originals and the Rankinized are the same. But Rankinizing goes further, and gives results unattainable by the original diagrams, besides exhibiting the working of the engine as a whole.

Taking the engine as a whole, the work done
By the four H. P. cylinders = 7702 H.P.
By the two I. P. cylinders = 8264 "
By the four L. P. cylinders = 9888 "

A total of 25,854 H.P., with a mean effective pressure of 30.737 lbs. per square inch; this is a little over 841 H.P. per pound of mean effective pressure. The stroke ends with a pressure of 10 lbs. above a vacuum, with a consumption of 11.8 lbs. of steam, accounted for by indicator, per H.P. per hour.

The above proves that this engine was then working close to her most economical rate, with a boiler pressure nearly 160 by gauge. If cut-off had taken place 8 inches further in the stroke of the H.P. cylinders, the H.P. would have risen to 30,000. But the cost per H.P. would have been greater. The theory of the compound engine is simple. By theory is meant a generalization of the facts of the case. In the above diagram an expansion curve in dotted line is described from the point of cut-off in the H.P. cylinders. Taking clearance into consideration, the expansion at the end of the stroke is 13⅓ volumes. The losses, principally due to unresisted expansion of the steam in the passage between the cylinders, the gaps as they are called, are clearly defined by the curve, amounting in this case to over 4,000 H.P. If a series of expansion curves be drawn in order on the same sheet, corresponding to cut-offs, from ⅛th to ¾ths of the stroke of the H.P. cylinders, the necessary action of the engine under different circumstances is made visible, and valuable data is obtained from curves described in conformity with different pressures in the boiler, say from 150 to 75.

Contrary to what is often heard in discussions about compound engines, the so-called back pressures in high and intermediate cylinders is not a loss. It is restored on the piston of the following cylinder with a bonus of over one hundred per cent. The back pressure due to the condenser is a necessary loss common to all condensing engines.

For THE CANADIAN ENGINEER.

MACADAM STREETS IN TORONTO.

BY ALAN MACDOUGALL, M. CAN. SOC. C. E.

The report of the city engineer of Toronto on the reconstruction of several cedar block paved streets which are now worn out, was adopted by the City Council, and in it are given many estimates of the cost of renewals in the several materials now finding favor as permanent surface-materials, and a recommendation is made in favor of renewals with cedar block paving. The comparatively low cost of this class of roadway, and the stringency of the times, has apparently induced the engineer to consider the pockets of the ratepayers. The policy adopted by the City Council in making no repairs on the streets improved under the local improvement system has been fatal to all prospects of a good surface; no street left to itself can be expected to be decently passable after being laid for two or three years; the cedar block roadway shaving had no repairs made on them, the surface did not take long to become well nigh impassable, whilst the condition of the roadway was sometimes worse than a mud road. The experience of the citizen as ratepayer and traveller over these surfaces, enables him to form a just estimate of this policy, and should induce him to call for some system of maintenance in the future. There is in the city a considerable mileage of a class of roadway which can be maintained with a small yearly outlay, which has the advantage of improving under proper maintenance, and forming a firmer and finer surface the more it is cared for. There are at present about 36 miles of macadam roadways in the city. This class of roadway has fallen from public favor during the cedar block era. Many miles of streets have been torn up and replaced by cedar block, which would have been in splendid form to-day, if the cost of the cedar block paving had been expended in maintenance, during the period appointed under the by-laws for payment of the cedar block improvement. Every city engineer, during the past twelve to fourteen years, has urged the council to maintain in efficient condition the macadam roads; each in turn has again and again pointed out the advantages to be obtained by proper methods of maintenance, and has urged the council to purchase a steam road roller; as yet their efforts have not met with much success. We notice an advertisement calling for tenders for a steam road roller, and trust, now that the council has gone so far, it will act on the engineer's advice and purchase a serviceable roller.

The macadam road suffered from its rival, the cedar block, for many years. One ground of objection taken was the dusty and unhealthy condition of this class of roadway. The experience gained from cedar block streets should set ratepayers thinking and make them look into the wear and conditions of macadam surfaces, before they condemn more of this class of roadway. With examples of well rolled metalled (or macadam) surfaces on the streets of Montreal and Ottawa, and the experience of both cities directly favorable to the use of a steam road roller, and also opportunities of seeing the same class of work in many places close by us on the other side of the border, there should be no hesitation now in following the advice of the city engineer. Under existing circumstances, the metalled streets are necessarily dirty, ill-conditioned and fair samples of the "awful example." Under the treatment of a good steam road roller, and a good clean, hard wearing material on the surface, these streets will rapidly rise in favor. Every year's maintenance will improve them, the material placed on them will compact the body of the surface; each year they will make a better return for the care bestowed upon them, whilst the lessened cost for repairs and renewals will make glad the heart and lighten the pocket of the ratepayer.

CEMENT TESTING.

BY CECIL B. SMITH, MA. E., A.M. CAN. SOC. C.E.

(Concluded from last issue.)

The writer, speaking of other tests, considers that compression tests, though valuable, are not needed, because compression strength varies regularly with tensile strength, and is so great that we need to concern ourselves with it. Moroever the strength of mortar in thin joints is much greater than in cubes. The machinery for such tests is not generally available. Transverse tests have often been advocated, but are objected to because the co-efficients of rupture do not indicate the tensile strength of the outer layer of fibre, and because a slight flaw, such as a bubble, would vitiate the test. It is also known that if tested upside down from position moulded, the results are higher than when tested as moulded.

FROST TESTS.

This series consisted of various investigations into the strength of mortars when mixed with different con-