The disc recordings made in connection with water listening described above as well as in the tests on segregated fish are available in the Naval Ordnance Laboratory's files. Dubbings can be made available to any biological laboratory which can put them to use.

Reference

1. TOWER, R. W. *Ann. N. Y. Acad. Sci.*, 1908, 18, 149–180.

Portable Glycol Vaporizers for Air Disinfection[1]

F. C. W. OLSON, EDWARD BIGG, and BURGESS H. JENNINGS

Northwestern Technological Institute and *Department of Medicine, Northwestern University Medical School*

The promising results of recent studies (*3, 5, 6*) on the use of propylene glycol and triethylene glycol vapors for air sterilization have created a need for portable and inexpensive glycol vaporizers for constant or intermittent use in small spaces such as operating rooms, two- or three-bed hospital wards, laboratories, classrooms, etc. Vaporizers in present use (*1, 4*) are suitable for large spaces, as dormitories, auditoriums, assembly halls, office and factory buildings. While they fulfill the requirements for generation of vapors at a constant rate, size and cost limit their use to relatively large installations.

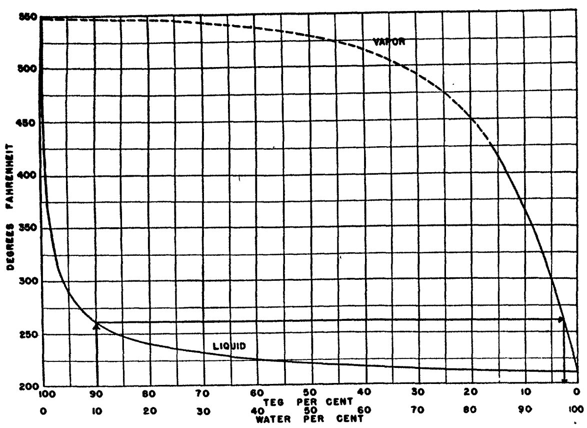

FIG. 1

From study of the temperature-composition diagram of glycol-water solutions (Fig. 1), it may be seen that the relative proportions of vapors emitted from a boiling mixture are dependent upon the concentration of the solution. The total vapor output will depend upon the heat input (rate of boiling). A method for controlling the concentration of the solution would, of necessity, determine the ratio of glycol and water vapor emitted. We have utilized two such control measures in the devices described below.[2] It should be pointed out that while only triethylene glycol (TEG) is mentioned in the description, the apparatus may also be used with propylene glycol (PG) if the different boiling temperature of PG is considered.

The portable vaporizer shown in Fig. 2 retains the essential features of the larger field model, but replaces the expensive and bulky thermoswitch-solenoid valve control system with a thermostatic bellows directly connected to a small valve. A low-pressure water line, which may be an aspirator bottle, is connected to the water inlet. The bellows is filled with a TEG-water solution in equilibrium with the desired concentration in the liquid container. For satisfactory operation, the bellows should be completely immersed and the valve must be above the surface of the liquid.

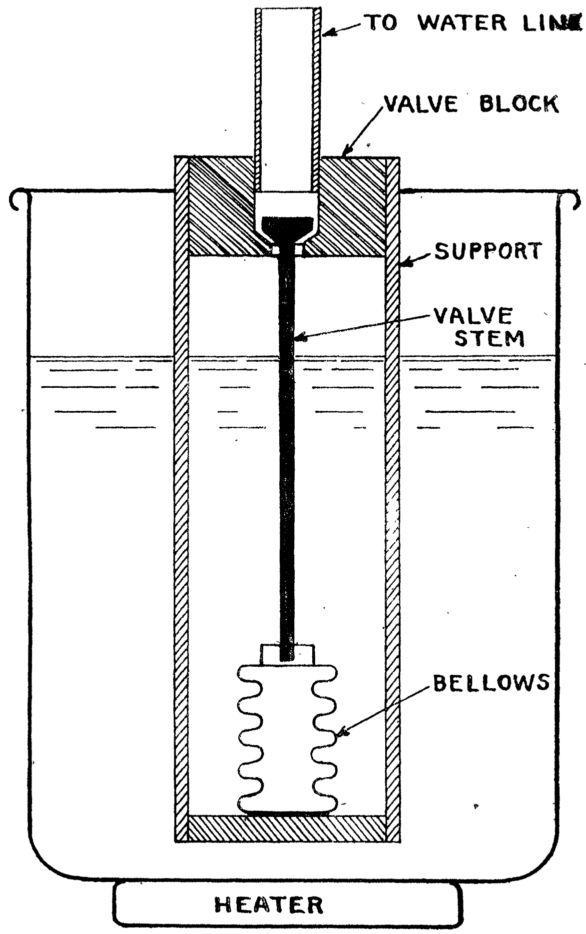

FIG. 2

The container has a capacity of approximately two quarts. It is preferably heated by a disk type three heat coil (100, 200, 400 watts) mounted beneath the vaporizer. An immersion heater may also be used, although it may not be quite as convenient.

To illustrate the mode of operation, assume we wish to vaporize TEG at 290° F. From the temperature-composition diagram, a solution of 4.7 per cent water and 95.3 per cent TEG boils at 290° F., and the corresponding water output is about 96 per cent water and 4 per cent TEG. The bellows is accordingly filled with a 95.3 per cent TEG solution and sealed.

[1] The work described in this paper was done under a contract, recommended by the Committee on Medical Research, between the Office of Scientific Research and Development and Northwestern University.

