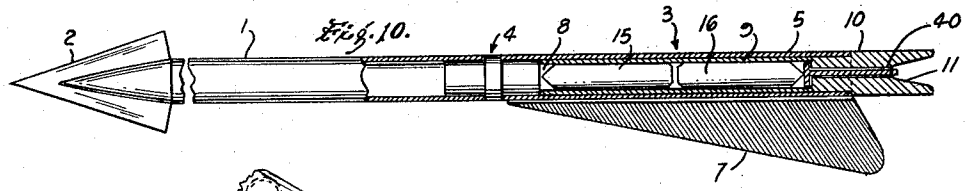

Fig. 13.

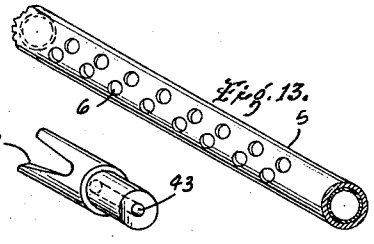

Fig. 11.

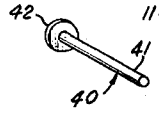

Fig. 12.

INVENTOR.
WILLIAM L. SEARLES

BY
Clarence B. Hollabaugh
ATTORNEY.

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SELF-LOCATING ARROW HAVING BREAKABLE CONTAINER MEANS CONTAINING ARTIFICIAL SMOKE PRODUCING CHEMICALS

William L. Searles, New Canaan, Conn. (% Searles Signals Co., Ridgeway Station, Box 104, Stamford, Conn.)

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14 Claims. (Cl. 273—106.5)

This invention relates to a self-locating arrow and more particularly to a hunting arrow which gives a signal after being shot from a bow which enables it to be located even though buried under leaves or hidden by shrubbery.

In recent years archery has become an increasingly popular sport. In many areas the bow and arrow hunters are given preference over the firearm hunters of wild game by the conservation authorities. Archery hunting is, however, a relatively expensive sport since good quality hunting arrows are relatively expensive and are difficult to locate when they miss their targets.

It is an object of this invention to provide an arrow which releases an artificial smoke, after being shot from a bow, which signals its location at the end of its flight and enables the archer to locate it readily.

Another object is to provide a self-locating arrow which releases an artificial smoke which persists for several minutes without creating a fire hazard when in the presence of flammable materials.

A further object is to provide a self-locating arrow which releases artificial smoke by the use of cartridges or ampules of chemicals which are relatively inexpensive and which are readily replaced in the arrow to permit its reuse at once.

Other objects of this invention and its various advantageous features will become apparent as this description proceeds.

The arrow, in accordance with this invention, is in general, comprised of the conventional components of an arrow, which includes a stele or shaft which carries on its forwardly end a pile or pointed metal cap and on the rearwardly end a nock or transverse groove or notch by which the end of the arrow is held in position on the string of a bow. It is provided with the usual fletching or feathering located near the end of the stele provided with the nock, which holds the arrow on a steady course during its flight. It is preferably, but not necessarily, provided with a crest consisting of an identifying arrangement of colored bands around its shaft near and forwardly of the fletching.

The arrow in accordance with this invention comprises a stele or shaft which consists of two detachably connected sections. The rearwardly section of the shaft which carries the fletching and the nock is partially hollow, providing a cylindrical chamber within the shaft. This hollow section of the stele is provided with a means, operable from the outside of the shaft, by which force can be applied on the inside of its cylindrical chamber, which will be termed the "hammer" in this specification and the appended claims. In one embodiment of this arrow the hammer is adapted to transmit force from the string of the bow to the inside of the cylindrical chamber at the instant the bow string is drawn against the arrow to shoot. In other embodiments of this arrow the hammer is adapted for the transmission of force from the fingers of the archer while the arrow is held in position to be shot by the bow. This rearwardly section of the stele carries the fletching and the nock of the arrow and is provided with a series of perforations which connect the cylindrical chamber with the outer atmosphere. In a preferred form of this arrow the cylindrical chamber in the rearwardly section of the stele carries a cylindrical, porous

liner which may be made of porous paper or of a porous cloth, such as, for example, a flannel.

