geneous mass, becomes pasty, and, as the volatile matter is expelled, yields a solid mass, preventing the passage of the gas.

II. A non-caking fuel is a fuel that, when heated, approximately retains its original shape and then crumbles into ash.

Test for Caking Coal.

1. Powder the fuel very finely in a mortar.

2. Place in a small crucible a teaspoonful of the powder.

3. Place a loose-fitting lid on the crucible and heat over a spirit lamp.

4. Heat until all the gas has ceased to come off.

5. In order to test this apply a match above the crucible and around the edge of the lid, when probably a flame will spring from the crucible and burn for a few seconds.

6. In case no gas is available, heat the crucible for five minutes.

7. Allow the crucible to cool naturally.

8. Turn out the contents.

9. If the residue is a compact, homogeneous mass, you will know that it is coke and the fuel is caking.

10. If the residue comes out fairly loose, you will know that the coal is non-caking.

11. Most caking bituminous coals give a yellow flame. This generally indicates tar.

12. If the sample swells very much and gives a soft, porous coke, it is probably suitable, and at any rate worth trying.

When a test of this description has been carried out, and if the fuel proves itself non-caking, an ordinary bituminous plant can be installed; if the test is not very distinct in its result, then the only satisfactory action to take is to ship a bulk sample and test it in the factory.

If, however, the fuel according to the test is clearly caking, a very special plant must be installed, with a water-cooled, motor-driven poker This is a complicated plant, and the high first cost is only justified in the case of large installations.

The Wellman-Seaver-Morgan Engineering Co.'s plant, designed by Mr. Fraser Talbot especially for using caking coals, a vertical rod passes down the centre of the producer, which is of the water-bottom type, and carries two radial arms, which are placed at different angles.

The rod and arms are water-cooled, and rotate slowly, about once in ten minutes, at the same time having a vertical motion.

In this paper I have briefly tried to touch on the practical side of producer work as applied to gas engines, and have purposely left out gas engines, as both subjects are so large that it is impossible to do justice even to the one in the short time at my disposal.

There are, however, one or two practical points which make the difference between success and failure, satisfaction and disappointment in the combination of a producer with a gas engine, which truly come under the heading of the latter, and which I propose to mention before closing.

The gas engine as generally supplied to-day is either multi-cylinder vertical, or single flywheel single cylinder horizontal, and in the last design, as the sizes of the units grow, the weight of the flywheel increases to a point at which it is foolish, if not criminal, not to supply special gear for placing the engine into its starting position, and afterwards of causing the engine to carry out its complete cycle, and so obtain its own impulses by firing its own gas.

Barring Gear.

Some makers supply no means of placing the engine in position on the firing stroke up to as high as 75 horse-power. The result is that you will sometimes see the engineer and probably two or three helpers dragging on the flywheel, to their complete disgust and exhaustion. Other makers have small holes in the side of the rim of the flywheel, and supply a fulcrum and bar. This is better practice, but a poor job, and in this respect there is only one satisfactory equipment, and that is a pinion keyed on to a shaft resting in bearings and supplied with a large hand-wheel, the pinion meshing in teeth cast in the rim of the flywheel.

Starting Apparatus.

When an engine is put to work on producer gas, it is given an impulse either by what is known as an explosion starter or by compressed air. The first method consists of pumping a certain number of strokes of a pump, generally fixed to the engine, which delivers a certain quantity of gas into the engine cylinder, a valve is then operated and a certain quantity of air is pumped into the cylinder, so as to make an explosive mixture. The charge is then fired by electric ignition or tube.

Now, this system is a poor one for producer gas, because the quality of your gas at the commencement of operations is not constant, and, therefore, I would not recommend its use except as a standby. The engineer may obtain the right mixture the first attempt; he may try ten times, and, therefore, no one can call it a truly reliable system.

Compressed air from a separate small air compressor set is the ideal practice; failing that, compressed air stored in a receiver by running the engine as a compressor when shutting down, but economy should not be allowed to influence the engineer in these two details. An extra $200 on a plant of 50 horse-power will save the engineer's temper and avoid all delays in starting.

THE RECONSTRUCTION OF A CONCRETE GAS TANK HOLDER AT KINGSTON, ONT.*

Once more the necessity of care in concrete building has been demonstrated in the case of the concrete tank in connection with the gas plant of the corporation of Kingston, Ont. It has brought up the oft-repeated warning that concrete must be well built. It has demonstrated once more the fact that where care and precaution have been taken concrete is superior to all other materials for most classes of construction work. The general public of to-day are too well acquainted with the properties of concrete to condemn it whenever faulty construction has produced failure. In the case in question those in charge of the city's welfare, after first endeavoring to meet the difficulties by temporary changes and alterations, called for tenders, allowing those who tendered to use almost entirely their own methods of procedure. As a matter of fact, the work was well advanced by the successful tenderers, Messrs. Merrill & Allen, before they finally decided upon the method of waterproofing to be employed. The method of procedure throughout was entirely their own, and in portions experimental, as many difficulties presented themselves throughout the work. That the con-

* Mr. E. B. Merrill, consulting engineer, Toronto, delivered an illustrated address before the Engineers' Club of Toronto in connection with this work.