

umbilical cord, serves as an attachment for the spirit, which is *en rapport* with them.

The polity and government of the Baganda was a very perfect form of that kind of feudal monarchy which is frequent in Africa. The description of this system, and particularly of the functions of the King, forms the dominant feature of Mr. Roscoe's book. It is a remarkable chapter in political evolution.

The royal family is distinguished by a straighter nose and less protruding lips. Its descent is traced back, along with the history of the people, for thirty-two generations, about a thousand years, to the first monarch, Kintu, who made the Baganda a nation. Oral history of this type is a very real thing, transcending time and space more efficiently than written records, and probably avoiding many errors inseparable from literature. The other great landmark of Uganda history is the reign of King Mutesa in the middle of last century. Mutesa was a broad-minded and far-seeing ruler. He initiated liberal reforms, and broke away from the previous policy of isolation. It was by him that Speke was welcomed in 1861, and Stanley in 1875. Through the latter's representations Christian missionaries were admitted. But Mutesa also welcomed the Arabs. After his death there was a struggle between the Christian and Muhammadan parties for the succession to the throne, which was ended by the British Protectorate.

The succession, it may be noted, is hereditary, but a committee of chiefs selects and appoints one of the princes. There is much that is equally logical among the rights and duties as between king and chiefs and clans. Take away from the states of mediæval Europe their Greco-Roman culture and inheritance, and you have a civilisation little, if at all, more advanced, both politically, socially, and industrially, than that reached independently by the Baganda. The king is invested at the coronation by "the King's Father." The "Father" says to him: "You are king. Rule over your people well, and always do what is right." The king answers: "I agree to do so." "Always give just judgment." "I will." Side by side with this is the curious custom of killing men so that their lives may invigorate the king. But such atrocities, though differing in intention, have actually been more common in Europe.

Mr. Roscoe has lived with the natives for twenty-five years. He not only knows their character and customs, but has studied them as an anthropologist. His book is full of new and important facts which only scientific insight could have unearthed. Both the ethnologist and the constructive sociologist will find it the most significant and valuable study of a native race that has appeared since "The Northern Tribes of Central Australia." Nor must the author's human quality go without mention. There is an indefinable atmosphere of sympathy permeating his pages, the result of which is that the people as he describes them are a living reality.

A. E. CRAWLEY.

THE EVOLUTION OF AN AËROPLANE.¹

READERS of the first two numbers of the twenty-seventh volume of "Smithsonian Contributions to Knowledge," who have not forgotten the pleasure they derived from the study of Dr. S. P. Langley's work in aërodynamics, will welcome the publication of this third number, on mechanical flight. While experimental aërodynamics and the theoretical study of flight respectively may form the sole subject of an

¹ Smithsonian Contributions to Knowledge, vol. xxvii., No. 3: "Langley Memoir on Mechanical Flight." Part I., 1887 to 1896. By S. P. Langley. Edited by C. M. Manly. Part II., 1897 to 1903. By C. M. Manly. Pp. xi + 320. (Washington: Smithsonian Institution, 1911.)

investigation, the successful flight of models and of full-scale machines cannot be attained without both the guide of theory and the possession of accurate numerical data gathered by means of careful experiments. Appeal to nature is even necessary to obtain, through the observations of bird flight, some starting point in a line of research by trial and error that cannot be struck at random. For this reason the pursuit of success in actual flight is the most comprehensive branch of the science of aviation, and it

