of to-day are complaining of the same thing, and many of them say: "We have brought the engine to a nice appearance for workmanship, economy and usefulness, but the principal part we have so far not handled successfully, viz., how to build in our boilers; are they made of the right stuff and shape, and our chimney," could not some other material be used, mica, or anything that will not give off so much heat? When this 25 per cent. loomed up in Watt's mind, he planned a different shape boiler In one he put two large tubes in a round shell with a fire in each; but he found, if both the fires were not kept alike, it did not do justice to the boiler, and the water inside he then put in one large tube, and put the fire into it, hoping to get more heat into the steam than when the fire was outside, he found it worked better; this plan is now generally adopted in different shapes, but this plan did not, nor does it now, save the large percentage of heat leaving the boiler and going up the chimney to keep out the pressure of the atmosphere and give an upward draught or upward current not to burn, the air or oxygen, as some say, but to change the hot atmosphere and fuel into gas. A large number of new inventions have been made within the last few years, yet we are not perfect, but there is plenty of room for new plans left."

THE CONSTITUTION OF HYDRAULIC CEMENTS.

A series of experiments to determine the constitution of hydraulic cements has recently been made by S. B. Newberry and W. B. Newberry and described in a paper read before the Society of Chemical Industry. The questions which the authors have attempted to solve are as follows:—

1st. What proportions of lime must be employed for given percentages of silica and alumina in a clay? 2nd. Can a general formula be stated, applicable to all clays, which shall indicate the proportion of lime which will give the best result with each? 3rd. What effect has the presence of oxide of iron in the clay used on the proportion of lime required, and on the quality of the resulting cement? 4th. Is the presence of alkalies in the raw materials necessary to the production of good cement? 5th. Is magnesia capable of replacing lime in cement mixtures, or is it inert, as has often been stated, and how does magnesia affect the quality of the cement obtained?

The plan followed in the efforts to solve these questions was that of synthesis with pure materials, which materials were as follows:— 1st. Silica; ground quartz, in impalpable powder, containing 99.19 per cent. silica. 2nd. Alumina; C. P. precipitated, containing 99.50 per cent. alumina, .20 per cent. soda, .05 per cent. iron oxide and .25 per cent. silica. 3rd. Carbonate of lime, precipitated chalk, containing 99.7 per cent. calcium carbonate. 4th. Iron oxide; red, German C. P. 5th. Magnesia; German, C. P., containing only traces of silica, alumina and lime.

All these materials were in the form of a perfectly impalpable powder, and none of them left any residue on a sieve of 180 meshes to the linear inch. Mixtures of these materials, in calculated proportions, were made by rolling backward and forward on a large sheet of paper, then sifting three times through a 60-mesh sieve. The mixtures were then moistened with water, made into a cake, dried and broken into small pieces for burning. The burning was done in a Fletcher gas furnace, using gasoline gas as fuel.

The conclusions to which the writers are led by the above experiments may be briefly stated as follows. 1. The essential constituents of Portland cement are tri-calcium silicate, with varying proportions of di-calcium aluminate. This composition may therefore be expressed by the formula—

$$X\ (3CaO.SiO_2) + Y\ (2CaO.Al_2O_3).$$

From this formula it may be calculated that the correct proportion of lime, by weight, in Portland cement, is 2.8 times the silica plus 1.1 times the alumina. 2. Iron oxide combines with lime at a high heat, and acts like alumina in promoting the combination of silica and lime. For practical purposes, however, the presence of iron oxide in a clay need not be considered in calculating the proportion of lime required. 3. Alkalies so far as indicated by the behavior of soda, are of no value in promoting the combination of lime and silica, and probably play no part in the formation of cement. 4. Magnesia, though possessing marked hydraulic properties when ignited alone, yields no hydraulic products when heated with silica, alumina or clay, and probably plays no part in the formation of cement. It is incapable of replacing lime in cement mixtures, the composition of which should be calculated on the basis of the lime only, without regard to the magnesia present.