When ready for use, two containers of a breakable material which carry different chemicals which upon admixture produce a synthetic smoke, are positioned within the cylindrical chamber of this arrow. These containers may be placed in position as much in advance of use as is desired. The containers are preferably cylindrical in shape and of a size such that they fit snugly within the cylindrical chamber, with one in front of the other, in positions with respect to the hammer which permits both of them to be readily fractured, by the application of an outside force to the hammer.

In the use of the arrow in accordance with this invention, the fragile containers of the two different chemicals contained within the cylindrical chamber in the rearwardly section of the stele are both fractured by the application of force to the hammer of the arrow either immediately before or at the instant the arrow is shot, depending upon the particular embodiment of the arrow involved. This fracturing of the containers for the smoke producing chemicals permits them to flow together and become admixed within the cylindrical chamber while the arrow is in flight. Upon admixture these chemicals evolve a synthetic smoke, which passes out of the chamber through the perforations in the stele. The evolution of this synthetic smoke persists for an appreciable period of time after the arrow has completed its flight. The plume of smoke evolved from the arrow enables the archer to locate the arrow after it has come to rest and to recover it readily.

Having now indicated the general nature of the self-locating arrow in accordance with this invention, three specific embodiments of the arrow will be described with reference to the accompanying drawings in which like reference characters are used to refer to like parts. In the drawings:

FIGURE 1 is a broken view, in partial cross-section, of an embodiment of the arrow in accordance with this invention which is provided with a hand-operated hammer,

FIGURE 2 is a perspective view of a connector which joins the two sections of the stele of the embodiments of this arrow illustrated, respectively, by FIGURES 1, 6 and 10,

FIGURES 3, 4 and 5 are perspective views of three different individual parts of the embodiment of the arrow illustrated by FIGURE 1,

FIGURE 6 is a broken view, in partial cross-section, of an alternative form of the arrow provided with a hand-operated hammer,

FIGURES 7, 8 and 9 are perspective views of three different individual parts of the arrow illustrated by FIGURE 6,

FIGURE 10 is a broken view, in partial cross-section, of an embodiment of this arrow which is provided with a hammer which is actuated by the string of the bow when the arrow is shot, and

FIGURES 11, 12, and 13 are perspective views of three different individual parts of the arrow illustrated by FIGURE 10.

Referring to FIGURES 1, 6 and 10, the numeral 1 designates the forwardly section of the stele of the arrow which carries on its forwardly end a pile 2 and is connected to the rearwardly section of the arrow indicated generally by the numeral 3 by a connector 4 which is shown in a perspective view by FIGURE 2. The forwardly section 1, the rearwardly section 5 of the stele and the connector 4 may be made of any suitable structural metal, and both are preferably hollow tubes, or have hollow end sections adapted to receive the outer end sections of the forwardly section 1 and rearwardly section 5 of the stele. Alumi-

num is a particularly suitable metal for this purpose. In the case of an arrow intended for hunting the pile 2 is made of a structural metal and is terminated by a sharp point. Also, it may carry sharp fin-like barbs as shown by the drawings. In the case of a target arrow, the pile 2 may be made of a structural metal or of a hard, tough plastic material and may have a slightly rounded point.

Referring specifically to FIGURE 2, the connector 4 will be seen to have a cylindrical mid-section 12 which has the same diameter as the external diameters of the forwardly section 1 and rearwardly section 5 of the stele of the arrow. The end sections 13 and 14 have the same external diameters as the internal diameters of the sections 1 and 5 of the stele. The sections 1 and 5 of the stele are joined by the connector merely by slipping their open ends over the sections 13 and 14, respectively of the connector 4.

Referring again to FIGURES 1, 6 and 10, it will be noted in the case of each of the arrows illustrated, that the end of the connector 4 forms the closure for one end of the chamber 8 and that this chamber carries two separate containers 15 and 16 which are made of a material, such as, for example, thin glass which is easily fractured. These containers 15 and 16 contain different liquid chemicals, which upon admixture react chemically to evolve an artifical smoke. Alternatively, the chamber 8 may contain a single container which carries a chemical which will react with the moisture of the air to produce an artifical smoke.

