The Detection of Leakage.—The law $PV^n = C$ applies only in cases where the weight of the working medium remains practically constant during any expansion or compression. When this weight changes materially, either by leakage into, or out from, the cylinder, the resulting expansion or compression no longer obeys the law and it becomes a curve on the logarithmic diagram. Leakage is usually the result of wear, and occurs, as a rule, only when the pressure difference is over about 20 lb. This latter fact, founded on the analysis of numerous diagrams, makes it possible to divide the expansion and compression lines roughly into three equal parts on the logarithmic diagram (when these lines extend from the initial pressure nearly to the back pressure): (a) the upper third, influenced by leaks out from the cylinder; (b) the middle third, practically uninfluenced by leakage; and (c) the lower third, influenced by leakage into the cylinder. Thus, fairly reliable values of n, free from the effect of leakage, may be obtained from the middle third. The important result attained by this method of examination is the knowledge that leakage is taking place, so that it can be located and stopped.

The Approximate Determination of Steam Consumption from Indicator Diagrams.—The devising of an accurate method of measuring the weight of steam consumed from the diagram has hitherto been regarded as impossible, but, after many examinations into the cases of different types and sizes of engines, with non-jacketed cylinders in good order with pressures between 60 and 120 lb. absolute, and exhausting at or near atmospheric pressures, it has been found that while the initial condensation is subject to the action of ten or more variables, yet the value often resulting from a given value of Xc (or proportion of the total weight of steam mixture present as steam at cut-off, i.e., quality) is almost always substantially the same, and is expressed by the relation $Xc = 1.245n - 0.576$.

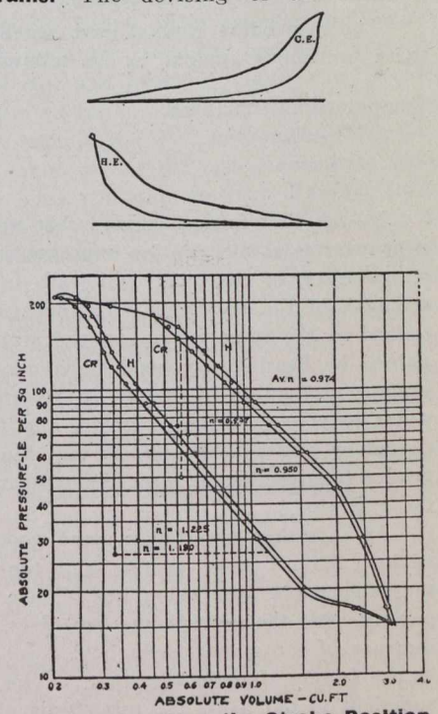

Fig. 3.—Locating the Stroke Position of Cyclic Events.

This relation is practically independent of cylinder size and of engine speed. The point of cut-off and the value of n being obtained from the logarithmic diagram, the value of Xc may be readily calculated and the actual steam consumption obtained by this method to well within 4% (on the average) of the amount consumed as measured by test.

This method is more accurate than the average test; it is the only accurate method available for testing certain classes of engines; it virtually measures an instantaneous rate instead of an average quantity over a long period, and thus enables a large number of points to be obtained for a water-rate curve; it permits of making tests at frequent intervals instead of once in the engine's life; the expense is not to be compared with that of an equally accurate test; it involves in the routine of the plant tested.

THE STRENGTH OF WOOD FOR PAVEMENTS.

The wood pavements in Paris, France, last on an average nine years, but in the most frequented roads they have to be renewed every five or six years. This rapid wear has led to the undertaking of various experiments in the Municipal Testing Laboratory in an effort to find means for increasing the strength and at the same time the durability of the materials for wood pavements. The following description of these experiments and the resulting conclusions are taken from a paper of M. P. Labordere, Engineer of Bridges and Roads, and M. F. Austett, Director of the Municipal Testing Laboratory of Paris, prepared for presentation at the Sixth Congress of the International Association for Testing Materials:

Up to the present time the only treatment to which the woods used in Paris are subjected has the aim of diminishing decay. It consists in impregnating the newly cut blocks with a heavy coal tar oil which is rich in phenols; this impregnation is as a rule simply effected by means of immersion. The Municipal Testing Laboratory, however, has for some years been occupied with securing some better impregnation by making the heavy oil enter the wood under a pressure of 5 kg. The first series of experiments which was executed in the laboratory in 1908 and 1909 brought out the conclusion that the impregnation with heavy oil under pressure improves the wood as regards the physical qualities, because it diminishes the porosity of the blocks (that is to say, the quantity of water which is capable of being absorbed by the wood after immersion), as well as their expansion under the influence of moisture, but that it remains without effect on the mechanical strength of the wood.

In order to compare the mechanical strengths of wood prepared in different manners the pressure per square centimetre which enacted in the direction of the fibres will produce crushing was adopted as a measure of this strength. The specimens used in these experiments were prisms of 75 x 75 mm. basis and 125 mm. height, and they were obtained by cutting three equal specimens out of each of the blocks, the blocks serving for the experiments being 240 x 80 x 120 mm. Care was taken to keep the different blocks employed for these experiments apart from one another, to number the blocks of each balk from one end to the other, and to mark each of the specimens cut out of each block in such a way that the specimens belonging to the same fife reckoned in the longitudinal direction of the balk could be compared. The different blocks of one and the same balk were submitted to different treatments, and the specimens cut out of these blocks were crushed in the hydraulic press.

The determination of the crushing strength does not offer any difficulties; for in the moment at which the specimen fails the pressure gage of the machine will mark a sudden fall. In order to take account of the effect of humidity which cannot be avoided on the roads, care was taken in each case to experiment on two specimens in the dry state, and on a third specimen which had been immersed in water for 30 days.

As the length of the longest balks, which the laboratory had at its disposal, 2.30 m., does not permit of cutting more than 18 blocks (or 18 comparable specimens), and as moreover the number of methods of preparing the specimen for the test was greater than 18, it was necessary to agree upon a reference basis for all these experiments. This standard was taken as the strength of an ordinary crude block and consequently in each balk two blocks at least were reserved which were left in the crude state and sawn into two specimens to be crushed in this state.

Attention having been drawn to various attempts of improving the wooden pavements by mixing the oil, with which