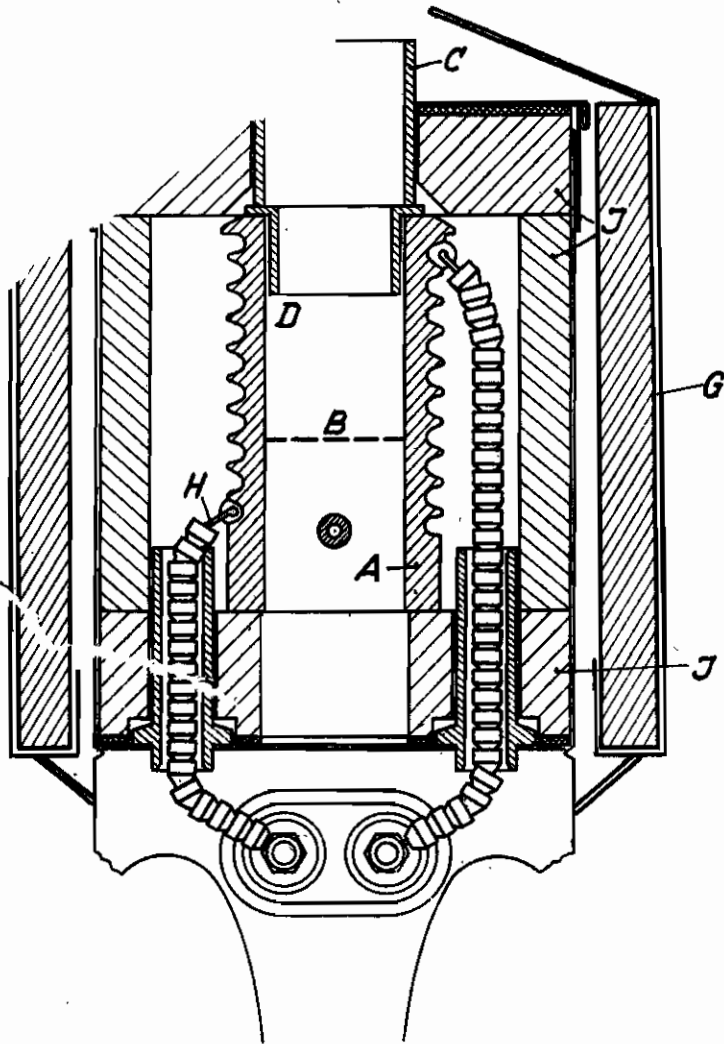


MÜLLER
VITABLE APPARATUS FOR
ID FOR DESTRUCTION
RESPECTIVELY
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ALIEN PROPERTY CUSTODIAN

PROCESS AND TO SUITABLE APPARATUS FOR DISINFECTION AND FOR DESTRUCTION OF BACTERIA, RESPECTIVELY

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This invention relates to a process and to suitable apparatus for disinfection and for destruction of bacteria, respectively.

My copending patent application Ser. No. 220,138 has for its object a process of disinfection by means of silver or silver compounds, characterized in that gaseous silver and silver vapour, respectively, or gaseous, and vapourous, silver compounds, respectively, are directly used. The process of manufacturing the gaseous silver, and silver vapour, respectively, or the gaseous, and vapourous silver compounds, respectively, is preferably performed by heating in an air current silver or silver compounds, or heat-resisting porous substances impregnated with silver or silver compounds.

It has now been found that among the compounds of silver the halogens of silver, especially chloride of silver and argentic bromide, display a particularly strong bactericidal effect in a highly humid condition, preferably at a relative air humidity of more than 60 percents.

In order to prepare the vapours of silver halogens, tablets are, for instance, used, which contain chloride of silver, and which in an electric heating cylinder are heated to glowing condition.

Experiments are described below, which have been carried through within a closed chamber of 100 · 60 · 60 centimeters in order to ascertain the bactericidal effect exercised by chloride of silver in the presence of steam upon erysipelas-typhoid fever-, paratyphoid fever-, abortus Bang bacilli, staphylococci, streptococci, pyocyanel, and spores of bacteria anthracis.