Referring specifically to FIGURE 1, it will be seen that the nock section 10 has a groove or slot 20 in which one end of the hammer 21 is pivotally mounted on the axle 22. The other end of the hammer 21 has enlarged inwardly extending head-section 23. This hammer is shown in perspective by FIGURE 4. The groove or slot 20 of the nock section 8 is best shown in perspective by FIGURE 4. The rearwardly section 5 of the stele has a slot 24 extending from its rearwardly end along a portion of its length, which is in alignment with the groove 20 of the nock section 8. This rearwardly section of the stele is also provided with a plurality of perforations 6—6 along its length and around its circumference.

In the use of the arrow illustrated by FIGURES 1, 2, 3, 4 and 5 the arrow is positioned with its nock against the string of the bow and the string of the bow drawn in the usual manner. The hammer 21 is then depressed by the fingers the instant before the arrow is shot, to fracture the containers 15 and 16. This requires only a slight finger pressure. By the time the arrow has reached the end of its flight, the chemicals from the containers 15 and 16 have started their reaction with the evolution of smoke which passes into the atmosphere through the porous cylinder 9 and the perforations 6—6. This smoke forms a plume which is clearly visible at a distance greater than that of the travel of the arrow, and which is persistent for several minutes.

After the archer has recovered the arrow, it can be made ready for another self-locating shot merely by slipping the backwardly section 5 of the stele off of the section 14 of the connector 4. The broken fragments of the containers 15 and 16 are then shaken out of the chamber 8, a fresh container of each of the two chemicals inserted into the chamber, and the section 5 again slipped onto the connector 4. The arrow is then ready for reuse.

The form of the arrow, in accordance with this invention illustrated by FIGURES 6, 7, 8 and 9 differs from that illustrated by FIGURES 1, 2, 3, 4 and 5 in the form of its hammer 30 which is illustrated in perspective by FIGURE 7. This hammer has a semi-cylindrical section 31 positioned within the chamber 8 extending over the ends of the containers 15 and 16 with a section 32 which extends through a slot 33 in the backwardly section 5 of the stele. The backwardly section 5 of the stele of this embodiment of the arrow is best illustrated by FIGURE 8. This section 5 is provided with a plurality of perforations 6—6 and has its rearwardly end closed by the nock section 10, illustrated by FIGURE 9 and its forwardly end closed by the connector 4 illustrated by FIGURE 2.

The arrow illustrated by FIGURES 6, 7, 8 and 9 is used in exactly the same manner as the arrow described hereinbefore with reference to FIGURES 1, 2, 3, 4 and 5, and is prepared for reuse in exactly the same manner as in the case of that arrow.

The arrow illustrated by FIGURES 10, 11, 12 and 13 differs from the two forms of the arrow discussed in the foregoing in the mechanism by which its containers 15 and 16 are fractured to initiate the artifical smoke producing reaction. In this embodiment of the arrow, the smoke producing reaction is initiated by the impulse of the string of the bow as the arrow is shot, rather than by a manual operation of a hammer by the archer.

Referring specifically to FIGURE 10 it will be seen that the nock section 10 carries the hammer 40, which is best shown by FIGURE 11, comprising a cylindrical, rod-like section 41 positioned through the perforation 43. The perforation 43 extends longitudinally through the nock section 10, as illustrated in perspective by FIGURE 12.

The head 42 of the hammer 40 is positioned against the container 16 within the chamber 8 and the end of its rod-like section 41 ends a short distance within the notch or groove 11 of the nock section 10. The rod-like section 41 of the hammer 40 may for example extend approximately one eighth of an inch into the nock of the arrow. The rearwardly section 5 of the stele of the arrow, illustrated in perspective by FIGURE 13, is a hollow cylindrical tube which has a multiple of perforations 6—6 positioned along its length and around its circumference.

