on the part of the assistants of M. Marcel Deprez, much patience and perseverance.

"On Oct. 9th and 10th, when the Commission of Investigation commenced its measurements, the greatest speed attained at Miesbach with the repaired machine was 1,600 revolutions per minute; the results were consequently much less favourable than they had been with the normal velocity of 2,000 revolutions per minute obtained at first.

"During a few moments only it was found possible to reach, during the measurements, the speed of 2,000 revolutions per minute, and quite at the beginning of the experiments one of the brushes of the machine became detached, which produced an extra current and destroyed the machine."

It will be seen from these extracts that the results were obtained under disadvantageous conditions.

They are not, moreover, perfectly exact, especially from the transmission dynamometer at Miesbach having been made for 15 horse-power, was ill adapted for the measurement of small forces.

The results were the following: work received 0·25 horse-power, electric return 38·9 per cent. The machanical return was not measured, but it is estimated at about 30 per cent.

All this, doubtless, was but a beginning; but it differed so widely from the attempts previously made, that a great outcry was raised. There was a brisk, indeed a violent, discussion on the results, the procedures, and everything which seemed open to attack. However, as was said by M. Cornu in a report to the Institute, to which we shall have to return below:—"The very violence of the polemic which has arisen on this question suffices alone to show that the author, if he has not solved the problem, has at least approached it very closely."

It was impossible to stop on so open a road. Along with these public trials, laboratory experiments were also advancing, and M. Deprez succeeding in deciding on the construction of his permanent machines.

On account of particular circumstances and of a special application which was projected at this time, it was not proposed to adapt the first machine to a distant transmission, but it was thought desirable to receive a quantity of work of practical importance.

A beginning was made with a single apparatus; prudence demanding that in novel regions we should advance only step by step. The machine was completed about the end of January, 1883; it was tried, at first, in the laboratory, and appeared to answer all expectations, but it was necessary to try it in a more practical manner, and on a real line.

A telegraphic line is not an easy thing to find. It is true one was urgently offered, but it was in Bavaria. As a sequel to the success of the first former experiment, the administration of Munich had urged upon M. Deprez to repeat it with the machines which he subsequently constructed. He might have accepted this offer, but it implied going to a distance, leaving France, and carrying his performances abroad. This did not please the inventor. Among the French telegraphic lines there are some which the Administration often devotes to experiments. But these are more especially reserved for telegraphy. Besides, it must be said that the Administration had an exaggerated fear of high tensions, and was reluctant to see them upon its lines. M. Deprez addressed himself, therefore, to the Companie du Nord. The engineer of the telegraphic service, M. E. Sartiaux, with great kindness, found a line which it was possible to withdraw from the general service for a few days. The engineers of the depots, MM. Delebecque and Sauvage, found in their work rooms a corner and driving gear; the working service and its engineer, M. J. Sartiaux, took the experiment under their charge, and occupied themselves with the details. In a word, the company showed a good will, for which M. Deprez is exceedingly grateful.

As it was necessary to know exactly all the circumstances, and to take as many measurements as possible, M. Marcel Deprez made the most suitable arrangements to facilitate such studies. To this end the two machines, the generator and the recipient, were placed near each other in the work-rooms of the company, connected on the one hand by a wire of trifling resistance, and on the other hand by a double telegraphic line going to Bourget and returning. The distance was 8·5 kilometres, and the total length of the wire about 17 kilometres. Of the two machines, the one which served as generator was the dyname recently constructed, of which we give a representation in fig. 8.

As will be seen, this machine has two induced rings, each turning in a distinct magnetic field. The inductors have the form of horseshoe electro-magnets, which has been found the most advantageous to produce the magnetic field with a small outlay of energy. The numerous terminals on the upper table are intended for effecting combinations, and for modifying the effects of the machine, which was thus adapted for study and experiment. The recipient was a Gramme machine, of the model. D, transformed. It was not unknown that this machine was inferior to the other, but we must add that the experiment was attended with all sorts of unfortunate circumstances. The recipient had suffered in recent experiments; the days for the experiment being fixed, there was no time for repairing it, and it had to be taken away as it was, with full knowledge that it was faulty in several places, but to what extent was not entirely known. To crown all, the generator, which was in very good condition, was drenched in a heavy shower whilst being taken down from the truck. It was thought at first that the damage was slight, but it had to be taken into account. To gain its electromotive force, this machine had to be revolved at a velocity of 1,000 to 1,500 revolutions. When set in motion, it was impossible to bring it to more than 500 revolutions. At this speed the insulators, soaked in water, allowed the electricity to pass, and sparks flew off continually. It was necessary to begin under these wretched conditions, and it was only by degrees, as the machine dried slowly, that it was possible to attain proper velocities. Still 1,000 revolutions, which ought to be a normal velocity easily exceeded, remained a maximum, which was not reached without difficulty, and which could not be kept up for any length of time. These experiments introduced quite a new feature into the question of the electric transmission of power. They attracted very strongly the attention of the scientific world, so much so that the Academy of Sciences, to whom communication had been made, wished to be completely enlightened on the subject, and nominated a Commission, composed of M. Bertrand, the perpetual secretary, as president, and MM. Tresca, De Freycinet, De Lesseps, with Cornu, as reporter.

The work expended at the generating machine was measured by means of a Morin taansmission-dynamometer, obligingly lent by the Commission of Arts and Trades. The work received was absorbed and measured by a Prony brake. The electric elements were determined in duplicate by M. Cornu with Deprez galvanometers, and by Dr. Hopkinson with the instruments of Sir William Thomson.

It must be added that these instruments had had to be arranged in a special manner to measure very high potentials, for which they had not been constructed, and for which, indeed, no apparatus exists. Thus the Deprez galvanometer acted in a circuit into which a resistance of 50,000 ohms had been introduced. All the details, and the procedures for aauging and verifying are explained with great care in the report made to the institute by M. Cornu, and have appeared in the *La Lumière Electrique* (April 14th, 1883). A series of experiments was made at different velocities, and the following values were obtained (see foilowing table extracted from the report). Among these experiments, one, No. 5, might be the subject of a certain doubt. This experiment was marked by an accident, fortunately unattended by serious results, but which greatly alarmed the observers. Whilst taking electric measurements, M. Cornu, wishing to move the commutator, grasped it by mistake by the metal instead of by the insulating handle, and thus found himself in a derived circuit taken from the extremities of the generator, the experiments showing at that moment that the difference of potential was at least 1,900 volts. M. Cornu was violently projected to the distance of some paces, but without falling. The two fingers which had touched the metal received two burns, not very serious, but rather deep. This injury was accompanied by stupefaction for some seconds. Such were the only results of this accident, but the general sensation may be conceived. Misfortune is not without its uses, and M. Cornu, on recovering after a few minutes, remarked that it was an interesting experiment. Currents of high tension were much dreaded; it had even been announced that their effects were like those of lightning, such alarming assertions being based upon accidents which had occurred with light machines.

*(To be Continued.)*

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SPANISH MINERALS.—Veins of argentiferous lead are said to have been recently discovered at Argentera, in the province of Tarragona (Spain).