Let $DB$ represent a half arch. Draw $AP$, $Oo'$ and $DP$. If $OP = AB$ the resistance of the abutments acting in the direction $DP$ will produce the same effect as a tie in the same direction, and capable of opposing the same resistance. Since, therefore, there is a change from extension at $P$, to compression at $A$, there must exist, as in beams or straight bridges, a neutral axis between $A$ and $P$; and as $AB$, as will be shown, equals $OP$, the neutral axis will bisect $AP$.

The pressure upon any given point of the joint $AB$, will be as its distance from the neutral axis; and if the perpendicular $An$ represents the maximum strain upon a square unit at $A$, join $Cn$, and the perpendicular of the triangle $ACn$ will represent the proportional pressures upon other points. The whole pressure upon the joint will be represented by the trapezoid, $Bn$. A perpendicular to $AB$, through the centre of gravity of the trapezoid, will give the centre of pressure of the joint $AB$, which, when $CB$ equals or exceeds $AB$, or in other words, when the rise of the arch is greater than about three or four times the depth of the arch-stones, will be sufficiently near the centre of the joint to render the error made by taking it at the centre very small, and that too on the side of stability.

When greater accuracy is required, the centre of gravity of the trapezoid must be found. As a general rule, we think that practical formulas of this kind should be made as simple as possible, and that instead of aiming at the greatest theoretical accuracy, it is best to reject small errors that are in favor of stability, in order that the formula may give an excess of strength. As an illustration of the little reliance that practical men place upon the deductions of theory, we will state, that the dimensions assigned to parts of structures are often twice as great as the rule allows. Such a difference should not exist; the dimensions of structures deduced from theoretical considerations should correspond with those assigned in practice, and in order that this may be the case, the theory must be based on correct principles, and include every circumstance which tends to derange the stability.

The ordinary equations of equilibrium will therefore give