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SMOKE SIGNAL

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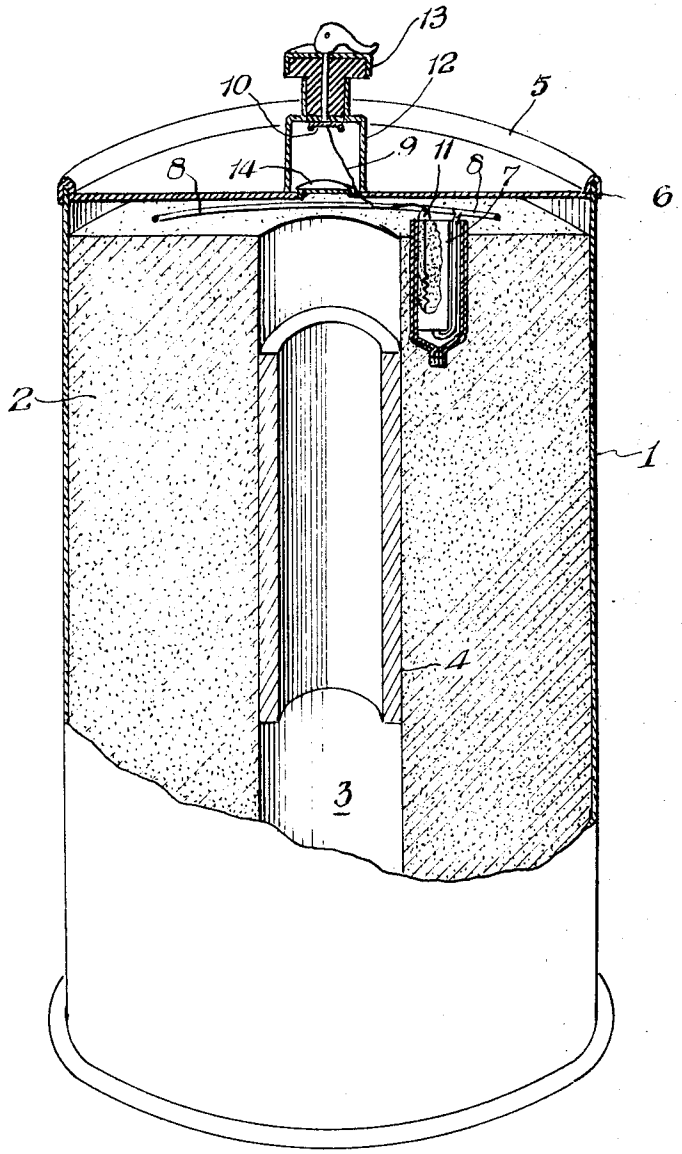

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SMOKE SIGNAL

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ABSTRACT OF THE DISCLOSURE

A smoke signal comprising a container provided with an orifice and filled with a charge of smoke producing combustible materials. A centrally located axial passageway or bore in the charge is provided with a snug fitting solid wall tube substantially shorter in length than the bore. Deterioration of dyes which may be used for coloring the smoke is prevented and the duration of the smoke discharge is greatly increased.

This invention relates to improved smoke signals for civilian and miltary uses and more particularly to colored smoke signals which provide improved daytime visibility for marine purposes.

Smoke signal devices heretofore available have been deficient in at least two important respects. As is well known, it is extremely difficult, particularly from aerial observation, to distinguish ordinary smoke against the background of the sea. Therefore, attempts have been made to incorporate organic dyes or other color material with the combustible material in a smoke signal. However, the heat generated after ignition of the combustible materials frequently causes deterioration and/or decomposition of the color ingredients and the signal fails to give the desired results. In addition, earlier devices fail to provide sufficient duration of smoke emission since the combustible materials are rapidly consumed in the usual conventional construction. Direct and uncontrolled emission of smoke and vapors into the atmosphere as provided in earlier devices not only causes deterioration and/or decomposition of the dye with resultant loss or change of color and brilliance but also greatly shortens the duration of the smoke emission because of the development of excess temperature during combustion of the smoke generating material. The improved device of the present invention eliminates the several deficiencies found in the earlier signal structures.