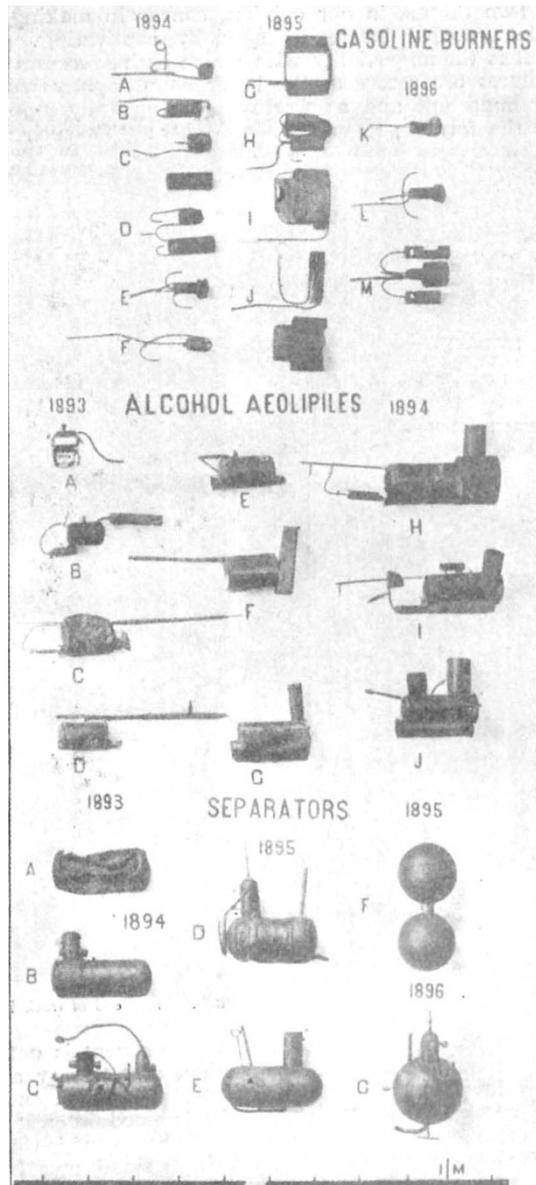


FIG. 1.—Burners, aeolipiles, and separators.

will be enough to say that the work before us deals with the history of Dr. Langley's efforts to realise artificial flight to convey the impression that the account put before us is pregnant with details of the utmost interest to men of science and to non-technical readers alike.

Those indeed who have appreciated Dr. Langley's indomitable perseverance in overcoming the ever-recurring obstacles that stand in the way of any experi-

mental achievement, and have an idea of the endless chain of linked difficulties that runs through the whole problem of mechanical flight, cannot fail to recognise that no better man could have harnessed himself to its solution, and will open the book with a feeling of expectation which, it is needless to say, does not end in disappointment. The gradual evolution of a full-size gasoline-propelled flying machine from a shellaced paper model propelled by twisted india-rubber is presented with a faithfulness and a precision of details that render the story most fascinating.

Two things, in our opinion, concur in making the tale unfolded before us specially captivating. The first is the impartiality with which both successes and failures are recorded, the latter being rightly judged as important and as worthy of being fully reported as the former; to quote Mr. Manly: "To such men

The aim of the research is stated simply to be "putting a trial aërodrome—to use the name adopted by the investigator—successfully in flight, and thus giving an early demonstration . . . that mechanical flight is possible, by actual flying." We shall leave the reader to judge if such a modest statement adequately describes the strenuous endeavour to overcome the manifold difficulties, by gathering highly specialised knowledge in widely different fields of technical attainment until a new science was found to have sprung from the harvest of accumulated data and the acquired experience.

The work is divided in two parts. Part i., written by Dr. Langley himself, deals in chronological order with the flight of models, in ten chapters retracing the successive attempts, beginning with india-rubber models similar to those previously constructed by Pénaud. This portion of the book (chapter ii.) is

