

APPARATUS FOR THE DELINEATION OF CURVED SURFACES, IN ILLUSTRATION OF THE PROPERTIES OF GASES, ETC.

BY MORRIS LOEB, PH.D.

In attempting the graphic representation of the relations between the volume, temperature and pressure of gases, or of other problems involving three variables, one is met by the difficulty of properly constructing the surfaces in question. Drawing isothermals, etc., as projected upon a single plane, gives a very imperfect idea of the actual proportions. For many years this method has been occasionally supplanted by the actual construction, in papier maché or plaster, of models bounded on one side by the surface in question, relief maps in other words. This plan suffers from several disadvantages. Aside from the notion of solid volume which is involuntary entertained in beholding such a model, some of the surfaces are too complex to be well shown in this manner. Furthermore, the models are rather hard to make, expensive and occupy a good deal of room.

I have obviated most of these difficulties by obtaining a set of glass plates, about 11 cm. square and 7 mm. thick, ruled in squares 7 mm. wide. Placed one on top of the other, these form a block whose perpendicular edge may be taken for the third axis in a system of rectangular co-ordinates. Having drawn upon a sheet of paper the curves representing the relation between volume and pressure at successively 0°, 10°, 20°, 30°, etc., of temperature, I can trace them, with suitable grease-chalks, upon the successive glass plates. When these are superposed, the curves exhibit the proper relations in space and afford a very fair idea of the nature of the surface of which they are elements, without arousing any sensation of an included volume. Since the lines can always be erased and replaced by others, a set of twenty plates suffices for all purposes, and the surfaces can be produced at a moment's notice if the necessary sketches on paper are preserved. Besides

being useful for illustrating lectures in molecular physics, the plates can also be employed to advantage in the construction of crystallographic, geological and other models.

Where the parallax, inevitable for glass plates, becomes annoying, it is possible to substitute wide-meshed cotton netting, stretched upon square frames of uniform thickness. The curves can be embroidered upon the net, as it were, with pieces of colored thread; although it is not quite so easy to make the lines conform to the drawing, the general effect remains the same.

FOURTH GENERAL MEETING.

Dec. 29th and 30th, 1891.

FIRST DAY'S SESSION.

The meeting was called to order at 11 A. M. in the chapel of the University of the City of New York, the president, Prof. Geo. F. Barker, in the chair.

Chancellor Henry M. McCracken, of the University of the City of New York, having been introduced by Prof. McMurtrie, the chairman of the Committee of Arrangements, welcomed the society to the University and to the city.

President Barker replied briefly, referring to the contributions which the University had made to science through the work of Morse and the Drapers.

The Secretary announced the various places of interest to be visited after the close of the session; the first being the Columbia College School of Mines (upon the invitation of Prof. Chandler), then the Ehret Brewery, the Works of the Brin Oxygen Process Co., etc.

The following gentlemen were nominated for membership:

E. H. Adams, of N. Y. Tartar Co., 9th St. and Gowanus Canal, Brooklyn, N. Y.

Wm. N. Berkeley, University of Va., Va.