and that the process of replacement of cerebro-spinal fluid by air causes their disruption.

E. M. JOSEPHSON

THE OXIDATION OF CARBON MONOXIDE CATALYZED BY NITROGEN DIOXIDE

THE rates of this reaction at 500° C. have been studied. The effect of NO_2 increases to a maximum. This can be explained readily by assuming that O atoms are furnished by the NO_2 which are removed by NO_2 as its concentration is increased. The catalyzed reaction was found to be very sensitive to small amounts of hydrogen or water vapor, the rate increasing rapidly to infinity, as the concentrations of these substances increases. This effect suggests the appearance of atomic hydrogen chains in the system, which increase the total rate of oxidation. A complete study of these reactions will be presented shortly.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A DEVICE FOR MICROMANIPULATION

DURING the summer of 1930, while working at the Marine Laboratory of the Collége de France at Concarneau in Finistère, a situation arose which led to the construction of a very simple device by means of which it is possible to accomplish, in a slightly crude way to be sure, many of the relatively delicate operations ordinarily requiring the use of one of the more complicated and expensive types of micromanipulator. Since it is easily constructed at no expense and has numerous possible applications, it may very well be of interest to other investigators and hence is described here.

The question which was being studied involved three types of manipulation, *viz.*, the removal of a rather tough membrane from an egg, the sectioning of the egg in a definite plane and the subsequent isolation of the two fragments of the egg. After numerous attempts to manipulate a fine glass needle-knife and a micro-pipette free-hand under the compound microscope, an experience which any one who has had no previous training will find most irritating, a small appliance was made which may be used with great dexterity by any one who has had any experience with the manipulation of the ordinary slide. Free and accurate movement in any direction depends on the fact that the experimenter is acquainted with the direction of movement of the object on the slide but has to learn the movements of a needle or similar piece of equipment moved by hand only to find that even after considerable practise such motions are likely to be jerky at the very moment when they should be most steady. The pipette or needle is therefore held stationary in the center of the field, while the slide bearing the egg or other object to be worked upon is moved from place to place on the carrier. One has the additional advantage of a moist chamber for the culture. With very little practise it is possible to become quite skilful in the use of the apparatus.

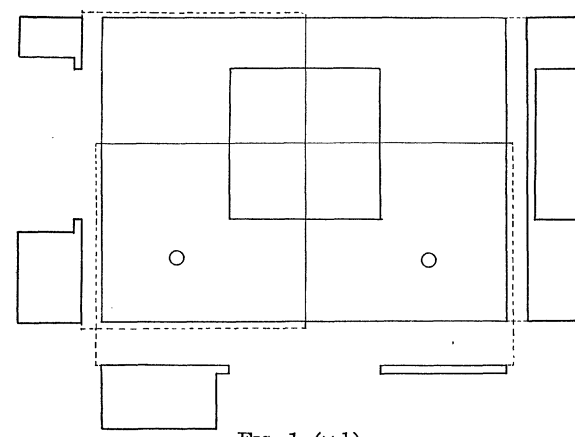

FIG. 1 (×½).

Drawings of the surface view as well as projections are given in Fig. 1. The measurements are for a convenient size, which may, of course, be varied as desired. Wood may be used in constructing the holder, though care must be taken that a non-porous variety is selected. The block must be planed and well sanded to reduce to a minimum the friction between the bottom of the block and the stage. It is also essential that the finished product be of equal thickness throughout if the object is to remain in focus as the carrier is moved from one position to another within the field. The exposed surfaces of the block may be waterproofed by waxing if desired, but none should be put on the lower surface, as that will increase the friction between the bottom of the block and the stage and irregular movements will result.

The apparatus may be described best in terms of its use. A piece of square filter paper is folded so that it is not over ½ inch wide and 4½ inches long. This is wet with tap water and placed in the undercut recess seen in the projection at the left and at the left of the projection below. Care must be taken that the filter paper is not too wide, for in that case it may touch the stage or moisture from it may dampen the bottom of the carrier. The clips of the

microscope are then placed in the holes seen in the surface view $\frac{3}{4}$ inch from each side and $\frac{5}{8}$ inch from the lower edge. These are used to hold the large 2 inch by 3 inch slide or heavy cover glass on which the culture is placed. The cover glass is essential if the work to be done requires the higher powers of magnification. The culture is suspended in a hanging drop in the center of the square opening shown in the surface view and in the projections below and to the left. The instrument to be used is held in one hand and enters the moist chamber through the opening seen in the projection to the right.