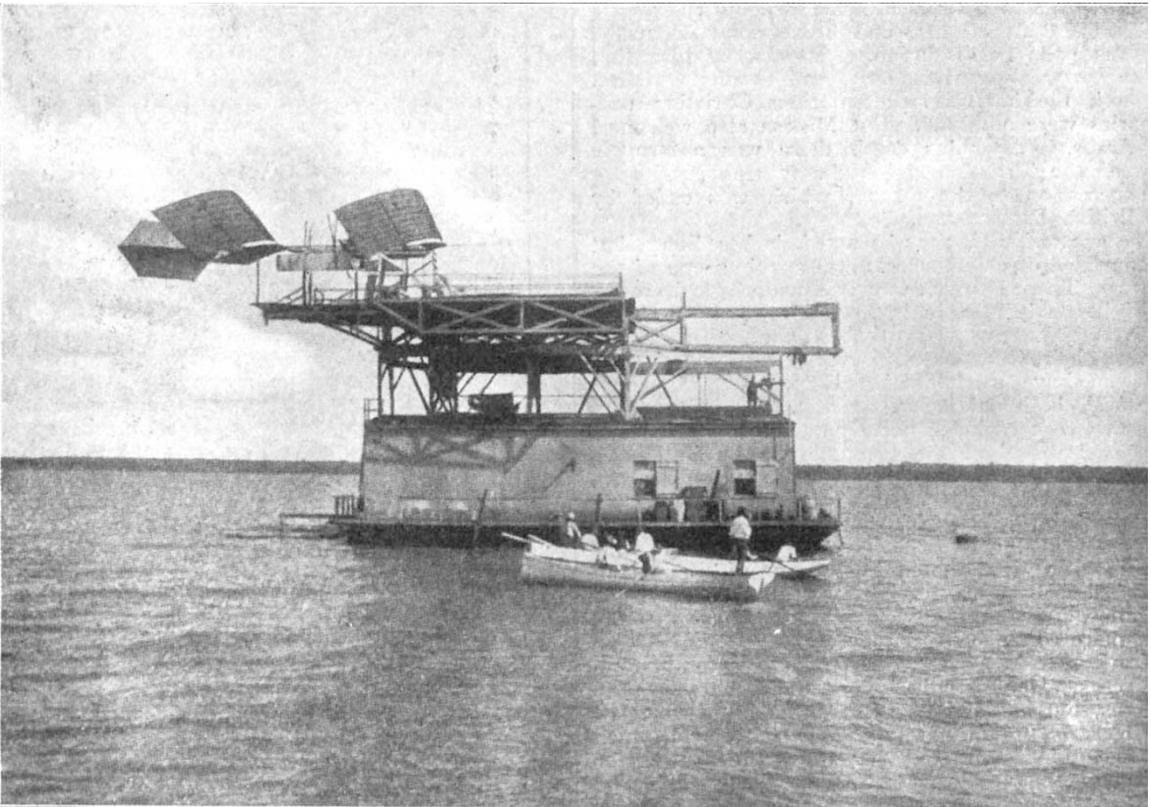


FIG. 2.—Front end of track just preparatory to launching aërodrome.

as Mr. Langley, an unsuccessful experiment is not a failure, but a means of instruction, a necessary and often invaluable stepping-stone to the desired end." The second and chief cause of sustained interest is undoubtedly the special circumstances in which the work was undertaken, for, although small toys had been made to fly a few yards, yet, at that time, "hardly any scientific men of position had made even preliminary investigations, and almost every experiment to be made was made for the first time." The book is therefore, we believe, perhaps unique in its kind, being a complete record of the production of a highly complex and novel machine from an initial stage where very little help was available, not even an idea of the proportion of sustaining surface area to weight, which had to be gathered from measurements on birds, nature supplying the first—and misleading—data in an almost virgin field of knowledge.

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by no means the least interesting, owing to the fact that practically every difficulty experienced later was met at the outset, the structure being too heavy if able to bear the strain, or too fragile if sufficiently light, while even the difficulty of launching, that was to require so much skill and ingenuity later, was felt at this early stage. A short discussion of the available propelling agents and the history of the special type of steam engine finally found to answer the contradictory requirements as to power and weight is the subject of the next two chapters, and goes far to show that the key to success was the determination with which the word "disheartening" was cancelled from the dictionary of the experimenter and of his able assistant.

Sustaining surfaces and "balancing" are then shortly dealt with. The relative importance of skin friction is not touched upon. The important subject

of stability is dismissed in eight pages, but this chapter is supplemented by experimental information given at various places elsewhere in the book. The rest of part i. is taken up by the description of the several models constructed and of an overhead launching gear by which they were released; Fig. 1 (a reproduction of plate 12) gives an idea of the thoroughness with which the evolution of each part is described. Elaborate and vivid descriptions of the performance of these models are given in each case, including as a rule a map of the path followed during their flights.

Part ii., written by Mr. C. M. Manly, Dr. Langley's chief assistant—to whom no doubt he would have ascribed a large part of the success had he edited himself the present account of his researches—is solely concerned with the construction and the trials of a man-carrying machine, the two first chapters being devoted to general considerations. The alteration of design necessitated by the change of scale required further experiments with two of the models already described; an account of these is found in chapter iii. A new launching gear, shown in Fig. 2 (a reproduction of

hundred plates of a high standard of excellence, including many detail drawings, several maps, and reproductions of photographs; an exhaustive index of twelve pages is not the least commendable feature of this latest and most important addition to the bibliography of aviation.

MAURICE E. J. GHEURY.

THE BESSEMER MEMORIAL GIFT TO THE ROYAL SCHOOL OF MINES.

