

other end being somewhat overweighted by a piece of chain, whose end hung down to the table. In using this apparatus, the loop was immersed in the acid till just covered, and a trigger was sprung; the weight of the chain lifted the tube perpendicularly through the centre of the meniscus at a fixed speed; and then as the loop rose and the length of chain on the table increased, the whole came gently to rest, without jolting out the drop. With this device the volume of acid lifted depended only on the depth to which the tube was immersed; if attention were paid to this matter uniform results were attained, the deviation between greatest and least of six successive determinations never exceeding five percent of a total volume of about 0.005 cc.

This machine was used in all the work with *antitox* and *staphylococcus* referred to below, and gave good satisfaction; but it soon became apparent that equal volumes of the same suspension of spores or cocci were far from containing an equal number of cells; even when the suspension had been thoroughly centrifuged to remove clumps, two 10 cc portions of agar infected by two successive loopfuls would often differ by 20 percent in the number of colonies they would produce.

#### Determination of the Equivalent Solutions

Toluene was selected as immiscible solvent, and 50 cc of aqueous solutions of phenol of various known concentrations, with or without salt, were placed with 10 cc toluene in stoppered bottles in a thermostat at 25° C and shaken repeatedly. When the two layers had finally separated, a glass tube with a thin bulb blown on the lower end was passed through the upper layer, the bulb crushed against the bottom of the bottle, and a portion of the lower (aqueous) layer pipetted out for analysis. The concentration of phenol in the upper layer was calculated by difference.

In analyzing the solutions, at first Koppeschaar's method<sup>1</sup> was used (it depends on the action of bromine on phenol); but his procedure was found most unsatisfactory, duplicate

<sup>1</sup> *Zeit. anal. Chem.*, 15, 233 (1876).