

neer, by receiving a certificate, he often shows a lack of interest in acquiring a more extended knowledge of the duties of his calling, and frequently becomes too conceited to take instruction from others, or even ask a question, although the answer might put him in possession of a fact of great value to himself.

On the whole, I am of opinion that the condition of engineering cannot be much elevated by examination and awarding of certificates.

The only way lies in the motto of Canadian Association of Sanitary Engineers: "Better education and mutual improvement."

For THE CANADIAN ENGINEER.

THE INDICATOR AND ITS USE.

BY A. C. M'CALLUM, PETERBORO.'

When first I undertook the work of treating this subject, I had no thought that it would find its way into print, but it was believed by a few that it might possibly be of some real benefit to others, not members of the No. 14 branch of the C.A.S.E., if I would agree to its going into print, and through the kindness of the editor of *THE CANADIAN ENGINEER* a few tit-bits of my first remarks before the members of Peterboro' Branch of the stationary engineers, society were published in the February number; through lack of time I have been unable to put my notes into a readable form. The endeavor will be made to put the subject as plainly as possible, so that "he who runs may read," and only the simplest figuring will be made use of.

In the February number mention was made of the uses to which the indicator could be put. The manner of presenting this subject is manifold. Of books and writings upon the indicator there is no end; and doubtless much that will appear in those papers to many may prove only to refresh the memory.

The object for which the indicator card is taken, the manner in which it is obtained, the mechanism employed in its production, are doubtless by this time familiar to most readers of *THE CANADIAN ENGINEER*; to describe the various reducing motions at this time would be needless. The correctness of long and short connections to the indicator from the engine cylinder are no doubt settled points in the minds of most readers. The object of these papers upon the indicator was to deal principally with the cards taken, the methods in use to enable a correct interpretation of them, what to do to secure the best results, and to note the influence of the indicator upon the development of the steam engine.

In the February number a brief sketch of the invention and history of the indicator was given, and the great improvement of the modern indicator over that of Watts' was doubtless noted.

The builder of the modern high speed engine owes many thanks to this useful instrument, and no doubt the boilermaker also would be benefited by its use if properly applied.

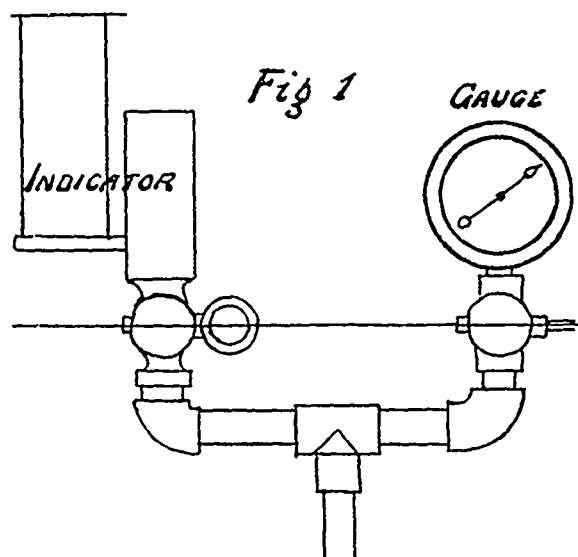
Too much care cannot be exercised in the use of the Indicator to secure a correct diagram, and as the liability of errors taking place are many, it is well to note a few of the most likely ones. The movement of the pencil is at times liable to be erroneous, from the fact that it may not move equal distances vertically, for equal movement of the piston of the indicator at different portions of the stroke, or the pencil may not move in a straight line vertically. Sometimes, owing to

friction of the piston in the cylinder of the indicator, the pencil may not locate itself accurately. As a test to determine the ease with which the instrument will work, having the indicator placed vertically, with the spring being attached to the piston, raise the pencil motion to its highest position, it then should fall back to its lowest or home position with ease; or place the thumb over the hole by means of which the steam is admitted to the cylinder, first raising the pencil to its highest position, the pencil motion and attachment to piston will move at a uniform rate to their home position. Ideas will suggest themselves as to the tests one should make to determine the correctness of pencil motion when freed from the influence of the steam and spring.

However, as the error from irregular movement of the pencil is more liable to take place at the extreme travel, we may conclude to reduce the height of the card.

The spring, through constant use, may become weak and therefore will not record correctly the changes in pressure, and from the use of many makes of indicators in service at different power plants, from which the writer has taken test cards, this has been found to be the case, comparing the springs used with springs that had been calibrated, to be employed in the test.

The error due to the want of proper elongation or compression of the spring for equal changes in pressure cannot be well overcome, and we should try other springs.



The springs in use should be constantly tested, a very simple method is to connect up the indicator to a test gauge as shown on Figure I. Care must here again be exercised to take steam to indicator and gauge from some place on the main steam pipe where there is no fluctuation of pressure; places will be suggested to one's mind where best to make this test. When in readiness, turn on steam to gauge and indicator. Allow them to warm up, noting the pressure on gauge; by pulling the cord give motion to the drum, at the same time bring the pencil to the paper on drum and record the steam pressure line, close off the steam from the instrument and record the atmospheric line. Taking the paper upon which we have recorded the pressure, by means of the scale we can then measure what pressure has been recorded by the indicator. If the result agrees with that of the gauge we may safely use that spring, but should the gauge register the greater pressure the spring is heavy, and if less the spring is light. A remedy to allow the use of such springs is to make a new set of scales.