In the use of the arrow illustrated by FIGURE 10, 11, 12 and 13, the force exerted by the string of the bow when the bow is drawn for shooting impels the hammer 40 against the container 16. This takes place before the bow string is released to exert its force on the bottom of the notch or groove 11 of the nock section 10 to propel the arrow on its flight. The force applied to the hammer against the container 16 fractures both that container and the container 15, permitting the liquid chemicals carried by these containers to flow together and to react chemically to produce an artificial smoke which passes through the porous cylinder 9 and the perforations 6—6. As in the case of the forms of this arrow described hereinbefore, the result is an evolution of a smoke signal after the arrow comes to rest at the completion of its flight. This arrow is prepared for reuse by the use of new containers 15 and 16 of the smoke producing chemicals in exactly the same manner as described hereinbefore with reference to the arrow illustrated by FIGURE 1.

As noted hereinbefore, the chamber 8 may carry a single breakable container which carries a liquid chemical which is capable of reacting with the moisture of the air to produce an artificial smoke. Titanium tetrachloride or silicon tetrachloride may be used for this purpose. In the presence of atmospheric moisture they hydrolyze to form titanic hydroxide and silicon dioxide, respectively. This reaction of titanium tetrachloride is shown by the following equation:

$$TiCl_4+4H_2O\rightarrow Ti(OH)_4+HCl$$

The hydrogen chloride is hygroscopic in nature and forms liquid droplets of hydrochloric acid by the absorption of atmospheric moisture. Titanic hydroxide is a solid. When dispersed as fine particles the titanic hydroxide provides nuclei for the formation of liquid droplets of hydrochloric acid. The result is the production of an effective white smoke.

The use of titanium tetrachloride or silicon tetrachloride as a source for the artificial smoke produced by this arrow has disadvantages arising from the evolution of free hydrochloric acid. The hydrochloric acid is irritating to the eyes and respiratory passages. For this reason

it is desirable to permit the artificial smoke to dissipate before the archer recovers the arrow. Another disadvantage arising from the evolution of hydrochloric acid is its corrosive action on metals, which make necessary the use of an acid-resistant material for the rearwardly section of the stele 5, the connector 4 and the nock section 10.

A number of combinations of chemicals have been disclosed in the literature for the production of artificial smoke which may be used in the containers 15 and 16. The combination of chemicals which I prefer to use is one of titanium tetrachloride or silicon tetrachloride in one of the containers 15 and 16 and in the other container an organic amine which is a liquid at normal atmospheric temperatures and pressures.

The organic amine used in conjunction with titanium tetrachloride or silicon tetrachloride in this arrow may be, for example, a primary aromatic amine, a primary cyclic amine, a primary aliphatic amine, a secondary cyclic amine, a tertiary aliphatic amine, a primary alkanol amine, a secondary alkanol amine, a tertiary alkanol amine or any mixture thereof which is a liquid at normal atmospheric temperatures. I prefer to use an organic amine which is a liquid at normal atmospheric temperature and pressure, which has a boiling point above about 50° C. and which has a viscosity at the temperature at which the arrow in accordance with invention is to be used which permits it to flow and to admix freely with the titanium tetrachloride or the silicon tetrachloride when the containers 15 and 16 of the arrow are broken.

Specific examples of organic amines which may be used in the container 15 or 16 of the arrow, in conjunction with titanium tetrachloride or silicon tetrachloride in the other one of these containers, together with the class of amines to which each belongs and their boiling points are listed in Table I.

TABLE I

Specific Organic Amines Suitable for Reaction With Titanium Tetrachloride or With Silicon Tetrachloride to Produce Artificial Smoke

Class of Amines	Specific Amine	Boiling Point, ° C.
Primary aromatic	Aniline	184
Primary cyclic	Cyclohexylamine	134.5
Secondary cyclic	Morpholine	126–129
	Dicyclohexylamine	256
Primary aliphatic	Monoethylamine	16.5
	N-Propylamine	50.0
	N-Butylamine	78
	N-Amylamine	104
	Ethylenediamine	117
	Trimethylenediamine	135.5
	Tetramethylenediamine	158
	Pentamethylenediamine	178
Secondary aliphatic	Diethylamine	55–56
	Diisopropylamine	83–85
	Di-n-propylamine	110
	N-Butylamine	76
	N-Amylamine	104
Tertiary aliphatic	Triethylamine	89–90
	Tert-n-butylamine	45.2
Primary alkanol	Monoethanolamine	171–172
Secondary alkanol	Diethanolamine	268
Tertiary alkanol	Triethanolamine	277–279 (150 mm.)

