

Local & Munl. (1899) Department.
Plague.

MISCELLANEOUS.

G.O., No. 1145

DATED 26.7.98
O.P.A. 28.7.98

[Despatch Abstract.]

Gas disinfecting-apparatus

Recording the report of the Sanitary
Commissioner on his experiments with
the ——— referred to in P.O's Progs 300 & 1-2-99

BACK PAPERS.

G.O.	No.	Department.	Date.	G.O.	No.	Department.	Date.

FURTHER PAPERS.

G.O.	No.	Department.	Date.	G.O.	No.	Department.	Date.

Local & Munl. (1899) Department.

CURRENT No. *1988 P*

From

The Sanitary Commissioner for Madras.

Order No 1145 *7 May 1899*

Recorded.

No. *1890*

both
20.7.99

Dated 15: July 1899.

Received 17 JUL 1899

Registered 17-7-99

Enclosures 1

Spare copies.

To The Sanitary Commissioner

SUBJECT.

Submitting his ^{report} on a series of experiments conducted with the gas disinfecting apparatus and states that he is ^{now} in a position to determine its value ^{in his letter} referred to in P.C's info 308 1.2.99

BACK PAPERS.

G.O.	No.	Department.	Date.
Prop	308		1-2-99
So	852	P.	3-6-99
Dr	March's report-		
S.C	to 98	I's Circular re: disinfection	

FURTHER PAPERS.

G.O.	No.	Department.	Date.

[500-5-8-99.]

No. 1890
5

Office of Sanitary Commissioner,
Madras, 15 July 1899.

From

Lieut.-Colonel W. G. King, C.I.E., I.M.S.,
Sanitary Commissioner for Madras,

To

The Secretary to Government,
Local and Municipal Department.

Enclosure.

Sir,

NO. 308/24
dated 1st
February
1899

With reference to Plague Commissioner's Proceedings

stating he would wish to see the gas disinfecting apparatus
referred to in my letter NO. 250/Slated 23rd January 1899, I
have the honour to state that I have completed a series of
experiments with it, and am now in a position to determine
its value.

2. There can be no doubt that heat is the most ef-
ficient disinfectant available. In the "kiln method" of Hy-
derabad, it is endeavoured to bring this agent into-play by
using cow-dung cakes. Its adaptation by this method is open
to the criticism that the very material to be disinfected is
disturbed, and is liable to be scattered during excavation of
floors. It hence occurred to me that if gas could be stored
in cylinders as practised on the Madras Railway, and if the
conditions of intense heat that are obtainable in the labora-
tory and workshop by means of Bunsens, or other burners, were

secured

secured, it would be possible to produce to a nicety the degree of heat absolutely required, and, as flexible India rubber tubes of any length for conveyance of the gas are available, it was considered no difficulty would exist in applying

heat to any non-destructible part of a house, with the same facility as the application of paint, by a single man. As an alternative, I also thought it might be possible to produce a sufficiently powerful flame with the aid of a forced draft

from kerosine oil. After consulting Mr: Mansfield, senior, and Mr: Phipps of the Loco: Department, Madras Railway, I abandoned

the idea, as impracticable with appliances now obtainable in

Madras. In the matter of using gas, however, Mr: Phipps, with

the utmost kindness, undertook numerous experiments for me as

he found that the exact description of burner and the mechanism for the forced draught required study, and was by no

means so easy a matter as I had anticipated. This difficulty

was, however, successfully overcome by him, and the result was

the apparatus described by him in the accompanying letter.

The consumption of gas as arranged by the gas "regulator" is

15 cubic feet per hour. The cost of 1000 cubic feet is Rs 15.

5. The first effort was to find out to what depth the

heat would penetrate. Hence varying depths were attempted.

The following shows the result at 2 inches depth, which may be

regarded as typical of others. In making this experiment, the

thermometer was buried in the earth in small compressed "pyals",

so arranged that on its being first placed in position, its register could be observed without disturbing the earth :-

Time of exposure		
to flame.	4 Min.	78° C
	5 "	89° C
	6 "	94° C
	7 "	95° C
	8 "	95½° C
	9 "	96° C
	10 "	105° C
	11 "	104° C
	12 "	120° C
	13 "	140° C
	14 "	150° C

