EXPERIMENTS ON THE STEAM ENGINE.

In a former number of the FORTNIGHTLY reference was made to the paper of Professors Callendar and Nicolson ON THE LAW OF CONDENSATION OF STEAM DEDUCED FROM MEASUREMENTS OF TEMPERATURE-CYCLES OF THE WALLS AND STEAM IN THE CYLINDER OF A STEAM ENGINE, which was read recently before the Institution of Civil Engineers.

It is not within the province of the FORTNIGHTLY to give more than a superficial outline of the work as carried on and of the results deduced; details, if desired, may be found in THE ENGINEER and in the PROCEEDINGS OF THE INSTITUTION OF CIVIL ENGINEERS.

The paper is valuable and interesting not only because of the conclusions arrived at, and the novel and ingenious methods used to obtain these results, but also on account of the experiments performed in connection with and subsidiary to the main one.

The results themselves throw light on a subject about which prior to their publication very little was positively known, and in which former conclusions, being hypothetical, were, as not unfrequently happens, considerably at fault.

It will only be necessary to read the following quotation from an editorial in THE ENGINEER to observe the importance given this paper by English engineers:—

"An excellent paper has been read lately at the Institution of Civil Engineers on this most difficult subject (Condensation of Steam in Steam Engine and its Measurements), and is the best yet published. This masterly treatise is full of the most interesting and elaborate experiments, tables and diagrams, all bearing on the intricate question of cylinder temperatures, of which so little is known. The paper brings out afresh the immense importance of the temperature of the cylinder walls, compared with that of the working steam in contact with them. If the temperature of the walls is higher than that of the steam, there is little or no condensation; if it is lower, great condensation and loss of steam will be the result. It is therefore of the utmost consequence to determine, not only the temperature of the steam during a complete revolution, but especially that of the walls at the surface, and throughout the thickness of the metal for the same period, particularly during admission. This the authors have done with great care and ability, and by the best methods yet known, namely, with electrical thermometers and thermo-couples. Professor Callendar has for many years made a study of these instruments, and obtained from them very accurate results, as they are quicker in action and more delicate than mercurial thermometers. To ensure accuracy, both the authors carefully calibrated and tested the electrical thermometers used, and succeeded in getting minute and trustworthy data throwing new light on the subject of cylinder temperatures."

Incidentally it may be mentioned here that the author, in the article from which the above is quoted, refers to the Thermodynamic Laboratory in the Engineering building, where the experiments were performed, as being "perhaps the finest and best equipped laboratory yet built in any country."

The special object of the experiments was the measurement of the cyclical interchange of heat between the cylinder walls and the steam—that is, the exchange of heat per revolution.

The cylinder wall temperatures were obtained by the thermo-electric method. In taking observations the Poggendorf compensation method was used, and the delicacy of the apparatus is shown by the fact that with a contact duration of only $\frac{1}{30}$ of a revolution, the galvanometer could be read to nearly one tenth of a degree. Another feature of the thermometry was the insertion of a platinum wire thermometer into the piston rod to observe the temperature of the main body of the steam at a distance from the walls.

In determining the conductivity of cast iron, which was done with great care, the astonishing difference of 30 per cent. appeared between the value found and that usually assumed.

The most important general conclusion derived from the experiments is, that the rate of the condensation of steam on a metallic surface is limited, and for this finite rate of condensation a result approximately equivalent to 2.7 lbs. of