The above listed specific amines which have boiling points above about 50° C. are each suitable for use in this method without admixture with another amine. Of these amines, cyclohexylamine, aniline, diethylamine and di-isopropylamine are the most generally useful in this method. It has been found that diethylamine is a particularly good multi-purpose amine for use in this arrow.

Already noted, the containers 15 and 16 may be, for example, thin-walled, cylindrical glass ampules. I have found that glass ampules containing, respectively, about one milliliter of carbon tetrachloride or silicon tetrachloride and one milliliter of a liquid organic amine, respectively, and having external diameters which permit them to fit snugly into the chamber 8 are suitable for this purpose.

The results of a series of tests in which one milliliter of a series of different amines were contained in glass ampules, each wrapped side-by-side with a glass ampule containing one milliliter of titanium tetrachloride, the ampules of each side-by-side assembly fractured by a hammer blow and the assembly thrown into tall grass on a day when the wind was gusty and the temperature was 65° F., provides an accurate comparison of the effectiveness of the various amines when used in the arrow of this invention. The results of those tests are summarized by Table II.

TABLE II

Examples of the Production of Artificial Smoke by the Reaction of Different Organic Amines

Example No.	Amine Tested	Boiling Point, ° C.	Result of Test
1	Cyclohexylamine.	134.5	Smoke evolution started fast and continued for about four minutes. The volume of smoke was good and clearly visible at considerable distance. Filter paper was not charred and there was no other evidence of heat evolution.
2	Aniline	184	Substantially identical with that of Example 1.
3	Morpholine	126–129	Good smoke evolved for three minutes, which had a slight hydrochloric acid odor.
4	Dicyclohexylamine.	256	Very similar to that of Example 1.
5	Monoethylamine	16.5	Very fast start of smoke evolution which continued 1½ mins. Filter paper charred.
6	Diethylamine	55–56	Smoke evolution started very fast and continued for four minutes. The volume of smoke produced was approximately twice that of Example 1.
7	Di-isopropylamine.	83–85	Smoke evolution started fast and persisted for about four minutes. There was no charring of the filter paper. Results better than that of Example 1.
8	Monoethanolamine.	171–172	Smoke started well and continued for about two minutes.
9	Diethanolamine	268	Smoke started slowly but continued in good volume for about four minutes.
10	Triethanolamine	277–279	Results substantially identical with that of Example 9.

As will be noted from Table II, cyclohexylamine, aniline, diethylamine and di-isopropylamine gave the best results under the conditions of test used in these examples, with diethylamine being particularly good. Further, is will be noted that monoethylamine, with the relatively low boiling point of 16.5° C. reacted so rapidly that it did not give a persistent evolution of smoke and that the heat evolved by the reaction was sufficient to char the filter paper in which the ampules had originally been wrapped.

As can be readily appreciated, the combinations listed in Table II which did not char the filter paper in these tests present no fire hazard when used in this arrow, even when the arrow terminates its flight on dry leaves or other flammable material, since the reaction takes place within the stele of the arrow which tends to dissipate any heat which is evolved by the reaction.

As mentioned hereinbefore, the chamber 8 may be provided with a porous cylindrical liner. Such a liner is not essential, but is advantageous in assuring a complete chemical reaction of all the material carried by the chamber 8 since neither material can flow through the perforations 6—6 before it becomes fully admixed with the other material carried by the chamber. Furthermore, the porous cylinder tends to slow-down the initial evolu-

tion of the artificial smoke and to cause it to persist for a longer period of time.

In the foregoing, three specific embodiments of this self-locating arrow have been described and numerous details have been given for the purpose of fully explaining the invention. It will be fully understood that many changes may be made in those details without departing from the spirit of this invention or the scope of the claims which follow.

I claim:

1. A self-locating arrow which comprises a stele, a pile on the forwardly end of the stele, a nock on the rearwardly end of the stele and fletching on the stele near the nock, the said stele of the arrow comprising two sections which are detachably connected together, of which the rearwardly section has an internal chamber the end of which is open when the said section is detached from the forwardly end, perforations connecting the said chamber with the outer atmosphere, at least one breakable container within the said chamber carrying a liquid chemical which evolves an artificial smoke when the container is broken and a hammer which is adapted to break the said container by the application of force from outside the arrow.

