the constituents of the fuel are, as the conditions are such that tar, carbon, or anything else will be completely consumed.

When heavy oil is heated in a retort there is a tarry residue left, because there is no oxygen present to combine with the carbon, and the temperature is not high enough for ignition; but when an infinitismal particle of oil is ignited in a hot chamber of compressed air, the entire substance must be completely burned. Even if there was an unburned residue, the size of the individual particles of unburned material would be considerably under 1-1,000 of an inch in diameter, and could not under any circumstances foul a cylinder.

4. If the walls of the combustion chamber are water cooled, as in the ordinary type of engine, any of the small particles of fuel strike the walls adhere to the surface, the light portions burn off or evaporate, the tar remains, and by constant repetition of the process, an accumulation of material occurs which eventually clogs the machine.

In the engine designed by the writer, no water cooled surface is presented to the charge until a considerable period after the oil is injected and fired. The walls of the combustion chamber are arranged to be maintained at a temperature, higher than that at which the oil will wet the interior surfaces, and it is found that no tar ever accumulates under these circumstances.

Any oil which may not be consumed as it enters the cylinder is believed to rebound from the hot walls of the combustion chamber, in the same manner as drops of water bounce from a hot stove lid.

As the engines are now constructed it is believed that practically all the oil is consumed before it can reach the walls of the combustion chamber.

The use of a hot combustion chamber is still further an advantage, in that the air is raised to quite a high temperature before the oil is injected, and hence is in a better condition for combination than if it were cooler.

A number of engines have been constructed embodying these principles, ranging from 10 horse-power to 200 horse-power; they have all proved successful.

The first commercial engine built, a 9 x 12-inch cylinder, has been running the factory of the Johnston Oil Engine Co., Toronto, for nearly 18 months, and a number of similar engines are now running factories in Toronto.

These engines will run on any liquid fuel that may be obtained—crude oil, fuel oil, kerosene, benzine or gasoline, and without any change whatever in any part of the mechanism.

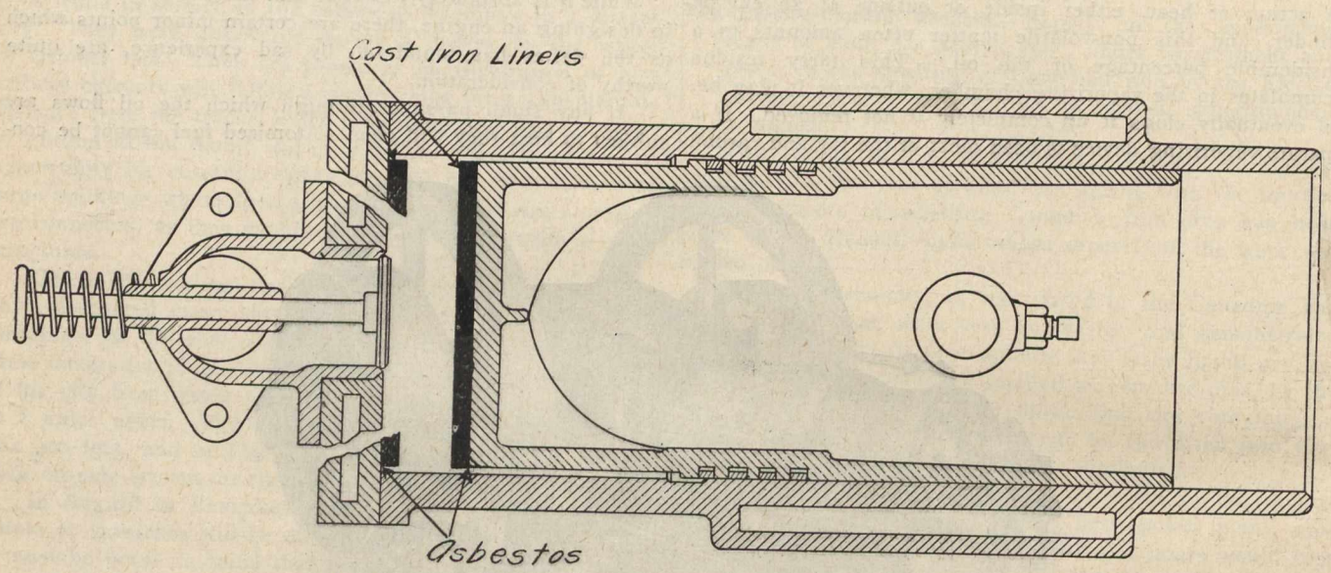
The oil used in Toronto is a refuse from the crude oil, after the gasoline, benzine, kerosene and paraffin wax have been extracted. The engines are guaranteed to develop 10 horse-power hours on ¾ gallons of this or any other petroleum oil. This oil can be obtained here cheaper than the crude, and gives no trouble in the engines. It is a dark greenish black in color, specific gravity .875, flash point 170° F., open test.

Samples of oil from all available sources have been tried in the engine, but in no case has there been any signs of clogging or necessity of making any adjustments, The oil is not prepared in any way, except to strain it through a fine sieve. The writer will be glad to communicate with any person who wishes a test made of any particular sample of oil.

The features of the engines now being put on the Canadian market are briefly these:—

They run on any grade of fuel, require only three minutes heating to start with ordinary equipment, or start instantaneously with an electric attachment.

No cranking, start made with compressed air. When once started will run indefinitely until stopped. Ignition troubles unknown. Mixer or carbureter troubles the same. No clogging of any parts.



Showing construction of cylinders up to 12 inch diameter.

The great question, however, before power users is, "How much does the power cost?"

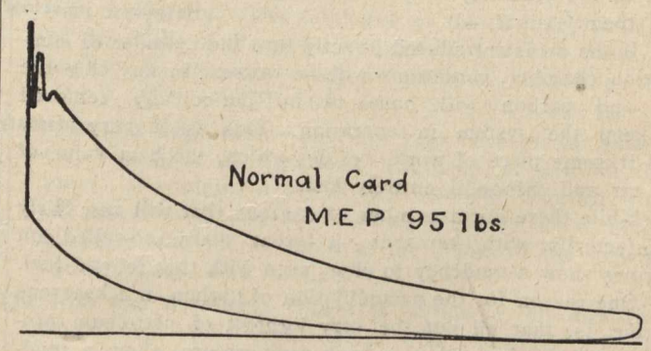
Fuel oil costs in Toronto 6c. per gal., retail, delivered.

Gasoline, 21c., city gas, 75c. per thousand feet.

The Johnston oil engine uses ¾ gal. oil per 10 h.p. hours 4½c.

The gasoline engine uses 1 gal. gasoline per 10 h.p. hours 21c.

The gas engine uses 200 feet of gas per 10 h.p. hours 15c.



Thus it will be seen that the cost of power from fuel oil is over four times cheaper than from gasoline, and over three times cheaper than from city gas.

These comparisons are for small units; for large plants the oil should be figured at 4½c. per gal., as it would then be brought in tank cars.

The saving over ordinary steam plants amounts to from 50 to 70 per cent. when changing to fuel oil.

No fireman is needed with the oil engine.