

UNITED STATES PATENT OFFICE

2,595,774

PROTECTION OF STRUCTURES FROM
NOXIOUS ATMOSPHERES

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Application January 2, 1948, Serial No. 300

8 Claims. (Cl. 175-265)

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This invention relates to method and means for the protection-in-part of structures and the personnel thereof from noxious atmosphere, in particular to ships and buildings and the like structures.

The objects of this invention may be set forth as follows:

(a) To offer as an improvement in the art of structure and personnel protection by water droplet envelopment and screening water droplets with an electric charge and field characteristic, to make for improved and more efficacious protectiveness.

(b) To protect-in-part such structures as ship or building and the personnel thereof from noxious atmosphere, e. g., atmosphere contaminated with radioactive matter, bacterial warfare agents and chemical warfare agents, and, from other harmful agents which may be carried therein or traverse same, e. g., intense ultraviolet and heat radiations and certain corpuscular radiations.

(c) And, concurrently with the aforementioned objects, to carry out and not detract from a secondary object possessed by the parent invention, disclosed in co-pending application S. N. 748,632, filed May 16, 1947, to make available method and means of camouflage effective to render a target of substantially deceptive nature and dimensions to enemy observers.

Referring to the accompanying drawings which form a part of the present disclosure:

Figure 1 illustrates in end-elevation this invention in form applied to a ship; the numeral 1 designates the ship hull; 11 and 11', the superstructure thereof; 111, another part of the superstructure, say the mast; 2, a flexible or less preferably a rigid liquid conduit, say an asbestos, rubber or metal hose; 3, a liquid pump, with which 2 is in communication; 33, the outlet main or pipe from the pump; 333, distribution mains; 4, nozzles or water droplet releasing means; 5, a suitable source of high voltage direct current electrical energy; 55, the electric leads therefrom, being in communication with the plurality of nozzles 4; and 6, water droplets or water spray screens being ejected from 4, and possessing electric charges of differential signs.

Figure 2 illustrates that part of Figure 1 taken on the lines 2-2, and shown in side-elevation. In Figure 2, the numeral 44 refers to an insulating collar or joint member, say of glass, plastic or other suitable insulating material, between the nozzle or droplet-forming means 4 and the liquid water supply main or pipe 333. The letters WF and the arrow designate water flow and its direc-

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tion. Moreover, suitably attached, say by bolts to the insulator 44, is the water-droplet charging or electrification member 555, shown as a closed or nozzle-enveloping wire-mesh basket or sieve-form enclosure fitting over the end of the nozzle and within the trajectory of the water droplets so that same pass therethrough electrification member 555 and acquire an electric charge. The numerals 6(0) and 6(plus or minus) refer to the water droplets first without electric charge, i. e., immediately after formation, and then with electric charge, i. e., after passage through the member 555, respectively; in communication with the member 555 of alternate series of nozzles are negative and positive electric leads 55 from the transformer and rectifier system or other power source 5.

Other details in the accompanying drawings are fully described hereinafter.

In the invention disclosed in my co-pending parent application, Ser. No. 748,632, the water droplets are formed from clean uncontaminated water, as is the case herein, and are distributed by suitable means over and about the structure to be protected, with no special treatment being given the water droplets insofar as their electrical characteristic is concerned. Also, in my co-pending application entitled "Protection of Structures from Noxious Atmosphere," Serial Number 791,073, filed December 11, 1947, the water droplets are given a negative electrical charge of high potential so that they have an electric field surrounding them.

The present invention differs from the art, supra, in that the water droplets layers (or sheets) are differentially electrified. Thus, in Figure 1, separate water droplet screens or layers are shown, these having electrification of differential sign (or polarity) in alternate water droplet screens making up a plurality of screen layers enveloping the structure to be protected.

This means that for example in the case of a ship enveloped in four concentric water droplet screens (or layers) of substantial demarcation from one another, the outermost water drop screen will bear say a positive electrical charge, the screen beneath that a negative electrical charge, the water drop screen beneath that a positive electrical charge, and, finally the water drop screen beneath that or innermost a negative electrical charge.

With this arrangement, which is subject to considerable modification in geometry, and number of charged layers of water drops in a system (which must be at least two, one of positive sign

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and the other of negative sign, with the arrangement of signs not being especially important), the equivalent of an electrostatic precipitation system is obtained, except that fluid electrified members (the screens of water droplets) are involved and the effectiveness of the fluid system is greater than in the case of an electrostatic precipitation system with rigid electrified members (or electrodes). The enhanced effectiveness of the "fluid electrostatic precipitation system," i. e., the present invention, is realized from the fact that not only is protective action exerted by the charged field of the water droplets, but also by the nature of the liquid water substance itself in droplet form; as set forth in the aforementioned applications and following.

