quarter of an hour, to the highest heat (about 1,700° C.) of a Siemens regenerative furnace, two platinum crucibles, one filled with powder residue, the other with potassium hyposulphite. At the conclusion of the exposure, and while the crucibles were still red hot, they were plunged into water, deprived of air by long-continued boiling, and at once sealed. The powder residue was found still to contain 1·27 per cent. of hyposulphite, while the crucible with the pure salt consisted of a mixture of sulphate and sulphide, but with an amount of 2·1 per cent. of hyposulphite.

It is probable that, if the exposure had been still longer continued, the hyposulphite would have altogether disappeared, and the experiment can only be taken as proving that the hyposulphite, especially if mixed with other salts, is neither quickly nor readily decomposed, even at very high temperatures.

II. "On the Dynamo-Electric Current and on certain Means to Improve its Steadiness." By C. William Siemens, D.C.L., LL.D., F.R.S. Received March 1, 1880.

(Abstract.)

The author, after alluding to the early conception by Dr. Werner Siemens of the dynamo-electric or accumulative principle of generating currents, makes reference to the two papers on the subject presented, the one by Sir Charles Wheatstone and the other by himself, to the Royal Society in February, 1867. The machine then designed by him, and shown in operation on that occasion, is again brought forward with a view of indicating the progress that has since taken place in the construction of dynamo-electrical machines, particularly those by Gramme and Siemens-von Alteneck. The paper next points out certain drawbacks to the use of these machines, both of them being subject to the disadvantage that an increase of external resistance causes a falling off of the current; and that, on the other hand, the short circuiting of the outer resistance, through contact between the carbon electrodes of an electric lamp, very much increases the electric excitement of the machine, and the power necessary to maintain its motion, giving rise to rapid heating and destructive sparks in the machine itself.

An observation in Sir Charles Wheatstone's paper is referred to, pointing to the fact that a powerful current is set up in the shunt circuit of a dynamo-electric machine, which circumstance has since been taken advantage of to some extent by Mr. Ladd and Mr. Brush, in constructing current generators.

The principal object of the paper is to establish the conditions under

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which dynamo-electric machines worked on the shunt principle can be made to give maximum results. A series of tables and diagrams are given, the results of experiments conducted by Mr. Lauckert, electrician, employed at the author's works, which lead up to the conclusion that, in constructing such machines on the shunt principle, the resistance on the rotating helix has to be considerably reduced by increasing the thickness of the wire employed, and that on the magnets has to be increased more than tenfold, not by the employment of thin wire, but by augmenting the length and weight of coil wire employed.

The results of this mode of distributing the resistances is summarised as follows:—

1. That the electro-motive force, instead of diminishing with increased resistance, increases at first rapidly, and then more slowly towards an asymptote.

2. That the current in the outer circuit is actually greater for a unit and a half resistance than for one unit.

3. With an external resistance of one unit, which is about equivalent to an electric arc, when thirty or forty webers are passing through it, 2·44 horse-power is expended, of which 1·29 horse-power is usefully employed, proving an efficiency of 53 per cent., as compared with 45 per cent. in the case of the ordinary dynamo-machine.

4. That the maximum energy which can be demanded from the engine is 2·6 horse-power, so that but a small margin of power is needed to suffice for the greatest possible requirement.

5. That the maximum energy which can be injuriously transferred into heat in the machine itself is 1·3 horse-power, so that there is no fear here of destroying the insulation of the helix by excessive heating.

6. That the maximum current is approximately that which would be habitually used, and which the commutator and collecting brushes are quite capable of transmitting.

Hence the author concludes that the new machine will give a steadier light than the old one with greater average economy of power, that it will be less liable to derangement, and may be driven without variation of speed by a smaller engine; also that the new machine is free from all objection when used for the purpose of electro-deposition.

This construction of machine enables the author to effect an important simplification of the regulator to work electric lamps, enabling him to dispense with all wheel and clockwork in the arrangement. The two carbons being pushed onward by gravity or spring power are checked laterally by a pointed metallic abutment situated at such a distance from the arc itself, that the heat is only just sufficient to cause the gradual wasting away of the carbon in contact with atmospheric air. The carbon holders are connected to the iron core of a solenoid coil, of a resistance equal to about 50 times that of the arc, the ends of which coil are connected to the two electrodes respectively.

The weight of the core (which may be varied), determines the force of current that has to pass through the regulating coil in order to keep the weight in suspension, and this in its turn is dependent upon the resistance of the arc. The result is that the length of the arc is regulated automatically, so as to maintain a uniform resistance signifying a uniform development of light.

III. "On the Influence of Electric Light upon Vegetation, and on certain Physical Principles involved." By C. William Siemens, D.C.L., LL.D., F.R.S. Received March 1, 1880.

Although according to Ste. Claire Deville the dissociation of CO_2 and H_2O at atmospheric pressure commences at a temperature not exceeding 1,200° C., the reverse action, namely, combustion, continues to be sufficiently active to increase the heat of a flame until a temperature of probably 2,200° C. is reached, of which the Deville oxygen blast and the regenerative gas-furnace furnish examples.

In the working out of a process, by means of which steel and fused iron are produced in large masses on the open hearth of the regenerative gas-furnace, I have had frequent opportunities of observing the utmost limit of temperature practically attainable by means of the combustion of carbonaceous substances. The heat of that furnace is not dependent upon a blast or upon chimney draught, and the pressure within the furnace balances the external atmospheric pressure so completely that the large working doors may be opened occasionally for inspecting the metal. On these occasions it may frequently be observed that serrated clouds of highly heated combustible gases pass through the furnace chamber (as may be seen through obscured or coloured glasses) without suffering apparently any diminution through contact with an excess of heated oxygen, showing that the limit of furnace heat, or the point of complete dissociation, has been nearly reached.

When thus brought face to face with the utmost limit of heat attainable by combustion, it is surprising how slight is the inconvenience (in the absence of heated matter flying about) experienced in approaching the open furnace, and how much higher must be the temperature of the sun or of the electric arc when the effects of distant radiation suffice to break up compounds such as nitrate of silver in a few seconds. Some years ago I undertook certain experimental inquiries having for their object to study the effect of radiant energy upon the ordinary products of combustion, CO_2 and H_2O, presenting them in an extremely rarefied conditon to solar and electric