Patented Feb. 23, 1943 2,311,635

UNITED STATES PATENT OFFICE

2,311,635

METHOD OF PRODUCING SMOKE

Herbert E. Britt, Los Angeles, Calif.

No Drawing. Application January 3, 1940, Serial No. 312,228

8 Claims. (Cl. 252—305)

This invention relates to a method of producing smoke and has as its primary object the provision of a method whereby a volume of smoke composed of solid matter carried in suspension in the atmosphere may be readily formed without combustion and in a fashion to render it suitable for use as an obscuring medium in warfare as in the concealment of troops, military equipment, etc., in defensive operations, and in the attack of enemy positions in offensive operations, and which is also suitable for use as a blinding medium in the dispersion and overcoming of riotous mobs and entrenched persons, and also in creating the illusion of smoke or fog as in photography and particularly in the making of motion pictures.

Another object is to provide a mode of producing smoke as needed by the admixture of liquids having the properties of coacting when brought together to form minute opaque solid particles capable of floating in the air, and also by the addition of another liquid produce a smoke of various regulated predetermined densities relative to surrounding atmosphere whereby a smoke may be made that will float freely or sink with predetermined speed in atmosphere.

Another object is to provide a smoke producing process whereby clouds of various densities may be formed ranging from a translucent cloud, through which objects are visible as in a fog or haze, to a dense practically opaque cloud which will render objects shrouded therein invisible.

Another object is to provide a method whereby a cloud or smoke may be produced which is harmless to human or animal life and has no appreciable destructive effect on construction and finishing materials when used under proper conditions and by reason thereof is especially applicable for use in the taking of motion pictures where persons, animals and properties are subjected to the smoke.

A further object is to provide a mode of producing smoke of the character above described which may be readily accomplished.

With the foregoing objects in view, together with such other objects and advantages as may subsequently appear, the invention is carried into effect as hereinafter set forth by way of example, and as defined in the annexed claims.

The primary substances employed in forming the smoke comprise an amine and an acid which is normally liquid at ordinary temperatures and possesses low viscosity, and specifically consists of cyclohexylamine and a volatile organic acid such as acetic acid. Since it is old and well known in the art to produce smoke or salts by uniting acids with amines or ammonia, the term "amine" as employed herein is to be construed as meaning cyclohexylamine, and the term "acid" is to be construed to mean a volatile normally liquid organic acid such as acetic acid having comparatively slow corrosive action or low degree of disassociation.

In forming smoke the acid and amine are brought into contact with each other in the presence of atmosphere with either the acid or the amine, or both, in vaporous form. For example, the smoke may be formed by passing vaporized acid into or against a volume of liquid amine, or vaporized amine may be directed into or against a volume of acid, or acid vapors and amine vapors may be brought together. In either event the contact of the acid and amine in atmosphere, with either the acid or the amine, or both, in the form of vapors, will result in the production of a mass of fine opaque particles consisting of amine salt that are capable of being suspended in atmosphere and when so suspended will have the appearance and effect of a white smoke, fog or mist. Any suitable spraying or vaporizing apparatus may be employed in effecting vaporization and delivery of the atomized acid or amine.

To vary the weight of the smoke a volatile liquid of low boiling point, such as acetone, is added to either the acid or the amine, or both. A non-combustible fluid, such as carbon tetrachloride, is added to either the acid or the amine to reduce combustibility of the smoke where fire would be undesirable or hazardous, and which will also serve to increase the weight of the smoke; however, where tetrachloride is admixed with the amine the mixture must be used immediately to be effective.

The relative proportions of the materials is arbitrary since, other than in forming a mixture of either or both the acetone and carbon tetrachloride with either the acid or amine, no preliminary admixture of the materials is effected; the acid and amine being brought into contact with each other as above stated at the time of forming the smoke.

When acetone or other volatile liquid of low boiling point is employed the quantity thereof is varied according to the results desired; the low boiling point liquid acting to increase the rate of evaporation of the mixed acid and amine liquids and to produce cooling by more rapid evaporation so that the generated smoke will

have a density greater than the surrounding atmosphere proportional to the volume of low boiling point liquid employed relative to a given volume of acid and amine. The use of a volatile liquid of low boiling point affords a means of varying and controlling the density and the weight of the produced cloud and whereby floating of the cloud in atmosphere may be prolonged or diminished as occasion requires, and conversely the sinking of the cloud to the lowest points may be augmented or retarded. In like fashion the use of carbon tetrachloride serves to afford a means for varying the weight of the generated smoke relative to the surrounding atmosphere; the weight of the smoke being increased according to increase in the quantity of carbon tetrachloride used.