A principal object of the invention, therefore, is the provision of a signal device which prevents deterioration and decomposition of dyes or other color materials within the signal container during combustion of the smoke generating materials. Another important object is the provision of a smoke signal which greatly increases the duration of the smoke discharge into the atmosphere. Another object is the provision of a long burning smoke signal which retains the color brillance of the smoke after it is expelled from the signal container. A further object is the provision of a smoke signal which avoids accumulation of excessive heat within the container during combustion of the smoke generating materials. A still further object is the provision of a smoke signal device which is simple in construction and inexpensive to manufacture. Other objects will become apparent as the description of the invention proceeds.

These objects are accomplished by means of a smoke signal device comprising a rigid water-tight container with an orifice in the top cover of the container, a charge of smoke generating combustible materials intermixed with a color component disposed and compressed within the container, a centrally located axial passageway or flue through said charge, and a substantially non-heat conducting tube insert situated snugly within the passageway and below the passageway orifice, said tube being substantially shorter than the length of the passageway. In the preferred embodiment of the invention the water-tight container is of metal and cylindrically shaped and the non-heat conducting tube is fabricated from cardboard. If desired, the color component of the charge may be omitted.

Referring now to the drawing which is illustrative only and is not to be construed as limited to the particular details of the device illustrated, except as the same may be defined in the appended claims; the drawing illustrates the novel signal construction partially in perspective and partially in cross section. The container **1**, temporarily fitted with a centrally located spindle or mandrel (not shown), is charged under manual compression with a mixture of combustible smoke generating materials and vaporizable color material **2**, after which the spindle (not shown) is withdrawn leaving a flue-like passageway or hollow core **3**. A substantially non-heat conducting solid walled, open tube **4**, substantially shorter than the passageway, is inserted in the passageway a short distance below the passageway orifice. A container cover **5**, with a centrally located hole, preferably about ½ the diameter of the flue-like passageway, is then tightly attached to the container wall by double-crimping of its outer edge **6**.

The container **1** may, for ease of manufacture, preferably consist of metal such as tin plate, copper, bronze or galvanized iron. However, it may also be fabricated from other waterproof or water and heat resistant materials such as certain plastics, for example, "Teflon®" tetrafluoroethylene resin, resin impregnated fiber glass, asbestos board, etc., although metal is preferred for its heat conducting properties. The container may vary in size depending upon the ultimate utility of the device but for many uses, I have found that a convenient size is about 12 inches in length by 5 inches in diameter.

The flue-like passageway preferably extends throughout the entire length of the combustible charge and maintains its contour during burning of the signal because the combustible and vaporizable materials are charged into the container under compression around a temporarily installed mandrel or spindle which is removed before the tube is inserted in the passageway. For the specific container dimensions mentioned in the preceding paragraph, the flue-like passageway is preferably one inch in diameter, although the device is operable with larger or smaller diameters, for example, from about ½ inch to 1½ inches.

As indicated above, the tube insert **4**, which is basically the heart of the invention, is solid walled and preferably fabricated of cardboard. For the dimensions of the container referred to above, it is about 4½ inches long and has a wall thickness of about ⅛ inch. Its outside diameter is only very slightly smaller than that of the flue-like passageway in order to provide a snug fit. The tube length is rather critical although operative results may be obtained with lengths between 3½ inches and 5 inches. Also the tube length will vary depending upon the length of the container but in general its length will be about ⅓ the length of the passageway for best results. If the tube is too long, the vapors of the color material in the smoke rising through the hot porous burned combustible material or ash will deteriorate or decompose, causing loss of color and brilliance. If the tube is too long, the hot smoke and vapors are restricted from passing into the center, causing an increase in burning temperature, which in turn speeds the reaction, thus reducing the burning time. With a tube of proper length, the smoke and vapor pass directly into the cooler center. If the tube is too short, the hot smoke and gases accumulated in the center and in direct contact with the burning mixture will accel-

erate the decomposition of the color material. Although the tube is described as being fabricated from cardboard, it may be made of other substantially non-heat conducting materials, such as asbestos, fiber glass, "Teflon®" tetrafluoroethylene resin fabric, etc.

The combustible and vaporizable charge introduced into the signal container may consist of conventional fuels, oxidizers and color materials, for example, wheat, sugar, flour, sulfur, dextrine, lactose or sawdust as the fuel, a chlorate or nitrate as an oxidizer and an organic dye, metallic sulfide or red arsenic as color material. The mixture may consist of about 20% fuel, such as cane sugar or lactose, 25% oxidizer, such as potassium chlorate, and 55% of color material such as a vaporizable aniline dye, for example, orange aniline dye.

