the problem becomes this,—“To draw upon the surface of the vault a curve which shall cross all the lines of pressure squarely.” This belongs to a well-known class of problems in what is called the calculus of variations.

The nature of this curve must depend on the character of the arch; yet it has certain general features independent of that character. The chief of these may be explained in this way. If we take two closely contiguous curves, inclosing between them, as it were, a course of arch-stones, the breadth of that course, at any place, is proportional to the cosine of the inclination of the line of pressure. Hence, in every skewed arch the breadths of the stones as seen on the parapet plane, must diminish from the crown downwards, becoming at 60° from the crown just half as broad as at the top.

In the case of the circular arch, the projection of the curve upon the plane of the parapet is the well-known tractory, which is asymptotical to the horizontal line passing through the centre. Hence we cannot have a semicylindric skewed arch, because the curve of the course-joint cannot reach to the vertical part of the surface.

The nature of the true arrangement is shown on the other side of the model.

A glance at the ends of the arch-stones of any skewed bridge is enough to apprise us of whether or not the structure have been properly arranged.

3. On the mode of Growth and Increase amongst the Corals of the Palæozoic Period. By H. Alleyne Nicholson, M.D., D.Sc., Professor of Biology in the Durham University College of Physical Science.

In the first portion of this communication, the author discussed the general phenomena exhibited by the Palæozoic corals as regards their mode of growth and increase. Five chief modes of growth were distinguished :—

a. Simple calicular gemmation, in which the corallum sends up from its calicine disc a single bud, which usually repeats the process, until there is produced a succession of corallites vertically superimposed upon one another. The peculiarity of this process consists in the fact that the same calice never produces more than one bud.

b. Compound calicular gemmation, in which the primitive corallite throws up two or more buds from its oral disc, these in turn usually repeating the process, till the corallum comes to form an inverted pyramidal mass, composed of numerous corallites diverging from the base.

c. Basal or marginal gemmation, in which new corallites are produced at the circumference of the colony or along certain definite lines proceeding from the base.

d. Parietal or lateral gemmation, in which the increase of the corallum is by the production of buds at some point in the walls of the parent corallite between the lip of the calice and the base.

e. Fission, in which the growth of the corallum is effected by the cleavage of the calice of the original corallite or corallites.

Numerous examples were adduced of the occurrence of the above modes of growth, singly or in combination, amongst the Palæozoic corals, and various modifications of these processes were discussed.

The author next discussed the value of the mode of growth of the corallum as applied to the classification of the Palæozoic corals, and arrived at the conclusion that much stress could not be laid upon this point unless accompanied by other distinctive characters as well. The chief grounds upon which this conclusion was based were, that allied forms in the same genus, and sometimes even different individuals in the same species, show entirely different modes of growth; that forms belonging to the most remotely allied groups often increase in the same way; and finally, that the difficulty in determining the precise mode of growth amongst some of the fossil corals is so great as often to render this test practically inapplicable.

In conclusion, the author discussed the relations between the growth of the different parts which may comprise a compound corallum, as regulating its final form and structure.