the highest class of steam-engines using fuel at 12s. per ton, while for small loads up to 500-horse power they can safely compete up to a distance of fifty miles, a feature which must be admitted is sufficient to demand the attention of all who are responsible for the generating and distribution of power to do useful work.

Previous to the conclusion of this paper I may perhaps be excused for stating that, although we have some very able electric engineers capable of designing and erecting excellent installations to do all classes of work that it is possible for any motive power to do, we do not in this country seem to take the same interest in the theory of production and transmission of electric currents that is taken by our scientific brethren of America and those of many European nations, where mining forms an important branch of their national industry.

With respect to the spark problem, it may be noticed that some very elaborate experiments have been carried out in Belgium to prove the risk to firedamp explosions, which may be said to be the one great disadvantage which prevents the general adoption of electricity as a motive power in mines. The result of this inquiry was that under given conditions the spark may be produced without exploding the most sensitive gaseous mixture, a feature which was obtained by joining up by a secondary conductor the two points between which the spark passes, when it was found that with the resistance at a high value the current-breaking spark invariably caused an explosion. The corollary to this is that when the spark takes place in a single circuit, the breaking of which completely cuts the current, explosion is the inevitable result. On the other hand, explosions are more easily avoided the nearer the ratio of resistance approaches unity, while both above and below this value there is, as it were, a boundary-line within which explosion is avoidable. Hence the solution of the spark problem seems to depend upon the finding of this boundary-line and of carefully adapting the working-conditions to it in such a manner as to insure its permanency, a feature which alone would warrant the general adoption of high-tension electricity to do work in deep and dry coal-mines, which invariably have a continuous and in some cases a sufficiently heavy natural discharge of firedamp to render the currents in many instances more or less foul, and the consequence would be that the introduction of electricity would, in the event of certain damage to its parts, or from extreme irregular working-conditions, increase the risk of explosions, a feature to avoid which is ever the chief consideration of those who are responsible.

Therefore, in making a general summary of the advantages and disadvantages of electricity as a motive power applicable to general underground work in mines, we find that in it we have a force that is easily conducted to any point or points required—these may be at any reasonable distance, say up to ten miles, from the generator—will do any class of work that it is possible for any other power to do, and gives off an efficiency of from 40 to 60 per cent. of the power transmitted to the dynamo, while the first cost and general maintenance would be less than a compressed-air installation fixed to work at its much shorter distance-limit. Against this we have the risk of sparking and the liability to persons receiving shocks. Consequently, in concluding this paper I would advise every mining student to make the study of electricity an important branch of his educational curriculum, when the possibility would be that Britain may produce one man to do for electricity that which George Stephenson accomplished with steam, and so place it upon a sound and safe basis for use under any conditions that may occur either above or below ground.

Examination for Mine-managers' Certificates.

The papers used at the examinations held in the beginning of February, 1903, are appended.

Schedules.

The list of persons holding certificates of service and competency as coal-mine managers is appended, as are also the statistics of output, persons employed, &c.

I have, &c.,

JOHN HAYES,

Inspecting Engineer.

The Under-Secretary for Mines, Wellington.

No. 2.

Mr. JAMES COUTTS, Inspector of Mines, to the UNDER-SECRETARY, Mines Department, Wellington.

SIR,— Inspector of Mines' Office, Thames, 7th February, 1903.

I have the honour to furnish herewith the following report on the coal-mines in the Auckland District for the year ended the 31st December, 1902, in compliance with section 67 of "The Coal-mines Act, 1891":—

Kawakawa Mine.—The operations in this mine have been chiefly directed to working out pillars near the outcrop under Carraway's Hill. On account of the pillars being small and the covering of the coal having settled down from the surface around the pillars, some of the men are required to be continuously employed driving through the fallen ground, exploring for pillars to keep up a regular supply of coal. A natural result is that a large amount of timber is required to keep the men safe, thus adding considerably to the cost of production, but as the coal is easily worked it just about pays expenses. It is true the amount of coal raised from this mine is only very limited; still it is a boon to the district, affording, as it does, a supply to the locomotives on the short line of Government railway and the Northern Steamship Company's boat trading between Auckland and the northern ports. Six men were employed during the year, and the quantity of coal raised was 3,640 tons. The mine was inspected twice during that period, and was found to be safe and the ventilation good.