The bacilli used were, in the manner already known, caused to cling to small patches of cambric, which were suspended in the closed chamber in such a way that from every direction they were exposed to the vapours of silver chloride.

The various percentages of air humidity were brought about according to Obermiller "Die Einstellung von Luft auf bestimmte Trocknungs- oder Feuchtigkeitsgrade mit Hilfe von Salzen und ähnlichen Stoffen und das 'relative' Trocknungsvermögen" (The adjustment of air to certain drying- or humidity percentages with the aid of salts and similar materials, and the 'relative' drying capacity), (Zeitschr.f.physik.Chemie, Vol. 109, p. 145 of 1924), and were controlled by hygrometers. The slight fluctuations in the course of the tests are due to temperature influences.

After the adequate periods of time the small patches of cambric were taken from the test chamber and put into bouillon. The results were then read, after the patches had been put in the incubator for 48 hours at 37 centigrades.

The results are shown in detail in the subsequent tables.

By the tests it has been established that at a high degree of humidity, preferably at a relative humidity of more than 60%, the bacilli and spores

are destroyed within a comparatively short period and that even anthrax spores are destroyed with certainty, if they have been exposed for eight hours. The other bacteria used in the tests were destroyed either earlier or later, corresponding to the rate of humidity higher than 60%, but under any circumstances, after having been exposed to the vapours of silver chloride for two to six hours. + signifies growth under the above described conditions, - signifies destruction.

Test 1

	After 1 hour	After 2 hours	After 3 hours	After 4 hours
Streptococci	+	+	-	-
Staphylococci	+	+	+	+
Erysipelas bacilli	+	+	+	+
Anthrax spores	+	+	+	+
Humidity per cent..	42	40	37	67

Test 2

	After 1 hour	After 2 hours	After 3 hours	After 4 hours
Streptococci	+	+	+	-
Staphylococci	+	+	+	-
Typhoid fever bacilli	-	-	-	-
Anthrax spores	+	+	+	+
Humidity per cent..	40	40	55	65

Test 3

	After 3 hours	After 4 hours	After 5 hours	After 6 hours
Pyocyanel	+	+	+	-
Typhoid fever bacilli	+	+	+	-
Staphylococci	+	+	+	+
Anthrax spores	+	+	+	+
Humidity per cent..	45	44	44	50

Test 4

	After 4 hours	After 5 hours	After 6 hours	After 7 hours	After 8 hours
Pyocyanel	-	-	-	-	-
Typhoid fever bacilli	+	+	+	+	+
Staphylococci	+	+	+	+	+
Anthrax spores	+	+	+	+	+
Humidity per cent..	68	70	70	73	73

Test 5

	After 1 hour	After 2 hours	After 3 hours	After 4 hours
Streptococci	+	+	+	-
Staphylococci	+	+	+	+
Erysipelas bacilli	+	+	+	+
Anthrax spores	+	+	+	+
Typhoid fever bacilli	+	+	+	+
Humidity per cent..	68	60	58	58

Test 6

	After 1 hour	After 2 hours	After 3 hours	After 4 hours
Streptococci.....	—	—	—	—
Staphylococci.....	—	—	—	—
Erysipelas bacilli.....	—	—	—	—
Anthrax spores.....	+	—	—	—
Humidity..... per cent.	65	75	75	70

Test 7

	After 1 hour	After 2 hours	After 3 hours	After 4 hours
Streptococci.....	+	—	—	—
Staphylococci.....	+	—	—	—
Erysipelas bacilli.....	—	—	—	—
Anthrax spores.....	+	+	±	—
Humidity..... per cent.	66	62	65	70

Test 8

	After 6 hours	After 7 hours	After 8 hours	After 24 hours
Paratyphoid fever bacilli.....	+	+	—	—
Abortus Bang bacilli.....	—	—	—	—
Erysipelas bacilli.....	+	+	—	—
Staphylococci.....	+	+	+	—
Streptococci.....	+	+	—	—
Anthrax spores.....	+	+	+	+
Humidity..... per cent.	50	49	45	50

Test 9

	After 2 hours	After 4 hours	After 6 hours	After 8 hours	After 24 hours
Paratyphoid fever bacilli.....	—	—	—	—	—
Abortus Bang bacilli.....	—	—	—	—	—
Erysipelas bacilli.....	—	—	—	—	—
Staphylococci.....	+	+	—	—	—
Streptococci.....	+	+	—	—	—
Anthrax spores.....	+	+	+	—	—
Humidity..... per cent.	90	86	90	87	100

It was established that in the production of halogen vapours, e.g. vapours of silver chloride, for remedial purposes or disinfection a considerable portion of silver chloride is not evaporated due to deposition of metallic silver.