This was certainly not encouraging. It forced the non-con-

ducting nature of earth upon notice, but one fact was well

demonstrated in this and other experiments. It will be no-

ticed that whilst the increase of temperature between 94° C

and 96° C was most systematic minute for minute, that a pause

occurred at about 100° C, but that this once successfully

passed the temperature rose by bounds. This seemed entirely

due to the presence of moisture in the earth, and I found it

always occurred that, until this moisture was got rid of, it

was impossible to secure a temperature over 100° C-a result

obviously due to the absorption of heat necessary for con-

verting the water into vapour. This little point is of prac-

tical importance in attempting other methods to disinfect

(by heat-
earth). Thus, I pointed out in my Inspection Notes on Vellore

and Ranipett, dated 13th March 1899, that it was an useless procedure to attempt the "kiln method" as there pursued; that is, the flooring of houses was flooded with perchloride, and, without waiting for it to dry, it was at once piled for cremation by the "kiln method". The idea on which this was founded was correct, namely, that if the infected flooring was at all it should be handled to be handled in a condition which would prevent the dust being scattered. The result, however, was obviously to secure imperfect and incomplete heating of the mass, as heaps that had burnt out on being opened up by me showed paper, string, coir fibre, and other matter unconsumed, uncharred, and unaltered.

In this experiment, it was further noted that on discontinuing heating, the temperature remained for 12 minutes above 80°C, 22 minutes not below 74°C, and 25 minutes not below 64°C. As might have been anticipated the earth was difficult to heat, but slow to part with its heat once acquired. The flooring - a compact floor of a stable - was then flooded with water to represent the method of using the perchloride of mercury solution. Penetration was found, after allowing a sufficient lapse of time for soakage, to amount to 1/6 of an inch. To compete against perchloride of mercury solution, therefore, it was evident that the heating of a depth of two inches of earth was an unnecessary test. Trials were consequently made at 1/2 inch depth, when it was found that it required

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required fully 5 minutes to secure a temperature of 104°C.

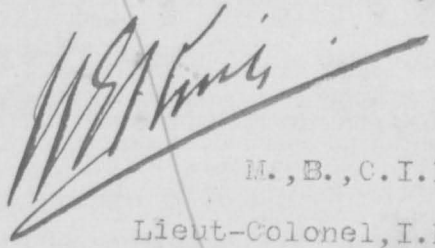
Smaller depths could not be experimented upon with an approach to compactness necessary for imitating the conditions of a floor. Numerous experiments were therefore made as to results on the surface of the ground. Allowing the flame to pass over the soil at the rate of one minute per square yard, the surface temperature was found to be 110°C, and direct over the thermometer ^{not than} 200°C. Wax was melted (95°C) and bread was incompletely browned (140° - 140°C). As the plague microbe perishes instantly at 100°C, the temperature secured was ample.

Having found that the rate of one minutes exposure to the flame per square yard would probably be effectual, the result on the microbes was ascertained. The usual inoculation and control experiments of agar-agar tubes and plate cultures was pursued, with the result that on cowdung floors a reduction of from 63 to 73 per cent of the microbes was secured, and, on ordinary compact earthen floors - in this case a hard stable floor - the reduction was from 75 per cent to 83 per cent. These experiments were conducted in April 1899. Since their completion, I am in receipt of Dr. Marsh's report (Bombay Plague Research Laboratory) showing that with the acid perchloride of mercury solution plus exposure to air and light, and subsequent lime washing, he gets results slightly better but so closely alike as to suggest that these

these percentages really imply the amount of microbes that are readily destructible by certain grades of heat and the chemical disinfectants used. His results convince me that the application of heat in the manner suggested by me is probably no more efficient than by the use of chemical disinfectants, and that when the time factor is considered chemical disinfectants must be regarded as decidedly advantageous. If, however, the plague bacillus is to be met with at any depth below 1/16 inch, according to Dr. Marsh's results, and below 1/6 inch according to mine as to soakage by chemical disinfectants, heat would undoubtedly still be the best method of securing disinfection, provided the apparatus could be made to yield a greater heat in a shorter time. Of this latter possibility, I have no doubt—a larger consumption of gas in a given time, means of heating the cold air used as a blast, and other minor matters would secure heat that should be very much greater than with the experimental machine employed. But, I hold whatever may be laboratory results on the point, bacteriologists have not yet placed at disposal information that would be of utility in enabling the practical sanitarian to determine what depth—if any—he must demand that disinfection take place of known infected parts of flooring—the Yersin controversy notwithstanding. In determining this, I think that, judging from the similarity of the percentages to which I have alluded, the common earth microbes should not be held

as a guide, but that experiments should be conducted with the plague microbe itself upon soil, in the manner followed by Dr. Martin and others in reference to typhoid bacilli. I am perfectly aware of the difficulties of segregation and identification which surround such an investigation—but considering the length of time plague has been in India, it certainly seems desirable that some definite information on these practical points were forthcoming. Until this is done, the work of disinfecting floors must proceed on the lines dictated by mere assumptions.

I have the honour to be,
Sir,
Your Most Obedient Servant,


M., B., C. I. E.,
Lieut-Colonel, I. M. S.
Sanitary Commissioner for Madras.