2. A self-locating arrow which comprises a stele, a pile on the forwardly end of the stele, a nock on the rearwardly end of the stele and fletching on the stele near the nock, the said stele of the arrow comprising two sections which are detachably connected together, of which the rearwardly section has an internal chamber the end of which is open when the said section is detached from the forwardly end, perforations connecting the said chamber with the outer atmosphere, two breakable containers within the said chamber carrying liquid chemicals which upon admixture react chemically to evolve an artificial smoke, and a hammer which is adapted to break both of the said containers by the application of force from outside the arrow.

3. A self-locating arrow which comprises a stele, a pile on the forwardly end of the stele, a nock on the rearwardly end of the stele and fletching on the stele near the nock, the said stele of the arrow comprising two sections which are detachably connected together, of which the rearwardly section has an internal chamber the end of which is open when the said section is detached from the forwardly end, perforations connecting the said chamber with the outer atmosphere, two breakable containers within the said chamber carrying liquid chemicals which upon admixture react chemically to evolve an artificial smoke, and a hammer which is adapted to break both of the said containers by the application of manual force by the archer from outside the arrow.

4. A self-locating arrow which comprises a stele, a pile on the forwardly end of the stele, a nock on the rearwardly end of the stele and fletching on the stele near the nock, the said stele of the arrow comprising two sections which are detachably connected together, of which the rearwardly section has an internal chamber the end of which is open when the said section is detached from the forwardly end, perforations connecting the said chamber with the outer atmosphere, two breakable containers within the said chamber carrying liquid chemicals which upon admixture react chemically to evolve an artificial smoke, and a hammer which is adapted to break both of the said containers by the application of force from outside the arrow by the action of the string of the bow when the arrow is shot from the bow.

5. A self-locating arrow which comprises a stele, a pile on the forwardly end of the stele, a nock on the rearwardly end of the stele and fletching on the stele near the nock, the said stele of the arrow comprising two sections which are detachably connected together, of which the rearwardly section has an internal chamber the end of which is open when the said section is detached from the forwardly end, a plurality of perforations connecting the said chamber with the outer atmosphere, a longitudinal slot in the wall of the said chamber extending from its rearwardly end to a point forwardly of its mid-point, two breakable containers within the said chamber carrying liquid chemicals which upon admixture react chemically to evolve an artificial smoke and a hammer which has one end pivotally mounted on the arrow near its nock and positioned to enter the said longitudinal slot and to fracture the said breakable containers when manually depressed by the archer while the arrow is in position to be shot from a bow.

6. A self-locating arrow which comprises a stele, a pile on the forwardly end of the stele, a nock on the rearwardly end of the stele and fletching on the stele near the nock, the said stele of the arrow comprising two sections which are detachably connected together, of which the rearwardly section has an internal chamber the end of which is open when the said section is detached from the forwardly end, a plurality of perforations connecting the said chamber with the outer atmosphere, a slot in the wall of the said chamber near its mid-point, two breakable containers within the said chamber carrying liquid chemicals which upon admixture react chemically, a hammer consisting of a semi-cylindrical section within the said chamber which conforms to the curvature of the chamber wall and a section which extends through the said slot in the chamber wall and beyond its outer surface, the said hammer being adapted to be manually forced against the said breakable containers to break them by the archer, while the arrow is in position to be shot from a bow.

7. A self-locating arrow which comprises a stele, a pile on the forwardly end of the stele, a nock on the rearwardly end of the stele and fletching on the stele near the nock, the said stele of the arrow comprising two sections which are detachably connected together, of which the rearwardly section has an internal chamber the end of which is open when the said section is detached from the forwardly end, perforations connecting the said chamber with the outer atmosphere, two breakable containers within the said chamber carrying liquid chemicals which upon admixture react chemically to evolve an artificial smoke, and a hammer having a head positioned within the rearwardly end of the said chamber and a rod-like section extending rearwardly into the nock adapting said hammer to transmit force from the string of a bow to fracture the containers within the said chamber as the arrow is shot from the bow.

