THURSDAY, JUNE 16, 1881

THE STORAGE OF ELECTRIC ENERGY

I AM continuing my experiments on the Faure accumulator with every-day increasing interest. I find M. Reynier's statement, that a Faure accumulator, weighing 75 kilograms (165 lbs.) can store and give out again energy to the extent of an hour's work of one-horse power (2,000,000 foot-pounds) amply confirmed. I have not yet succeeded in making the complete measurements necessary to say exactly what proportion of the energy used in the charging is lost in the process of charging and discharging. If the processes are pushed on too fast there is necessarily a great loss of energy, just as there is in driving a small steam-engine so fast that energy is wasted by "wire-drawing" of the steam through the steam pipes and ports. If the processes are carried on too slowly there is inevitably some loss through local action, the spongy lead becoming oxidised, and the peroxide losing some of its oxygen viciously, that is to say, without doing the proper proportion of electric work in the circuit. I have seen enough however to make me feel very confident that in any mode of working the accumulator not uselessly slow, the loss from local action will be very small. I think it most probable that at rates of working which would be perfectly convenient for the ordinary use of fixed accumulators in connection with electric lighting and electric transmission of power for driving machinery, large and small, the loss of energy in charging the accumulator and taking out the charge again for use will be less than 10 per cent. of the whole that is spent in charging the accumulator: but to realise such dynamical economy as this prime cost in lead must not be stinted. I have quite ascertained that accumulators amounting in weight to three-quarters of a ton will suffice to work for six hours from one charge, doing work during the six hours at the uniform rate of one-horse-power, and with very high economy. I think it probable that the economy will be so high that as much as 90 per cent. of the energy spent in the charge will be given out in the circuit external to the accumulator. When, as in the proposed application to driving tramcars, economy of weight is very important, much less perfect economy of energy must be looked for. Thus, though an eighth of a ton of accumulators would work very economically for six hours at one-sixth of a horse-power, it would work much less economically for one hour at one horse-power; but not so uneconomically as to be practically fatal to the proposed use. It seems indeed very probable that a tramcar arranged to take in, say 7½ cwt. of freshly-charged accumulators, on leaving head-quarters for an hour's run, may be driven more economically by the electric energy operating through a dynamo-electric machine than by horses. The question of economy between accumulators carried in the tramcar, as in M. Faure's proposal, and electricity transmitted by an insulated conductor, as in the electric railway at present being tried at Berlin by the Messrs. Siemens, is one that can only be practically settled by experience. In circumstances in which the insulated conductor can be laid, Messrs. Siemens' plan will undoubtedly be the most economical, as it will save the carriage of the weight of the accumulators. But there are many cases in which the insulated conductor is impracticable, and in which M. Faure's plan may prove useful. Whether it be the electric railway or the lead-driven tramcar, there is one feature of peculiar scientific interest belonging to electro-dynamic propulsion of road carriages. Whatever work is done by gravity on the carriage going down hill will be laid up in store ready to assist afterwards in drawing the carriage up the hill, provided electric accumulators be used, whether at a fixed driving station or in the carriage itself.

WILLIAM THOMSON

University, Glasgow, June 13

THE LIFE OF WHEWELL

The Life, and Selections from the Correspondence, of William Whewell, D.D., late Master of Trinity College, Cambridge. By Mrs. Stair Douglas. (C. Kegan Paul and Co., 1881.)

IT is now about four years since the first instalment of a biography of the late Dr. Whewell was published. These volumes, admirably edited by Mr. Todhunter, give us a brief outline of his history, but consist chiefly of a most valuable analytical account of his writings and a selection from his literary and scientific correspondence. In the preface a more complete memoir of Dr. Whewell's personal and domestic history is announced as in preparation. The present volume, edited by Dr. Whewell's niece, Mrs. Stair Douglas, fulfils the promise then given. The preface explains the long interval—fourteen years—which has elapsed since Dr. Whewell's death. A series of untoward events have continued to retard publication. From various causes much delay occurred before the exact plan of the work was determined and the subjects apportioned. At first it was hoped that what may be called the academic life of Dr. Whewell would be undertaken by Mr. Aldis Wright, the present Bursar of Trinity College. But the pressure of heavy and unavoidable engagements has precluded him from proceeding with the task. Mrs. Douglas then endeavoured to work the materials into the selections from Dr. Whewell's personal correspondence which she had nearly completed, with the assistance of Mr. J. Lemprière Hammond, Fellow of Trinity, and one of Dr. Whewell's executors. Before this was accomplished she was deprived of his invaluable aid by his lamented and untimely death. Thus some portions of the present work are a little incomplete. Still, as these are generally of a rather technical nature, and more interesting to members of the University than to the general reader, their absence probably will not be very widely felt. We may be allowed to express our admiration at the tact and good taste with which Mrs. Douglas has executed her task. She allows Dr. Whewell as far as possible to speak for himself, connecting his letters generally with only such brief biographical paragraphs as are necessary for a connected and intelligible narrative. There is little comment and no attempt at the fulsome praise with which biographies are often disfigured. Her descriptions, though brief, are often graphic, while the letters enable us to see the Master of Trinity as he appeared to the inner circle of intimate friends and loved relations.

Of his vast and varied knowledge it is almost needless