employers of labor must encounter it. Still, it is more the problem of the mechanical engineer than of any other, because he is, by education and experience, best fitted to reduce the amount of human labor required, and this is what he is continually attempting to do by the adoption of labor saving appliances, such as bucket elevators, belt conveyers, hydraulically operated valves and lifts compressed-air drip pumps, mechanical stokers for coal gas retorts, and for the boilers. In this field of endeavor he has no competitor. In common with many of his mates in other industrial enterprises, the mechanical engineer in the gas works has the problem of boiling water for making steam. No one will admit that this is, as a rule, intelligently and efficiently done to-day. And yet, knowing this, our practice and methods are not greatly different from what they were two thousand years ago. It is

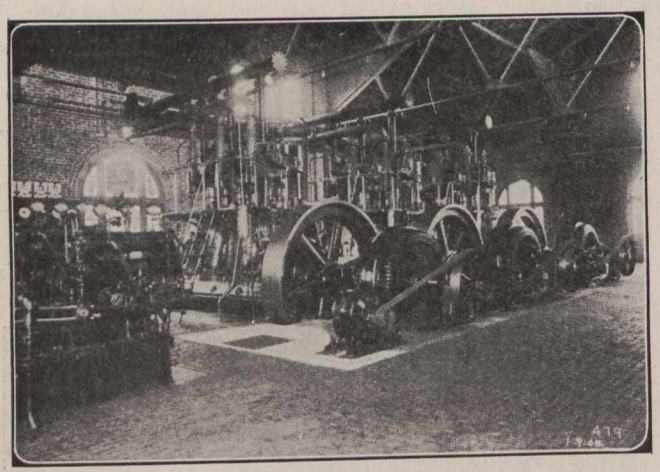

Fig. 5.

A Diesel engine power plant in which water-gas tar is the fuel, and where 25-cycle A.C. current is produced for power purposes, with a consumption of one-tenth of a gallon of tar per horse-power hour.

still believed that in boiler practice 50 per cent. excess air of combustion is necessary for best results, whereas, in almost every other form of combustion with which we are familiar, science has reduced the necessary quantity of air to the theoretical amount. As illustrating the waste due to 50 per cent. excess air in the ordinary boiler efficiencies, it may be calculated that such a percentage of excess means an increase of 10 per cent. in the total fuel consumed. In the year 1909 there were used in the United States under boiler furnaces for producing steam, approximately 340 million tons of coal. If this steam could have been produced by the combustion of coal with the **theoretical** amount of air, the saving would have been 34 million tons which, at an average price of $3.00 per ton, would amount to one hundred million dollars. Which of our young mechanical engineers, who are now earning their spurs at their chosen profession, will undertake to stop this waste and show us how to advance in the art of producing steam?

In a gas works a large percentage of the cost of the finished product is incurred in the generator of the water gas plant, or in the furnace of the coal gas bench. Here the problem is the apparently simple one of the combustion of carbon at temperatures above 2,000° F. However, owing to impurities in the fuel, such as ash of variable fusion temperatures, extra complications are introduced which make the operation extremely difficult. Clinkers—the bugbear of everyone who burns coal, sooner or later, as the operation continues—upset all nicely calculated adjustments, and, unless means and methods are adopted to vary the air and steam of combustion so as to bring about a readjustment, serious losses will result, both in efficiency of production and in the quality of the finished product. It is now that we find the mechanical engineer hard put to it, and it is only by combining his knowledge of the theory of combustion with his practical experience in doing things that he is able to supply the demand for gas and render the good service which the community expects of him. Lack of such knowledge and practical resourcefulness must be compensated for by increased investment for spare machinery, making it still more difficult to obtain the desired profit.

Many other interesting and important mechanical engineering problems might be mentioned, but enough has been said to indicate that the business of gas making is largely the work of the mechanical engineer. Even the abstruse reactions within the coal gas retort and the water gas carburetter are not entirely outside his field. Though they properly belong to the chemical engineer, still, the education of the mechanical engineer of to-day fits him for such work, should he care to specialize in it. Indeed, so satisfactory does the young mechanical engineer attack and master the work in a gas plant, that some gas companies have entirely restricted additions to their engineering forces to this class.

When we consider the immense amount of intelligent work which has been expended upon the engineering problems in a gas works, it is not to be expected that any very great economies in manufacture will be made. What reductions in the cost of the finished product will be made will be accomplished by close attention to the small savings possible in increasing thermal and mechanical efficiencies and in the substitution of mechanical appliances for human labor. These are problems which will be solved only by the trained mechanical engineer.

ENGINEERS' CLUB OF TORONTO.

At the meeting of the Club last Thursday evening, an illustrated address on "Municipal Bridges in Europe," was given by Mr. R. E. W. Hagarty, B.A., Sc. Mr. Hagarty said the contrasts to be noted between European bridges and those on this continent are: (1) In Europe the arch type predominates. (2) The art and architectural features of the bridge combine to eradicate the engineering features. (3) European bridges are the objects of more public attention and interest, as many have been built to commemorate historical events and designed accordingly.

It seems that traffic conditions have much to do with the number of bridges in a municipality. In London, where the traffic is well regulated, there are comparatively few bridges; but in Paris, where the traffic is not so efficiently regulated, there are numerous bridges. Paris has many beautiful and ornate bridges. The fact that one Parisian masonry bridge is three hundred years and another one hundred years old, seems to furnish a strong argument for using masonry bridges wherever possible. The long span is conspicuous; bridges there having spans of between 200 and 300 feet. A noticeable feature of the Parisian bridges is also that they give the same effect as the adjoining boulevard, and every bridge of any importance seems to lead to some great building, which is a prominent landmark.

The decorative effect of Parisian bridges is remarkable, statutes of historic characters or types are prominent as a

(Continued on Page 662.)