8. A self-locating arrow which comprises a stele, a pile on the forwardly end of the stele, a nock on the rearwardly end of the stele and fletching on the stele near the nock, the said stele of the arrow comprising two sections which are detachably connected together, of which the rearwardly section has an internal chamber the end of which is open when the said section is detached from the forwardly end, perforations connecting the said chamber with the outer atmosphere, two breakable containers within the said chamber one of which contains a chemical from the group consisting of titanium tetrachloride and silicon tetrachloride and the other of which contains an organic amine which is a liquid at normal atmospheric temperature and pressure and a hammer which is adapted to break both of the said containers by the application of force from outside the arrow.

9. A self-locating arrow which comprises a stele, a pile on the forwardly end of the stele, a nock on the rearwardly end of the stele and fletching on the stele near the nock, the said stele of the arrow comprising two sections which are detachably connected together, of which the rearwardly section has an internal chamber the end of which is open when the said section is detached from the forwardly end, perforations connecting the said chamber with the outer atmosphere, two breakable containers within the said chamber one of which contains a chemical from the group consisting of titanium tetrachloride and silicon tetrachloride and the other of which contains an

organic amine which is a liquid at normal atmospheric temperature and pressure and a hammer which is adapted to break both of the said containers by the application of manual force by the archer from outside the arrow.

10. A self-locating arrow which comprises a stele, a pile on the forwardly end of the stele, a nock on the rearwardly end of the stele and fletching on the stele near the nock, the said stele of the arrow comprising two sections which are detachably connected together, of which the rearwardly section has an internal chamber the end of which is open when the said section is detached from the forwardly end, perforations connecting the said chamber with the outer atmosphere, two breakable containers within the said chamber one of which contains a chemical from the group consisting of titanium tetrachloride and silicon tetrachloride and the other of which contains an organic amine which is a liquid at normal atmospheric temperature and pressure and a hammer which is adapted to break both of the said containers by the application of force from outside the arrow by the action of the string of the bow when the arrow is shot from the bow.

11. A self-locating arrow which comprises a stele, a pile on the forwardly end of the stele, a nock on the rearwardly end of the stele and fletching on the stele near the nock, the said stele of the arrow comprising two sections which are detachably connected together, of which the rearwardly section has an internal chamber the end of which is open when the said section is detached from the forwardly end, perforations connecting the said chamber with the outer atmosphere, two breakable containers within the said chamber one of which contains titanium tetrachloride and the other of which contains cyclohexylamine, and a hammer which is adapted to break both of the said containers by the application of force from outside the arrow.

12. A self-locating arrow which comprises a stele, a pile on the forwardly end of the stele, a nock on the rearwardly end of the stele and fletching on the stele near the nock, the said stele of the arrow comprising two sections which are detachably connected together, of which the rearwardly section has an internal chamber the end of which is open when the said section is detached from the forwardly end, perforations connecting the said chamber with the outer atmosphere, two breakable containers

within the said chamber one of which contains titanium tetrachloride and the other of which contains aniline and a hammer which is adapted to break both of the said containers by the application of force from outside the arrow.

13. A self-locating arrow which comprises a stele, a pile on the forwardly end of the stele, a nock on the rearwardly end of the stele and fletching on the stele near the nock, the said stele of the arrow comprising two sections which are detachably connected together, of which the rearwardly section has an internal chamber the end of which is open when the said section is detached from the forwardly end, perforations connecting the said chamber with the outer atmosphere, two breakable containers within the said chamber one of which contains titanium tetrachloride and the other of which contains diethylamine, and a hammer which is adapted to break both of the said containers by the application of force from outside the arrow.

14. A self-locating arrow which comprises a stele, a pile on the forwardly end of the stele, a nock on the rearwardly end of the stele and fletching on the stele near the nock, the said stele of the arrow comprising two sections which are detachably connected together, of which the rearwardly section has an internal chamber the end of which is open when the said section is detached from the forwardly end, perforations connecting the said chamber with the outer atmosphere, two breakable containers within the said chamber one of which contains titanium tetrachloride and the other of which contains di-isopropylamine, and a hammer which is adapted to break both of the said containers by the application of force from outside the arrow.

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