Enck

Madras Railway.

Locomotive Superintendent's office,

Perambur works, 14th April 1899.

NO. B.2881
904

The Sanitary Commissioner, Madras.

Dear Sir,

With reference to D.O. correspondence and conversation, I have pleasure in forwarding herewith an apparatus that I have put together for experimental purposes and which appears to answer fairly well. The apparatus consists of

- (a) One gas reservoir 5' long 19" diameter fitted with charging valve, gauge and all necessary pipe connections.
- (b) One automating regulating valve for reducing the pressure in the reservoir and regulating it to about $1\frac{1}{2}$ " of water, the pressure at which gas is found to burn most economically. This valve is so arranged that the pressure at the gas burner remains the same whatever pressure may be in the reservoir or source of supply.
- (c) One bunsen burner pipe arranged to couple on to the gas piping and air supply.
- (d) One rough fan with driving wheel with which I first experimented for the supply of air.
- (e). An arrangement of hand bellows with a floating drum for regulating the pressure.
- (f) One wells Lucigen lamp received from the Public works stores.
- (g) Some India rubber piping etc.
- (h) One luggage platform trolley on which the apparatus is mounted.

2. Items (a), (b), and (h), are all the Railway Company's property and have been issued to you on loan. These I should be

be glad if you would kindly return when done with. It is, of course, understood that you will be responsible for any damage that may be sustained by these articles during the time they are in your possession. The remainder of the gear has been charged to you and a bill for the cost of this will be sent to you in due course.

3. The cubical capacity of the gas reservoir is 9.8 c. ft. and I have had it charged up to a pressure of 10 atmospheres which is equivalent to a total quantity of 98.0 C.ft. of gas. The bunsen burner consumes, when fully open about $15\frac{1}{2}$ C.ft. per hour so that the gas now in the reservoir will burn for 6.3 hours. The amount of gas that you have left in the reservoir can be read off at any time from the pressure gauge by multiplying the cubical capacity of the reservoir, i.e. 9.8. by the number of atmospheres shown on the pressure gauge.

4. I find from experiment that the Bunsen burner to get the best effect required air to be supplied to it at a minimum pressure of about 3 to 4".

5. The fan, although it seems to throw a lot of air does not get up enough pressure and is not therefore a success. Probably if a pump apparatus is made an arrangement of this kind with the fan would be most convenient: in this case of course the fan should be finished more completely and speeded with a counter shaft up to some 3000 revolutions a minute. The temporary fan that I have made runs about half this speed. Failing this, the hand bellows seem to do fairly well and you can increase the pressure with this to any extent by weighting the floating drum and with this one cooly can keep up a sufficient supply of air.

6. The best result is probably obtained by coupling the air pipe from the burner on to the small pipe I have fitted to the wells Lucigen, the only difficulty is that the pump of this has scarcely sufficient capacity to keep up the pressure and it is pretty hard work for a couple of coolies.

7. The Bunsen burner is made of a piece of brass pipe only and if this is used for any considerable length of time with a flame of high temperature I fancy it would melt. It will therefore

be

be necessary so soon as it begins to turn red to shut the gas off for a moment and plunge it into a bucket of cold water, otherwise I am afraid you will melt it. For a permanent pukka arrangements the tube of the Bunsen ^{Burner} should I think be made of fire clay or of refractory porcelain.

8. I have given instructions to the Gas chargeman at the Central Station: that on your application he is authorized to fill the reservoir up for you for experimental purposes say a total number of 10 times but as explained although I shall be most happy to give you a limited quantity for experiment I could not undertake to supply gas in any large quantity.

9. With regard to the permanent supply of gas, if it is decided to go in for the arrangement I would suggest that you should apply to Messrs Mansfield who would no doubt be prepared to put down a gas plant for the manufacture of gas and who would also probably supply you with a compressing plant.

10. The present plant used by us at Central Station consists of a small vertical boiler driving a special compressing engine. The act of compressing the gas causes considerable heat and in order to keep the cylinder and pipes cool it is necessary to have water continually flowing round them. Should you wish to see our plant at any time at the central station you are welcome to do so and I have told the Gas Chargeman that should you call he is to explain the whole thing to you.

11. I do not know the cost of Messrs Mansfield's plant but this no doubt you can obtain without much difficulty. The cost of the compressing engine that we have was about £ 150 each including all pipes, valves etc. The vertical boiler with fittings cost £ 54.

12. If I can give you any further information or assist you in the matter in any other way I shall be only too happy to do so.

(True copy).

M. Balasubramanian
Manager and Assistant,
for Sanitary Commissioner

Yours faithfully,
(Sd). C.F. Phipps.
Loco Superintendent.

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CURRENT No.

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*1
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