Cooperantly with the foregoing considerations involved in electric potential-bearing water droplets in say screen-form, this invention involves several physical processes. As far as its functioning is concerned, those physical processes which may be regarded as the more salient include the following: (a) the trapping, by absorption and adsorption, of air-borne noxious matter by individual water droplets and the carrying of the matter from the air by the falling droplets, (b) the mechanical barrier which is provided by the plurality of droplets, this preventing access of noxious atmosphere to a structure behind this barrier, (c) the solution of hydrophilic and water-soluble noxious matter carried in the air, and so on, including a minor amount of nucleation and precipitation, from the evaporation-supersaturation-precipitation cycle that is involved, all of which processes may be taken as illustrations of the manifold effects which particles of liquid falling through the atmosphere contribute to the depression of the noxious matter content of that gas system.

From the accompanying drawings illustrating a preferred though not exclusive form of this invention it is seen that water taken from the depths of the sea, so as to be relatively free of noxious materials like atomic explosive debris, up through conduit 2 via the agency of force supplied by the pump 3 is distributed through conduits 33 and 333, to rain-forming means, say brass or metal nozzle 4, which are selectively positioned over the super-structure of the ship 1, effective to produce an envelope of artificial rain or water spray or droplets 6 which serves to provide a curtain about and over the ship or other structure, as disclosed infra, thereby providing protection in that of noxious agents like war gases, heat waves and radioactive poisons do not have access to the ship 1 and also its personnel. It is important that the water be derived from uncontaminated sources, and with sufficient lengths of conduit 2 water from depths of one hundred or more feet under the sea can be pumped up and relied upon to produce the rain-form envelope. The conduit 2 is provided with a winch, near the pump 3 so as to be used preferentially. In these respects nothing novel or new is claimed to be added to the art, and variations and departures in structure and choice of materials, as well as number, pressure and size of pump, can be made upon knowledge well known to those skilled in the art.

Since it is important to prevent the conduction of electrical energy through the water supply mains 333, as shown in Figure 2, and thereby short-circuit the system in the case of saline water (sea water), the electrification of the water droplets is made after same have is-

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sued from the nozzle, this being accomplished as shown in Figure 2 by a charged barrier or screen 555 which is insulated from the remainder of the water system 4 and 333, and which is placed at sufficient distance from the nearest electrically conducting element, member 4 for example, so as to insure against spark-over through that element and back through the water main 333 and into the power source 5 or elsewhere wherein a danger to personnel might be created. The electrifying screen element 555 may be made adjustable for use with different water pressures, nozzles, water of different conductivities and the like, so that its distance from say the nozzle 4 can be regulated in accordance to knowledge well known to those skilled in the art.

In the case of electrification means for pure, clean and non-saline water, such as is drawn from an artesian well or other such supply, the power lead 55 can be in communication with the nozzle 4 and the electrification member 555 dispensed, as desired.

Whereas in the accompanying Figure 1 this invention has been shown in form and modification as applied to a naval vessel or like water-traversing vehicle, it is understood that this is by no means the only form and modification of the present invention. Thus, without violating the spirit or scope of this invention, the same method and means can be effectively utilized on stationary structures, such as buildings and the like. In such instances the water supply and the nature of the water is slightly modified insofar as source and origin are concerned, though in any event the water must not be contaminated with noxious materials, and is preferred to be non-saline.

For example, this invention applied to the protective envelopment and/or electrified liquid screening of a multistory building comprises a source of clean water, say obtained from a remote reservoir which supplies the pump via deeply buried underground mains or pipes, or, a deeply buried tank of steel, tile or concrete, the same supplying water to the said pump as desired, or, preferably a natural water supply such as an artesian well drilled beneath or near the site of the building or other structure for the specific purpose of supplying clean, cool and uncontaminated non-saline water to the pump for all instances of distribution. On a building the nature of the nozzle, charging means (shown in Figure 2) and the like are more or less optional insofar as arrangement and distribution over the surface or other suitable parts of the structure are concerned, but constructional and operational features will be in principle essentially as set forth herein. The screens of differentially charged rain or water droplets are directed in curtain or umbrella form both away from but down the sides of the structure and over its top, to fall ultimately down the sides, preferably from select positions along the edges of the building and particularly from the top edges near the roof, effective to form an envelope which comprises two or a plurality of sheets or layers of charged water spray or droplets or rain over the exposed areas and surfaces of the said building but preferably not completely washing in contact over the sides and exposed portions of the structure.

