pensed with, it will be seen that the cost can be enormously reduced, the steel representing more than half of the total expenditure.

It is important that running water does not come in contact with the concrete until it has set, as the cement is liable to be washed out. When this has to be contended with, the general method adopted has been to put in temporary dams and pipe the water across the green concrete.

FUEL IN THE UNITED KINGDOM.

The industrial development of Great Britain is mainly due to the cheapness of fuel, raw material, labor and transport. The coal produced is anthracite and bituminous, and as the deposits to be found in Great Britain are being gradually exhausted, attention is being paid to the use of coal wastes, etc., which were formerly dumped over the tip as worthless. The cost of coal is low at the pit mouth, despite the enormous expenditure involved in the machinery, deep shafts and an increasing labor bill, yet the most inferior of slack and washery-refuse are now being consumed in considerable quantities for the development of cheap power. As one instance of the influence of cheap fuel and power the North-East Coast (England) Power system is referred to by R. O. Wynne-Roberts, M. Inst. C.E., in his report on the Coal and Power Resources of the Province of Saskatchewan. There are seventeen generating stations belonging to this company, of which six are coal-fired stations and the remainder waste heat stations, where steam for generating the electricity is obtained either from exhaust steam that has already done work in blowing, or other engines, or by steam raised by blast furnace gas, or from the waste heat and gas from coke-ovens; the total horse-power connected amounts to nearly 200,000. The engineer in his description of the work pointed out that cheap fuel is of paramount importance, and expressed his opinion that the future of electricity supply lies in the very large stations employing very big units of plants and established at the coal-fields. The above electrical installations have afforded facilities which have attracted several new industries to be located within the area of supply. The same remarks are applicable to the manufacture and distribution of gas, which is being adopted more generally each year.

The next International Geological Congress will be held in Belgium in 1917. "The Agricultural Resources of the World" will then be presented. Many geologists consider that the study of agricultural deposits of the world is the most important branch of geology, and by far the most important branch yet to be investigated. Owing to the fact that large territories of agricultural land have been discovered within the last ten years in Canada, South Africa and Australia, there is as yet no accurate compilation of the agricultural resources of the world. Another reason for the decision to investigate the world's agricultural resources is the attention at present being directed by political economists all over the world to the high cost of living. The geologists believe that if they can collect full details on the grain-growing land resources of the world, the march from the cities to the land will be strengthened and the price of food commodities will be moderated. Another topic that will be discussed in 1917 will be the nitrate, phosphate and soda deposits of the world. As these three chemical compounds form the basis of all fertilizers, the research to be conducted by the scientists will be of great importance to the subject of agriculture. Besides these topics the Belgium Council will be at liberty to consider two others which were suggested by the council. These are the world's copper deposits and petroleum resources.

BITUMINOUS CONCRETE PAVEMENTS.*

By Wm. B. Spencer,

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UP to the time of the advent of the automobile the question of modern highways was pretty well solved, except in the more highly trafficked streets of our great cities, by the discoveries of John Macadam, and the more recent improvements of the French engineers and the pioneers of this country. But in their system of road building the pioneers did not contemplate heavy vehicles carrying loads of from one thousand to twenty thousand pounds and passing over their prepared roadbed at the rate of from five to fifty miles an hour, sucking up the carefully placed filler or binder, and depositing it over our lawns, our farms and in our houses, permeating the entire atmosphere with a dust which was both objectionable and unhealthy. In response to the immediate cry of protest, engineers at once attempted to solve the puzzling problem. In the West temporary relief was found by taking the crude natural asphaltic or semi-asphaltic oils of California, Texas and Kansas and sprinkling them over the macadam roadways. This generally gave temporary relief from the dust nuisance, but it was found that these oils, which had not gone through the process of refining, contained many substances which were detrimental to the automobile tire. It was also found that they had a decidedly bad effect on the binding materials of the macadam roadways. A well-bound macadam roadway secures its cohesiveness by the hydration of its granular constituents, but when the surface coat is more or less thoroughly sealed by the application of a heavy oil, then the body of the mass is denied the water which prolongs its life, and shortly thereafter the road will commence to ravel.

Some time during the year 1903 an observer in the oil regions of California noted that a flock of sheep, which had been driven back and forth to pasture, over an oil-saturated piece of ground, gradually consolidated this soil to such a degree of hardness that it was not affected by vehicular traffic, and also produced a highway which was cheap and did not require the use of stone, which had always been deemed necessary for the construction of highways. A tamping roller, made as nearly as was mechanically possible to imitate the sheep's foot action on the soil, was designed, and the "Petrolithic" or tamped road was launched. In some sections of California it met with fair success, and is still in limited use in that section of the country.

In the summer of 1907 a road of the same type of construction was laid near New York City, and during the summer and fall season of that year it withstood traffic conditions remarkably well, but during the early winter frost penetrated the road and immediately thereafter a warm rainy period ensued, with the result that the road rapidly disintegrated and became a quagmire. The following spring it was found necessary to entirely remove the prepared roadway and substitute another form of road construction.

The Petrolithic specifications were substantially as follows:—

*Part of a paper read to the American Society of Engineering Contractors, and appearing in the Journal for June.