—The Government of New Brunswick has placed an order with the Good Roads Machinery Co., of Hamilton, for ten steel Champion road graders. The company is also shipping one of its well known Champion rock crushers, road rollers and engines to the town of Magog, Que.

TO ESTIMATE HORSE POWER.

Editor CANADIAN ENGINEER:

(a) In the question below please inform me in THE CANADIAN ENGINEER why "3" and "2" are used, that is, where they get the "3" and "2" in the text book of which I am studying. The question is: Required the horse power of an engine having one cylinder 30 inches diameter, 36 inches stroke, making 90 revolutions per minute, boiler pressure 75 lbs. per square inch, cutting off at ¼ stroke, vacuum 26 inches, mean effective pressure on piston throughout stroke 50.5 pounds per square inch.

$$\frac{30 \times 30 \times .7854 \times 50.5 \times 3 \times 90 \times 2}{33000} = 584.1234 \text{ H.P.}$$

(b) Does black oil in a boiler destroy the scale, or does it injure it?

YOUNG ENGINEER.

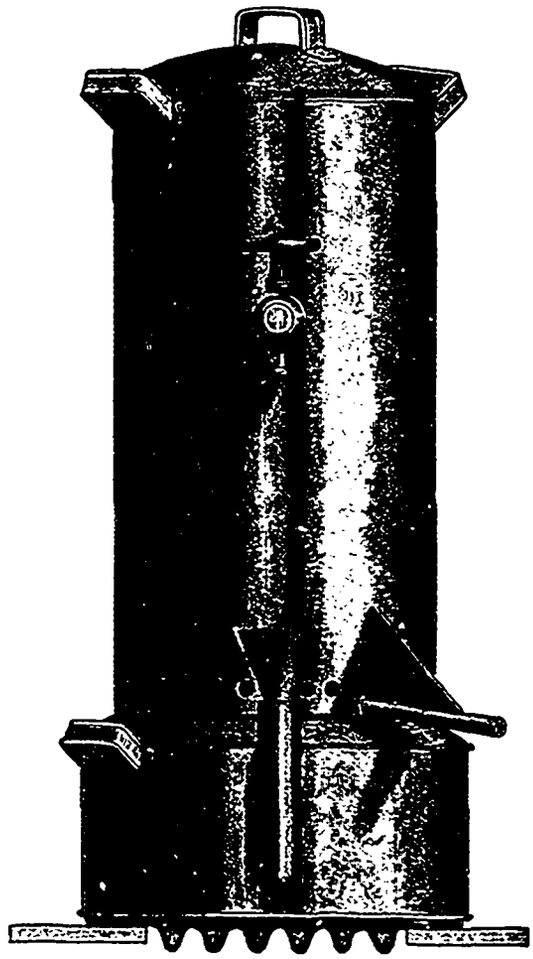
Midland, Ont.

(a) The "3" referred to here by our correspondent is the number of feet in the stroke, and the "2," is the number of revolutions per minute.

(b) The Boiler Inspection and Insurance Co. does not allow the use of oil as described. We would advise "Young Engineer" to write to some of our advertisers for information on the subject of scale in boilers.

DISTILLED WATER.

The accompanying illustrations show the New-Life Water Still for producing aerated distilled water for drinking, culinary and hygienic purposes. The action of the apparatus is as follows: The water to be operated upon is placed in the lower vessel or boiler, and when boiling is placed on the kettle, and the steam passes into, around and under the evaporators, heating them to nearly boiling point, by which a part of the water they contain is evaporated and is condensed by contact with



the upper vessel or condenser; a constant current of air passing through the holes at the bottom of the condenser is carried up and sterilized by coming in contact with the steam, and, the maker claims, combines with the product, which is pure distilled water, freed from all calcareous, organic and deleterious matter. The water is pleasant to the taste, satisfying, will relieve thirst, and can be borne by a weak