steam filling the clearance at boiler pressure. In the diagram under consideration, this volume corresponds to the distance ac, which is laid off from the point a for the reason stated. The values given in the steam table for different pressures multiplied by fractors for weight of steam and for the scale used, give abscissae of the other points in the saturation curve. In the test represented by the diagrams in Fig. 1, we have for the saturation curve the line $cc_1 c_2 c_3 c_4$. The abscissae of this curve for any given pressure ordinate shows the total volume that the same weight of dry and saturated steam would have had, to the same scale as the piston displacement. If now a horizontal line be drawn extending from the clearance line to the saturation curve, the ratio of the distance from the clearance line to the expansion curve, to the whole line is the quality of the steam.* Thus through the point Fig. 1, d_1, draw the horizontal line, $b_1 c_1$, then the ratio of $b_1 d_1$, to $b_1 c_1$, is the quality at the point d_1; in the same manner $b_2 d_2 \div b_2 c_2$ is the quality at d_2, etc. The variation in quality from point to point as obtained in that manner is shown for different positions in the stroke by the curve below the diagram, from which it is seen that the quality during the early periods of expansion rapidly diminished then gradually increased so that just before the period of exhaust opening, the quality increased considerable above that at the beginning. From a study of the conditions the same method could be applied during the period of compression, the only difficulty being this, that the quality of steam at any point in the cylinder during compression is not positively known, and an assumption must be made which is perhaps no better than to assume that during compression the curve is hyperbolic. The weight of steam imprisioned in the clearance spaces is always a very small percentage of the total, hence any error which is made in assuming hyperbolic compression cannot affect the results seriously, in fact it becomes of very little moment. There is very much in this graphic analysis which brings out thermal properties in a way better calculated to make an impression upon the mind than the analytic and more difficult methods of Hirn's analysis. I have employed this method in the Sibley College tests as supplementary to the analytical method devised by Hirn. So far as

* There is a slight error in this assumption, due to the volume of the entrained water. The error is in general less than can be measured. A table for correction is given at the end of the article.