joining four points in a plane, Binet puts $x+a$, $x+b$, $x+c$ for the lengths of three lines that are concurrent, and d, e, f for the lengths of the other three lines; a, b, c being the radii of the three given circles, d, e, f the distances between their centres, and x the radius of a circle touching the given circles all externally.

After a long reduction a quadratic equation in x with very complex coefficients is obtained, and no attempt is made to solve the quadratic.

We learn from Pappus that the problem "To describe a circle to touch three given circles" was the chief proposition in a lost work of Apollonius of Perga on Tangencies (c. 210 B.C.).*

Franciscus Vieta solved this problem at the close of the 16th century,† and since then it has occupied the attention of many mathematicians. In 1814 Gergonne, in the *Annales de Mathématiques*, t. vi., p. 439, gave a solution based on the theory of Radical Axis, Similitude, Pole and Polar. Gergonne's construction can also be applied, when one or two of the given circles become points or straight lines, and it seems to be the most general geometrical construction yet published.‡ For an enumeration of the different positions of the three given circles relatively to one another, with the number of possible tangent circles in each case, see an article by R. F. Muirhead "On the Number and Nature of the Solutions of the Apollonian Contact Problem" (*Proc. Edin. Math. Soc.*, Vol. XIV., pp. 135–147).

* Cf. *Hutton's Math. Dict.* pp. 129, 130, or *Leslie's Geometry*, 1811, pp. 434–437.

† For Vieta's solution see *Leybourn's Math. Quest.*, Vol. IV., pp. 262–264.

‡ Cf. *Chasles' Géométrie Supérieure*, XII. éd., pp. 498–501.

On the orthoptic locus of the semi-cubical parabola.

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