In operation of this invention, whether the structure under protection be a moving or stationary vessel like a battleship or aircraft carrier, or, a military or civilian installation like a multistory concrete and steel or brick building or a gun em-

placement or fort or storage house, it is generally important that the exposed parts and areas of the structure be as completely enveloped in artificial rain as is practicable. In the nozzles 4 of the accompanying Figure 1, the rain is produced by a so-called "spread-lip" or flat-spray ejecting nozzle from water introduced therein under sufficient pressure so as to achieve the objects mentioned supra and preferably so as to shoot or pass cleanly over the bow, stern or sides of the ship, depending upon the placement of the nozzles, and not drop or splash in large amounts onto the decks of the ship.

As to the source of high potential electricity, several of the apparatus well known to those skilled in the art may be chosen. To be preferred as sources of direct current are those systems which comprise a high tension transformer and suitable rectifying tubes or other such means for rectifying the output of the transformer. For small direct current, high voltage sources, transformers supplying up to say 15 kilovolts potential may be conveniently employed. This output is conveniently rectified by the mercury rectifier tube, commonly known in the art of electronics as an 866 or 866A. These small units are suitable for small installations and applications of the present invention, or, for employment in plurality, one of such high potential, direct currents means to a nozzle or spray forming means, in the case of large installations and applications of this invention. For sources of higher potential or use in large installations, choice of means may be made from a consideration of the apparatus used in the X-ray art. Thus, high tension transformers, usually oil immersed, supply anywhere from say 10 kilovolts to between 100 and 200 kilovolts, at low amperages. These high tension transformers function with large rectifying tubes or other rectifying devices which include for example mechanical rectifiers and electron valve-tube rectifiers, the so-called kene-trons. Also, if desired, the older and presently somewhat obsolete sources of high voltage, the "influence machines" or "static generators" may be relied upon for specific and special applications of this invention.

In general, as high a potential as is safe and convenient to use, should be communicated to the water droplets after their formation (saline) or to the liquid water (non-saline) prior to droplet production. Whereas an action is obtained with water drops bearing a charge of as little as less than one kilovolt it is preferred that at least ten kilovolts potential be imparted to the water droplets, and for use in highly contaminated atmospheres this value may be raised by a factor of ten or more, e. g., raised to 100 kilovolts or more charge. The high potentials involved in employment of this invention will not be unsafe when suitable insulating arrangements are made, and when the proper type of direct current power source is employed.

The disposition of the separated layers or screens of a plurality of water droplets electrified differentially as to sign may be considered modified in geometry and form and yet not violate the spirit nor scope of this invention. For ships and buildings at least two layers (or screens), one of positive sign and the other of negative sign, but both of equivalent potential, should be employed. These may be released, as shown in Figure 1, so as to be clearly separated from one another for the trajectory that corresponds to the region and area to be protected, and at their

final destination, e. g., upon striking the earth or surface of the water, it matters little if they mix.

The degree of separation, whether two or more layers (of odd or even number) be employed, also can vary between the least convenient distance (say less than one foot) for small protective installations and small structures or part thereof, e. g., portals on structures, on up to several yards or more, depending upon the conditions of application of this invention. The concentricity of successive trajectories, as in the case of a ship or building, may be said to fulfill separation conditions when the layers of water drops originate at different elevation from somewhat similar line or point sources and are pressure-projected outward at an angle less than normal (horizontal). When the layers fall perpendicularly, the separation may be considered uniform and nearly parallel in the absence of deforming factors such as wind.

As is the case in my co-pending application S. N. 748,632 and invention therein disclosed, with a large envelope or screen of water particles around and over a small structure, the latter can therefore be made of apparent size greater than real size. This is important in view of the fact that aerial observation and photography and radar and microwave and other like detection and observation methods and means are widely employed in the warfare art; it is therefore possible for a small vessel to hide itself under a large umbrella of water droplets, i. e., rain, preventing an enemy observer from ascertaining the true size and strength of the unit or ship, giving for example the impression that a small ship may be a capital fighting vessel. The forms of the umbrella of water droplets is designated in the claims by the term "umbrelliform." Other modifications and variations in this application of the present invention will be apparent to those skilled in the art.

This method of deception and camouflage, in any event, is especially expedient when a ship has been located by enemy radar, in view of the fact that relatively dense rain clouds and certainly a dense water spray or rain characteristic will evoke a response on the enemy radar means just like an object actually the size and dimension and geometry of the rain umbrella itself and not the structure hidden beneath.

I claim:

1. In the protective envelopment of a structure against atmospherically borne noxious agent the method which comprises removing liquid water from a non-noxious source thereof, distributing the said water to rain-forming means mounted in alternating disposition substantially at the surface of the said structure, projecting the water outwardly and freely away from the surface and shaping the water into a plurality of separated, outwardly-moving umbrelliform rain layers, and during the said projection communicating electrical charges of opposite sign to adjacent layers of rain.