[2] Patent applications made and assigned to Northwestern University.

A solution of the same composition is placed in the vaporizer. As heating progresses, the vaporizer TEG concentration increases, due to the loss of water, and consequently the boiling point of the liquid also rises. This rise in temperature vaporizes the solution in the bellows, causing it to expand and open the valve, admitting water into the solution. The added water lowers the boiling point of the solution, cooling the bellows, which then contracts and closes the valve. On continued heating this cycle is repeated, maintaining the concentration within close limits.

The vaporizer shown in Fig. 3 uses a modification of the well-known "chicken feeder" principle. A copper tube (about $\frac{1}{8}$

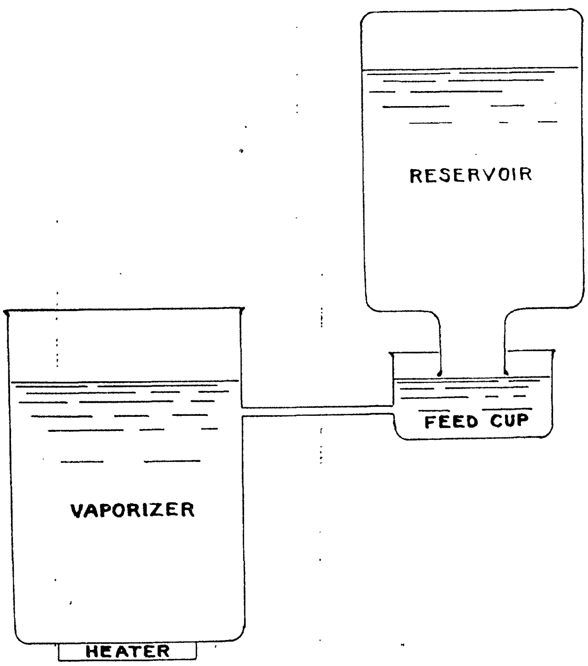

FIG. 3

inch inside diameter and 6 inches long) joins the vaporizer at a point about $\frac{1}{2}$ inch below the desired liquid level to an open feed cup in which an inverted large-mouthed reservoir bottle is mounted. The purpose of the rather long tube is to prevent the heat of the vaporizer from boiling the liquid in the feed cup. The bottle is filled with a TEG-water solution of the same proportions as desired in the vapors to be given off by the vaporizer. For example, since the vapors from a boiling 95.3 per cent TEG solution will consist of 96 per cent water and 4 per cent TEG, if the reservoir is filled with a 4 per cent TEG solution, it will automatically replace in the vaporizer the proper quantities of water and TEG, since the feeder action acts as a constant-level device.

It should be pointed out that even if the concentrations in the vaporizer and in the reservoir do not correspond to those in the temperature-composition diagram, the vaporizer concentration will approach a value determined by the reservoir concentration, so that eventually the two concentrations will correspond to those in the diagram. The reservoir concentration, however, is the controlling factor.

In permanent installations where glycol generators are connected to duct systems of known capacity or incorporated into air-conditioning systems, the necessary calculations to obtain an optimum TEG concentration of 0.003–0.005 mg./l. of air may be made with a fair degree of accuracy. Such a close control of concentration is not possible with the portable models herein described.

We would suggest that the vaporizer be placed in the room to be treated, either on the floor or on a table, in such a manner that air currents will distribute the vapors uniformly. A small, oscillating fan mounted behind the vaporizer may be helpful. The apparatus should then be turned on at high heat (400 watts) and allowed to operate until a slight fog becomes noticeable, at which time it is either turned to a lower heat or disconnected.

The space which may be treated by one of these devices will be dependent not only on its size but the degree of air infiltration and exfiltration which occurs within it. It is our feeling that a room of 15,000–20,000 cubic feet, under normal conditions, may be adequately treated, since the output at 400 watts is approximately 11 cc. TEG and 360 cc. water vapor per hour if the reservoir boiling temperature is 290° F. (95.3 per cent TEG). This output, of course, may be varied by altering the concentration of the boiling solution or changing the heat input. It will take individual adjustments and observations to adapt a vaporizer for a specific space, but these should be readily made.

These vaporizers offer the specific advantage over other suggested methods for glycol vapor generation by the simultaneous generation of water from a boiling aqueous solution. This serves two purposes, that of reducing possible fire hazards (*2*) and that of aiding in humidification.

References

1. BIGG, E., and JENNINGS, B. H. *J. ind. Hyg. Tox.*, 1944, **26**, 307.
2. BIGG, E., JENNINGS, B. H., and FRIED, S. *Amer. J. med. Sci.*, 1944, **207**,370.
3. BIGG, E., JENNINGS, B. H., and OLSON, F. C. W. *Amer. J. publ. Hlth*, 1945, **35**, 788.
4. COEY, S. C., and SPISELMAN, J. W. (To be published.)
5. HARRIS, T. N., AND STOKES, J., JR. *Amer. J. med. Sci.*, 1943, **206**, 631.
6. JENNINGS, B. H., BIGG, E., and OLSON, F. C. W. *Heating, Piping and Air Conditioning*, September 1944, 538.

Scanning Science—

The new catalogue of Harvard University shows a registration of 3,674 students, an increase of 74 over last year. There has been a slight decrease in the College, but a gain in the Lawrence Scientific School, in the Graduate School and in the Medical School. There has been an increase of 4 professors and 17 instructors.

—January 1, 1897