It was, however, found that the addition of chlorides of alkaline, and/or earthy-alkaline metals (sodium chloride, chloride of magnesium, etc.), preferably in the presence of voluminous, indifferent substances, as silicic acid, titanitic acid, etc. metallic silver is not formed to any considerable extent.

The invention further aims to proceed in such a way that a mixture of the halogen silver compounds and of the alkaline-, or earthy-alkaline chlorides with voluminous substances, as infusorial earth, silica gel, titanitic acid, etc. is compressed so as to form tablets, or that the molten mixture is absorbed by compressed, porous pills.

It was furthermore ascertained that in practising the process it is preferable to proceed, as described below:

If vapours of halogens of silver, e.g. a vapour of silver chloride, are produced in small, electrically heated devices, the liquid silver chloride thus formed is very troublesome, because it is readily inclined to creep, will penetrate, or flow around, the ceramic substances, on which the material used for the electric resistance rests, and thus finally will reach the materials used for the electric resistance, and will destroy them. This penetration, through it cannot be prevented,

can, however, be delayed, if the heating appliances are either lined with a sintered or molten substance, as porcelain or quartz, or are faced with a material tightening the surface by the formation of a layer similar to glass. The flowing-around can, on the contrary, only be prevented by keeping the entire device at a temperature, which makes the formation of liquid silver chloride impossible by immediate transformation of the latter into a vapour, which end can be reached by embedding the plant into a well insulating material. Though it is true that in the tube used for discharge of the vapours liquid silver chloride will again be formed by condensation, this newly formed silver chloride will also be prevented from doing harm by first keeping the pipe at a certain distance, though only a short one, from the internal follow space of the heating device, and furthermore in such a way that the lower end of this pipe projects into the device for such a distance that immediate evaporation will again take place. The same applies to the tablets containing chloride of silver, which tablets will discharge liquid silver chloride liable to display a detrimental effect in the stated manner, were would not the substances be placed in such a way that the halogen of silver will immediately be transformed into the vaporous state; according to experience this will take place in the lowest fourth of fifth part of the heating zone.

In order to prevent under any circumstances detrimental effects as soon as the current is mislead due to molten silver compounds or molten silver, or due to a penetration of the ceramic body by silver or silver compounds, the supporting grid, on which the tablets containing silver chloride are placed, is grounded, wherefore a jumping-over of the current, if any, will not imply any danger.

One of the many possible embodiments of the device is shown in the drawing.

The ceramic body A supports the heating wire H; its interior surface is tightened with a layer similar to glass, produced by fritting. The heating body is perfectly enclosed by an insulating jacket I. Tube C discharging the vapours of halogeneous silver, terminates at D placed in the uppermost fourth part of the heating device. Grid B, which supports the tablets containing silver chloride, is placed in the neighbourhood, of, or within the lowest fourth of the heating zone.

As small quantities of hydrochloric acid might be formed due to chemical transformation of the halogen compounds with silicic acid, or titanitic acid, or the like, in the presence of steam, especially due to overheating, it is preferable not to pass the steam through the heating tube, but to admit it only to the evaporated silver compounds near the upper end of the tube. In doing so, it is preferable to provide a vessel G surrounding the device at a short distance, and filled with porous substances imbued with water; by the radiation heat emanating from the heating device, the water will be evaporated to a considerable extent. The steam is thereupon mixed with the vaporous halogen of silver escaping from the heating tube. By an addition of small quantities of ammonium carbonate to the water it is possible to bring about an alkalization of the steam, if desirable.

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