gon which reads GF, FB, BC, CJ (heavy full line), JH (thin full line), and HG (in Fig. 128) is arrived at. (See discussion of Figs. 126 and 127.)

In the discussion of the Graphical Solution previous to this section on the Stress Diagram, the determination of the stress in the truss members was not carried beyond

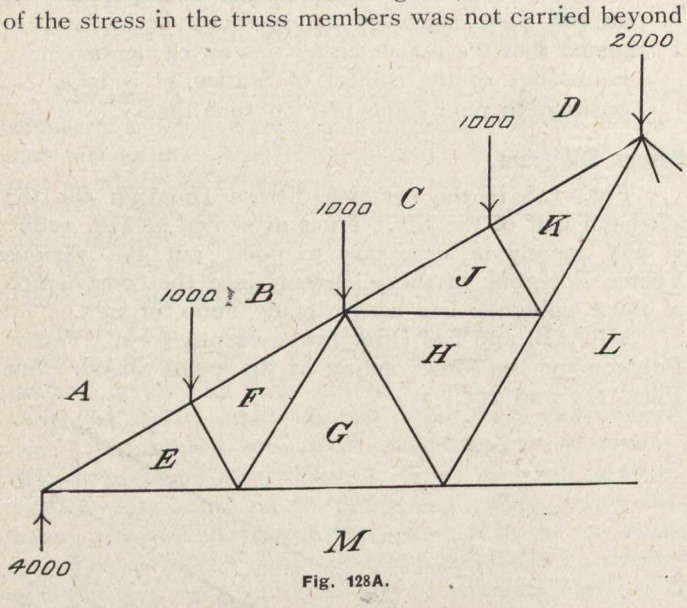

Fig. 128A.

the point GFBCJH, there being nothing difficult in the constructing of the Vector Polygons for the forces acting at the remaining points. These polygons may easily be followed out on the Stress Diagram as follows:—

Referring to Statical Diagram (Fig. 129) for **the point MGHL,** it is seen that MG, GH, HL, and LM (Fig. 128) constitute a Vector Polygon for the forces acting at this point. It is evident from this polygon that both the forces HL and LM act away from the point. The members HL and LM are, therefore, both in Tension.

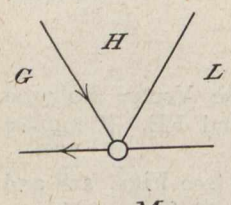

Fig. 129.

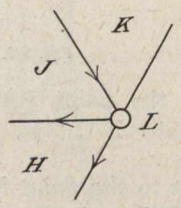

Fig. 130.

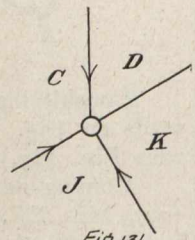

Fig. 131.

Consider **the point LHJK** (Statical Diagram, Fig. 130). LH, HJ, JK, and KL (Fig. 128) is the Vector Polygon for the forces acting at this point, from which it is seen that the member KL is in Tension.

Coming back, finally, to **the point KJCD** (Statical Diagram, Fig. 131), evidently KJ, JC, CD, and DK (Fig. 128) form a Vector Polygon for the forces being considered. The force DK is seen to act against the point. The member DK must, in consequence, be in Compression.

Three Forces in Equilibrium.

Three forces in equilibrium must have lines of action which intersect at a common point.

If it were possible, let P, Q, and S (Fig. 132) be three forces in equilibrium. Take moments about the point O, the intersection of the lines of action of P and Q.

$$\Sigma M = M_P + M_Q + M_S.$$
$$= P.o + Q.o + S.a;$$
$$= S.a;$$

i.e., these forces cannot be in equilibrium, for ΣM must equal zero for a set of forces in equilibrium.

It is evident, however, that if the distance a becomes zero, that is, the line of action of S passes through O, that ΣM would also become equal to zero and the three forces would be in equilibrium, provided, of course, that the other conditions, $\Sigma X = o$ and $\Sigma Y = o$, were also fulfilled.

(It may be mentioned here that three forces do not have to act at a point in order that ΣX and ΣY be equal

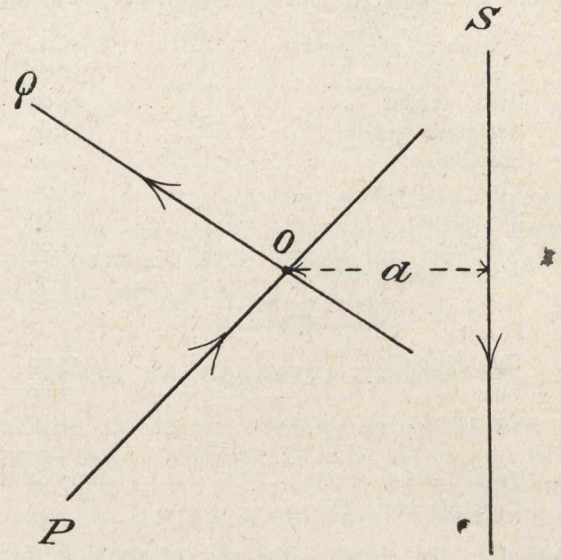

Fig. 132.

to zero. It is merely that ΣM may equal zero for three forces that the above condition must be fulfilled.)

The reader must clearly understand that every set of three forces which acts at a point is not in equilibrium; but if three forces are in equilibrium, they must fulfil the condition enunciated at the beginning of this proposition.

DEATH OF RANDOLPH MACDONALD.

Mr. Randolph Macdonald, of Toronto, a well-known contractor, died at his home there on January 21st, 1910. Mr. Macdonald was born in Drummondville, Ont., on March 30, 1849. His father was the late Angus Peter Macdonald, a Canadian by birth, but of Scotch descent, who represented West Middlesex in the Dominion Parliament for a number of years. Randolph Macdonald was educated at Dr. Tassie's Grammar School in Galt, and at Hellmuth College, London. His connection with railways began early. His introduction was as superintendent and clerk in the construction of the Cleveland and Mahoning Branch Railroad, Cleveland, Ohio. Then he was associated with his father and brother in a railroad contract on the Jamestown & Franklin Railway in Pennsylvania. This work lasted three years. In 1870 he became a partner with his brother, under the firm name of W. E. Macdonald & Company. They built sections of the Intercolonial, sections 1 and 2 of the Lachine Canal, and the Welland Basin, near Montreal, and the Fenelon Falls, part of the Trent Valley Canal. In 1887 Mr. Macdonald was awarded the Don improvement contract by the City of Toronto, and he continued this work in partnership with Alexander Manning, contractor and capitalist, under the partnership name of Manning & Macdonald. From 1891 to 1903 they built the Port Dalhousie harbour works, the Midland Division of the Grand Trunk to Campbellford, Ont., the Esplanade works of Toronto, the Canadian Pacific Railway, section on the Don River, the Toronto Belt Line Railway, section 13 of the Soulanges Canal at Coteau Landing, and section 9 at Coteau-du-Lac, these two sections costing $1,200,000, and the St. Lawrence River improvements at Cornwall. Mr. Macdonald purchased the Manning interests in the firm and carried out a harbour contract at Three Rivers, Que., and other dredging contracts. Mr. Macdonald was one of the organizers of the Sovereign Bank, and became vice-president of the institution. He was interested in the formation of the Crown Life Insurance Company, and was a director until two years ago.