An example of the proportion of low boiling point liquid used is ten to fifty per cent to a given volume of acid or amine, and an example of the proportion of tetrachloride used is ten to sixty per cent of the acid or amine, but such proportions may be varied as occasion may require.

In order to dilute and facilitate evaporation of the amine ethyl alcohol is added to either the acid, or amine, or both, in any suitable proportion. A mixture of twenty-five per cent of the alcohol is satisfactory.

An essential oil or other suitable odorizer is added in suitable quantity to the amine to impart either a pleasant or a disagreeable odor to the generated smoke, where desired.

Formation of the smoke is or may be effected at any atmospheric temperature above the sub-zero temperature at which the liquids employed freeze, without subjecting the liquids or the formed vapors to any temperature treatment and whereby the process can be carried into effect with the materials having a temperature like or approximating that of a surrounding atmosphere above the freezing point of the liquids used.

The smoke formed by the method herein set forth is characterized by its instant generation and its density; the action of the acid on the amine being to immediately produce a volume of white smoke composed of fine opaque salt the molecules of which are sufficiently large that when massed together form a dense cloud through which objects are invisible.

The smoke thus formed is especially applicable for use in the taking of motion pictures in producing effects of smoke, steam, fog and mist, and is also serviceable in producing smoke screens in military operations since large areas may be readily obscured thereby.

It may also be used as a harmless medium in dispersing crowds, and in breaking up mobs and riots, since the generated smoke is ordinarily non-injurious.

An important feature of the invention resides in the use of carbon tetrachloride as a means for rendering the generated smoke heavier than surrounding atmosphere, since the tetrachloride vapor developed in atomizing the acid or amine with which the tetrachloride is admixed are quite heavy relative to the atmosphere at any temperature of atmosphere above the freezing point of the mixture; this weight characteristic of the tetrachloride constituent enabling regulation of the weight of the generated smoke by variation of the proportion of tetrachloride used and without necessitating resort to temperature treatment as long as the temperature of the carbon tetrachloride does not exceed that of the surrounding air.

By the employment of a normally liquid organic acid which is slow in corrosive action, in conjunction with cyclohexylamine in the fashion set forth, a non-toxic and practically non-injurious smoke is produced which is more permanent and lasting in the atmosphere and has an exceedingly greater obscuring power than smoke produced by the use of ammonia and hydrogen chloride or by the use of methyl amine and hydrochloric acid as heretofore practiced. Furthermore, since the organic acid preferably employed and cyclohexylamine are liquids at ordinary temperatures and possess low viscosities they are subject to being readily sprayed and vaporized, and consequently caused to effectively intermingle and coact at ordinary atmospheric pressures and temperatures, without the employment of added heat and without the necessity of dissolving in water or other medium.

I claim:

1. The process of forming smoke consisting in subjecting cyclohexylamine to the action of volatile liquid organic acid in the presence of atmosphere.

2. The method of forming smoke consisting in subjecting cyclohexylamine to the action of acetic acid in the presence of atmosphere.

3. The method of making smoke consisting in subjecting cyclohexylamine to the action of acetic acid in the presence of atmosphere and also in the presence of acetone.

4. The method of forming smoke consisting in subjecting cyclohexylamine to the action of acetic acid in atmosphere in the presence of carbon tetrachloride.

5. The method of forming smoke consisting in subjecting cyclohexylamine to the action of acetic acid in atmosphere in the presence of carbon tetrachloride and also in the presence of acetone.

6. The method of producing an opaque cloud consisting in combining in atmosphere a volume of acetic acid and a volume of cyclohexylamine in the presence of ethyl alcohol.

7. The method of producing smoke consisting in separately vaporizing liquid cyclohexylamine and liquid acetic acid and bringing the vaporized cyclohexylamine and acetic acid in contact with one another in the atmosphere.

8. The method of producing smoke consisting in separately vaporizing cyclohexylamine and acetic acid and bringing the vaporized cyclohexylamine and acetic acid in contact with one another in the atmosphere and in the presence of ethyl alcohol to increase the rate of evaporation of the mixture and also in the presence of carbon tetrachloride to increase the weight of the produced smoke.

HERBERT E. BRITT.