2. In the protective envelopment of a ship against atmospherically borne radioactive agent the method which comprises drawing non-noxious water from the depths of the sea beneath the said ship, distributing the said water to rain-forming means mounted in alternating disposition substantially at the surface of the said ship, projecting the water outwardly and freely away from the surface and shaping the water into a plurality of separated, outwardly-moving um-

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belliform rain layers, and during the said projection communicating electrical charges of opposite sign to adjacent layers of rain.

3. In the protective envelopment of a building against atmospherically borne radioactive agent the method which comprises removing liquid water from a non-noxious source thereof, distributing the said water to rain-forming means mounted in alternating disposition substantially at the surface of the said building, projecting the water outwardly and freely away from the surface and shaping the water into a plurality of separated, outwardly-moving umbrelliform rain layers, and during the said projection communicating electrical charges of opposite sign to adjacent layers of rain.

4. In combination with a structure in the protective envelopment thereof against atmospherically borne noxious agent the system which comprises a protected source of non-noxious water and conduit means in communication with the source of water, a water pump having an inlet and an outlet, the pump inlet being connected to the water conduit means, a plurality of water distribution conduit means connected with the said pump outlet, a plurality of rain-forming nozzles connected to the water conduit means, the said nozzles being mounted in alternating disposition substantially at the surface of the said structure, to permit the projection of the water outwardly and freely away from the surface and shape the water into a plurality of separated, outwardly-moving umbrelliform rain layers, nozzle insulation means which insulate the nozzles from the surface of the structure and the said distribution conduit means, a source of electrical energy having negative and positive electrical energy outlets, and means for connecting the said nozzles alternately to the said negative and positive electrical energy outlets to impart electrical charges of opposite sign to adjacent layers of rain.

5. In combination with a ship in the protective envelopment thereof against atmospherically borne radioactive agent the system which comprises water conduit means suspended from the said ship and in communication with non-noxious water in the depths of the sea beneath the said ship, a water pump having an inlet and an outlet, the pump inlet being connected to the water conduit means, a plurality of water distribution conduits connected with the said pump outlet, a plurality of rain-forming nozzles connected to the distribution conduits, the said nozzles being mounted in alternating disposition substantially at the surface of the said ship, to permit the projection of the water outwardly and freely away from the surface and shape the water into a plurality of separated, outwardly-moving umbrelliform rain layers, nozzle insulation means which insulate the nozzles from the surface of the ship and the said distribution conduits, a source of electrical energy having negative and positive electrical energy outlets, and means for connecting the said nozzles alternately to the said negative and positive electrical energy outlets to impart electrical charges of opposite sign to adjacent layers of rain.

6. In combination with a building in the protective envelopment thereof against atmospherically borne radioactive agent the system which comprises a protected source of non-noxious water and conduit means in communication with

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the source of water, a water pump having an inlet and an outlet, the pump inlet being connected to the water conduit means, a plurality of water distribution conduits connected with the said pump outlet, a plurality of rain-forming nozzles connected to the distribution conduits, the said nozzles being mounted in alternating disposition substantially at the surface of the said building, to permit the projection of the water outwardly and freely away from the surface and shape the water into a plurality of separated, outwardly-moving umbrelliform rain layers, nozzle insulation means which insulate the nozzles from the surface of the building and the said distribution conduits, a source of electrical energy having negative and positive electrical energy outlets, and means for connecting the said nozzles alternately to the said negative and positive electrical energy outlets to impart electrical charges of opposite sign to adjacent layers of rain.

7. The combination of the surface of a structure having a plurality of electrically insulated, rain-forming nozzles mounted in alternate disposition thereon and a source of non-noxious water arranged to be in liquid communication with the said nozzles, to permit ejection of the said water as a plurality of separated layers of outwardly-moving umbrelliform rain freely away from the surface of the structure, and means for alternately connecting the nozzles to the negative pole and the positive pole of an electric circuit to supply electrical energy of opposite sign to the alternately disposed rain-forming nozzles, to electrify in opposite signal adjacent separated layers of outwardly-moving umbrelliform rain.

8. In the process of protectively enveloping the external surface of a structure against atmospherically borne radioactive agent which includes the steps of drawing water from a clean source thereof and distributing the water to the surface of the said structure and ejecting the water freely away from the said surface in a plurality of separated outwardly-moving umbrelliform rain layers, the improvement of imparting electrical charges of opposite sign to adjacent rain layers during the ejection of the said rain layers from the said surface.

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