If desired, the device may be provided with ballast consisting of iron, steel or sand placed at the bottom of the container to maintain the unit in an upright position when floating on water surfaces.

The ignition of the combustible component of the charge may be accomplished by conventional means. However, the ignition device shown in the drawing, known as the Ensign-Bickford Pull Wire Lighter, illustrates in detail a convenient means which is operative in the present invention.

In the drawing, numerals **7–14** represent elements of the igniter-fuse assembly. The rolled paper sheath **7** contains a small fiber tube enclosing a wire/flammable disc igniter and cotton braided fuse **8** which extends from the tube and out of the sheath container and is disposed in a circular path around and just beneath the surface of the combustible material charge. The cotton braided fuse preferably has a core of black powder to aid in igniting the combustible materials. The pull-wire **9**, consisting of brass wire about .036 inch in diameter, is attached at its upper end to washer **10** and passes into a fiber tube within container **7** through cap **11** and through a striker disc within the cap. This disc is coated with a compound of the type used in ordinary match heads composed essentially of potassium chlorate and phosphorous and ignitible by friction caused by pulling wire **9** through the disc. The pull-wire is partially coated (about 1 inch on the portion within the igniter) with a composition similar to the striking composition for safety matches. Nozzle **12** is adapted to receive the removable closure **13** which may be fabricated conveniently of neoprone and stainless steel. Vent covering **14**, which may consist of paper tape coated on one side with pressure-sensitive adhesive, functions to temporarily protectively seal off the contents of the signal container and is consumed by burning when the combustible materials in the container are ignited.

The orifice in the container cover shown at the upper terminus of the flue-like passageway is preferably about ½ the diameter of the passageway. This creates some back pressure which prevents entrance of water when the signal is used for marine purposes and also assists in providing emission of smoke and colored vapors without actual flaming of the combustible material.

In operating the device, the closure **13** is pulled upward, causing the igniter wire **9** to be pulled through the striker disc disposed within cap **11**, thereby creating friction against the ignitible coating on the disc and ignition thereof, which in turn ignites fuse **8**. Fuse **8**, which is disposed near the top of the device and just beneath the surface of the combustible material, in its burning ignites the combustible material at the top of the signal causing combustion thereof to proceed downward. The igniter container being of paper construction is consumed by

burning and quickly disintegrates. The important and basic function of the tube element **4** in providing an improved signal device is described above.

The novel construction of the signal device of the present invention affords a number of important advantages. Accumulation of excessive heat within the signal is prevented, thereby avoiding decomposition or deterioration of the color material and insuring maximum color intensity and brilliance in the smoke emitted from the signal after ignition. I have also found that with the particular construction of the new signal that the duration of the smoke emission is double that of a similar signal which does not incorporate the solid-walled tube element in the flue-like passageway in the dimensional relation described. The new device is also simple in construction and inexpensive to manufacture.

It is apparent that many widely different embodiments of the invention may be made without departing from the spirit and scope thereof; and, therefore, it is not intended to be limited except as indicated in the appended claims.

I claim:

1. A smoke signal device comprising a water-tight container with an orifice centrally located in the top cover of said container, a charge comprising combustible smoke generating material disposed within said container, a means for igniting said charge, a centrally located axial flue-like passageway through said charge and a substantially non-heat conducting tube insert situated within said passageway and below the passageway orifice, said tube being substantially shorter than the passageway and having a diameter only slightly less than the diameter of the flue-like passageway.

2. Device of claim **1** in which the smoke generating material is intermixed with a color component.

3. Device of claim **2** in which the color component of the charge is an organic dye.

4. Device of claim **1** in which the substantially non-heat conducting tube is fabricated of cardboard.

5. Device of claim **1** in which the non-heat conducting tube is about ⅓ of the total length of the axial flue-like passageway.

6. Device of claim **1** in which the orifice in the top cover of the container is about ½ the diameter of the axial passageway.

7. Device of claim **1** in which the non-heat conducting tube is disposed in said flue-like passageway so that the top of the said tube is about one inch below the passageway orifice.

8. Device of claim **1** in which the flue-like passageway extends through the entire length of the container.

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