The wet filter paper which is placed around the chamber maintains a humidity sufficiently high to prevent any considerable amount of evaporation from the culture over quite a long period of time. It is possible, therefore, to keep eggs in the chamber under constant observation until they reach the stage desired for operation and afterward to follow the immediate effects of the manipulation before transferring them to other containers without subjecting them to a hypertonic medium. This was done regularly in the experiments mentioned above. It is wise, however, if the culture is to remain in the cell for a relatively long time, to close the open end temporarily with a small door of cardboard or some similar material to reduce the area of exposure through which evaporation may take place.

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A CONSTANT-RATE DROPPING DEVICE FOR LIQUIDS[1]

IN SCIENCE, Vol. 79, No. 2059, p. 545, Dr. J. H. Wales, of Stanford University, describes a "Device for Constant Flow of Liquids," which is similar to one I devised a number of years ago, and which is described on page 76 and illustrated in Fig. 3 of the British Medical Research Council Report of 1923 entitled "The Wasserman and Sigma Reaction Compared."

Another device for the same purpose is illustrated herewith, which has the advantage that the distance between the dropping tube and the receiving vessel is held constant. In operation, fluid from the reservoir "R" is allowed to flow into the apparatus, the

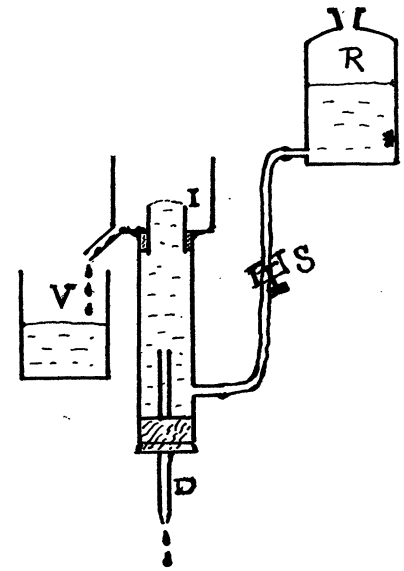

FIG. 1.

rate being adjusted by the screw-clamp "S" until a slight excess runs over the edge of the inner tube "I" continuously. This excess collects in vessel "V" and may be returned to the reservoir. The number of drops delivered per minute depends on the size of the orifice of the dropping tube "D" and the distance between this orifice and the top of the inner tube "I." The dropping rate may be adjusted, within limits, by sliding the tube "D" up or down through its cork.

The outer shell of the apparatus was made from an old student-lamp chimney; the edge of the inner tube "I" was ground flat on a rough stone so that the excess fluid would flow smoothly over it; the inner tube was held in place by a piece of thick rubber tubing, filling the space between it and the outer shell.

H. F. PIERCE

SPECIAL ARTICLES

THE ACTION OF HIGH FREQUENCY SOUND WAVES ON TOBACCO MOSAIC VIRUS[1]

RECENTLY Takahashi and Christensen[2] reported that tobacco mosaic virus is inactivated by high frequency sound waves.[3] They found that the inactivation of virus progressed with exposure, until

[1] From the Wilmer Institute of the Johns Hopkins University and Hospital.

[1] Thanks are due Professor E. Newton Harvey for the use of his laboratory where all the radiation experiments were performed, and Mr. Charles Butt for the use of his high frequency oscillator and for much helpful technical assistance.

[2] William N. Takahashi and Ralph J. Christensen, "The Virucidal Action of High Frequency Sound Radiation," SCIENCE, 79: 415, 1934.

[3] For a general survey and literature on supersonic waves see: E. Newton Harvey, "Biological Aspects of Ultrasonic Waves, a General Survey," *Biol. Bull.*, 59: 306–325, 1930; Leslie A. Chambers and Newton Gaines, "Some Effects of Intense Audible Sound on Living Organisms and Cells," *Jour. Cell. and Comp. Physiol.*, 1: 451–471, 1932.