ON June 29, 1903, on the very day that Lord Rosebery promulgated the scheme for the establishment of an Imperial College in London, a meeting was held at the Mansion House, under the chairmanship of the then Lord Mayor, Sir Marcus Samuel, for the purpose of devising a scheme "to perpetuate the memory of probably one of the greatest men who ever lived"—Sir Henry Bessemer. It was abundantly evident from the speeches delivered on that occasion by the Duke of Norfolk, Lord Haldane, and Sir John Wolfe Barry, that a very serious attempt was being made to establish in the metropolis of the Empire an

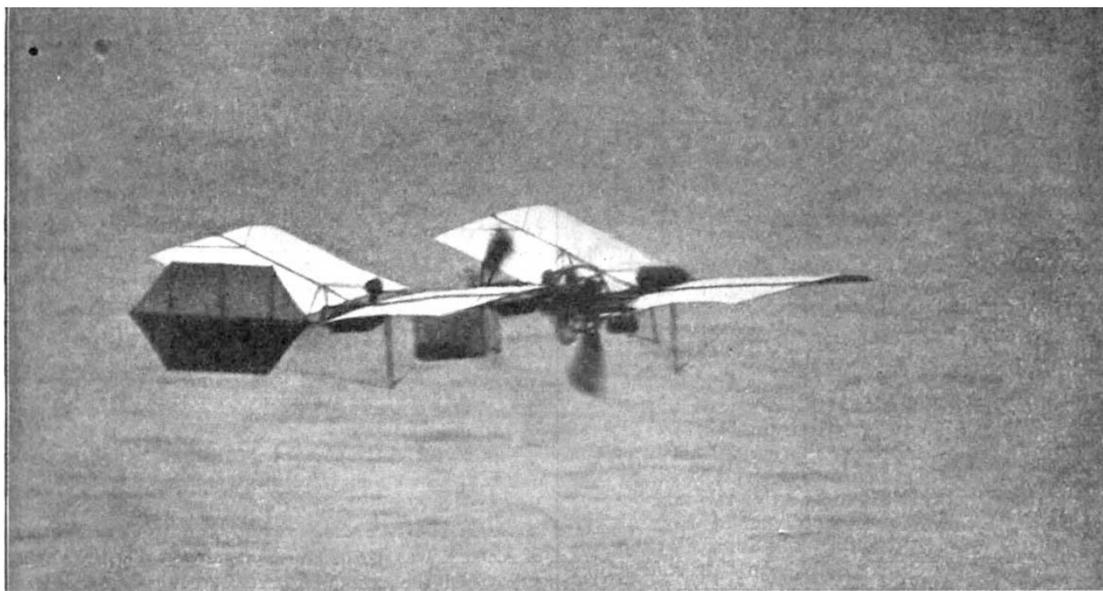


FIG. 3.—Quarter-size Model Aërodrome in Flight, August 8, 1903.

plate 43), forms the subject of chapter iv., and the next three chapters deal in an elaborate fashion with the construction of the frame and of the supporting surfaces of the large "aërodrome," and the method of ensuring its equilibrium while in flight.

Two chapters deal with the history of the engines of this machine, and of a quarter-size model of it, which it was intended to try first. This is shown in full flight in Fig. 3 (a reproduction of plate 92). The two last chapters contain the account of the shop and field trials and of the failures—solely caused by some defect in the launching gear—which ended the trials.

An interesting appendix on the flight of the American buzzard ends the book, which should be perused if one wishes to form an adequate idea of the value of the pioneer work done against difficulties of all kinds, conquered by sheer determination to succeed, and only baffled—just as success was at hand—by the lack of financial support due to the antagonism of a hostile Press.

The work is profusely illustrated by more than a

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institution having for its main object the organisation of scientific education with reference to national and imperial industries. Lord Haldane frankly admitted that "it was clear that in our industrial methods we were, in some respects, behind other nations. We possessed magnificent energy, we had a splendid record; but in the application of science to industry we had not hitherto developed anything comparable to those great institutions for technical training in the higher sense, such as exist elsewhere."

It was fitting that the memorial to Bessemer should be established in connection with an institution having aims so definite as the Imperial College, and it was a happy thought to associate the memorial with the Royal School of Mines, then about to undergo reorganisation. Much has occurred since those days. The Scientific development of the Royal School of Mines as a teaching institution is one of the events of the day. Visitors to South Kensington cannot fail to have noticed how largely the accommodation in that school has been increased, and those who have more intimate acquaintance with the internal affairs