HEAT ENGINES

EMBRACING

THE THEORY, CONSTRUCTION, AND PERFORMANCE

OF STEAM BOILERS

RECIPROCATING STEAM ENGINES

STEAM TURBINES

AND

INTERNAL COMBUSTION ENGINES

A TEXT-BOOK FOR ENGINEERING STUDENTS

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WITH 656 ILLUSTRATIONS AND 315 EXERCISES

FOURTH IMPRESSION

207. Mean Effective Pressure from Indicator Diagram.—One of the factors required in determining the work done on the piston of an engine per revolution of the crank shaft, as a step to finding the

indicated horse-power, is the mean effective pressure on the piston. The M.E.P. is the mean height of the indicator diagram measured on the pressure scale of the diagram.

There are various ways of finding the mean height of a diagram. The best way, when a *planimeter* is available, is to measure the *area* of the diagram with that instrument and then dividing the area found by the extreme length of the diagram, measured parallel to the atmospheric line, the result is the mean height, and this multiplied by the number of the pressure scale (units of pressure per unit of length) gives the required M.E.P. For example: if the area of the diagram as found by the planimeter is 1·68 square inches, and if the length of the diagram is 3 inches, then the mean height of the diagram is 1·68 ÷ 3 = 0·56 inch, and if the pressure scale is 100 lb. per square inch per inch, then the M.E.P. is 0·56 × 100 = 56 lb. per square inch.

The *mid-ordinate method* is the one generally used when a planimeter is not available. This method is illustrated by Fig. 336. The length of the diagram is divided into a number of equal parts, generally 10, and these parts are bisected by ordinates perpendicular to the atmospheric line AL. Applying the pressure scale the lengths of the ordinates lying within the diagram are measured and noted on the diagram as shown; adding these up and dividing by the number of ordinates, in this case 10, the M.E.P. is found.
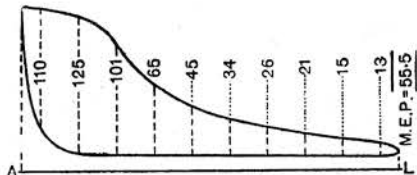

FIG. 336.

Instead of using the pressure scale directly on the separate ordinates, the lengths of these may be marked off in succession and continuously on the straight edge of a strip of paper. The sum of the ordinates is then measured, say, in inches, and the result multiplied by the number of the pressure scale and divided by the number of ordinates gives the M.E.P.

Theoretically the M.E.P. found by means of ordinates will be more accurate the larger the number of ordinates used, but in practice the number need not exceed 20.

If the length of the diagram be divided into as many as 20 equal parts and ordinates be drawn through the points of division and also through the end points there will be 21 ordinates in all and instead of drawing and measuring the mid-ordinates the mean ordinate may be found by first finding the mean of all the ordinates except the last, then the mean of all except the first, and finally the mean of these two means which is the mean required.
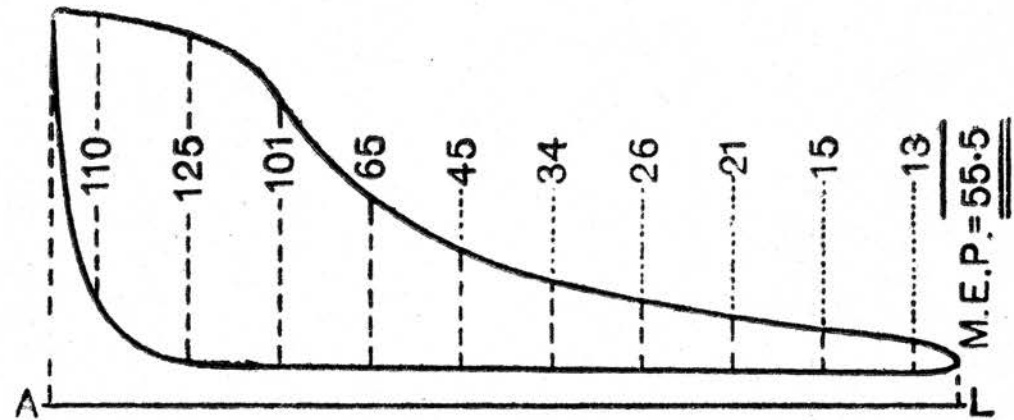

FIG. 336.