As a matter of historical interest in kite development, Mr. Eric Stuart Bruce exhibited a photograph of the great kite made for him by Mr. Douglas Archibald several years ago. This was originally intended for combination with a captive balloon, so as to steady the balloon in a high wind.

No Aeronautical Soiree would be complete if it did not include the work of Mr. Hiram Maxim. On the present occasion that was represented by Mr. Maxim's unique collection of lantern slides descriptive of his experiments.

Another feature of the soiree was the fine photographs taken from balloon by the Rev. J. M. Bacon. At the next meeting of the Society, that gentleman has promised to read a paper on cloud photography from balloons, and in his own words will describe his work, which is especially valuable to meteorology, and is one token of the close alliance of the sciences of aeronautics and meteorology.

The Pilcher Collection of Soaring Machines.

Owing to the generosity of the firm of Messrs. Wilson & Pilcher, who have presented the whole of the Pilcher collection of flying machines to the Aeronautical Society, those now historic specimens are the property of the Society, and form a substantial addition to the Museum, which it is Major Baden-Powell's wish to develop in connection with the Society.

These machines are now on exhibition at the Crystal Palace, Sydenham, the management having most courteously offered the Society ample space for their effective display.

The collection consists of:—

1. Lilienthal's Soaring Machine. With this type of machine, Herr Lilienthal met with his fatal accident, an account of which will be found in the January number of this journal, 1897.
2. Pilcher's Soaring Machine, with which he met with his recent fatal accident, an account of which appeared in the October number of the journal, 1899. This machine is exhibited in the damaged condition it was found in after it was precipitated to the earth with the unfortunate experimenter.
3. Pilcher's new and incomplete soaring machine. This is constructed on the principle of the Hargrave soaring kite, and consists of a large number of small wings placed in sets one above the other, and it was upon this machine that the oil engine, made by Messrs. Pilcher, was intended to be placed.

The Balloon Work of the Late Mr. Henry Coxwell.

By ERIC STUART BRUCE, M.A., Oxon.

In the last number of this journal, it was my sad duty to chronicle the death of Mr. Coxwell. In another part of the same issue some aeronautical suggestions from the celebrated balloonist, bearing on the present war, appeared, showing that he maintained the ardour in aerial affairs that characterised his life to its very end.

Henry Coxwell was born on March 2nd, 1819, at Wouldham. He was the son of a gallant naval officer. From the day that,

THE LATE MR. HENRY COXWELL.

through a telescope, he espied the balloon ascent of Mr. Green, at Rochester, he conceived the passion for aeronautics, that in later years transformed the pastime into a profession, and bore results which have considerably influenced both military and scientific ballooning.

Young Coxwell began earnest life as a dentist, and for some years combined a considerable amount of balloon experience as an amateur with this profession. But the earnestness of his aeronautical talents prevailed, and in time he became the professional aeronaut, devoting himself to that calling with

the utmost ardour. Throughout his career, he endeavoured to divest balloon ascents from the mere sensational character which has so often been imparted to them, and added to the spectacle some feature of practical utility. "In the preface to the second volume of my life and balloon experiences," he says, "my chief motive for adopting ballooning professionally was not the mere idea of making money, but a desire to master the various and difficult problems of aerial navigation, so as to apply the knowledge thus obtained to military and meteorological uses." Throughout his professional ascents, he made special efforts to revive interest in military ballooning, and often included in his programme a display of signalling from the balloon car. In the work above-mentioned (page 5), he says, "So far back then as the Crimean War period, my experiments, while they met with public approval as a 'spectacle,' were far from being seriously regarded or turned to account by those in authority, and it needed many years of perseverance on my part ere a real military trial took place at Aldershot. I had hammered away in the "Times" for little less than a decade, when I was requested to be present at a sham fight, and to ascend from Thorn Hill, with Captain Beaumont, R.E., naval officers having previously made captive ascents."

Sufficient on this point, has been said to show that to Coxwell's efforts must be ascribed the revival of military ballooning in this country, and the establishment of the balloon corps, the utility of which, so often questioned, is now completely proved by the success of the balloon in South Africa.

But, what principally secured Coxwell's fame were the ascents he made for scientific purposes, under the auspices of the British Association. It is true that in these ascents he merely acted as pilot, and not as the scientific observer, the researches being entrusted to Mr. Glaisher, an esteemed honorary member of the Council of the Aeronautical Society. But the successful piloting of the observer in a balloon calls for the utmost skill, and this Coxwell displayed in a manner that has made his experiences "classic." The pilot has no easy task to fulfil. He is responsible for the safety of life and valuable instruments, also for the attainment of knowledge, and often has to make a rapid decision as to how far he is justified in risking the sacrifice of the one to the other. Coxwell exercised his discretion in these respects in an admirable manner. He was daring, so long as prudence and risk were fairly balanced, but he did not allow the scale to turn too far on the side of the latter.

The successful issue of the ascents which were arranged by the British Association was largely due to Coxwell's financial enterprise. The resources of the British Association Committee for these aerial researches were so modest that they could not meet the initial and necessary expenditure of providing a new and gas-tight balloon. After some failures with an old and leaky balloon, Coxwell came forward and offered to provide a new balloon of 92,000 cubic feet capacity, which would be worthier of the elaborate programme the scientists had planned. A complete account of the British Association ascents has been published in the work edited by Mr. Glaisher, and entitled "Travels in the Air." The record teems with instances of Coxwell's skill in difficult and often perilous positions. That it was fully appreciated by Mr. Glaisher was evinced by his remarks to Section A of the British Association at the Cambridge meeting, on October 11th, 1862: "It has been fortunate for the Association and for myself that we have the assistance of Mr. Coxwell; he has the experience of more than 400 ascents, based upon knowledge of natural philosophy, and knows the why and because of all his operations, and it was this fact, which I saw immediately from the clearness of his explanations to me for each operation, that enabled me to dismiss from my mind all thoughts of my position, and to concentrate my whole energies upon my duties. In conclusion, I feel certain that if these experiments from the balloon are available for philosophic research, one of the brightest links in the long chain of useful works, performed through the agency of the Association, will be the proving that the balloon in proper hands may be made a powerful philosophic agent."

Though the whole series of scientific ascents may be said to have established Coxwell's fame as a balloonist, one ascent, in particular, claims historic interest. That was the famous ascent of seven miles, carried out on Sept. 5th, 1862, when the intrepid aeronauts ascended to within an inch of their lives. The exact height reached in this ascent has been disputed of late. Owing to Mr. Glaisher becoming insensible, no observation of the barometer was taken above 29,000 feet. The remaining feet attained before Coxwell, who was partly paralyzed, pulled the valve open with his teeth, were merely guesswork. But if the height attained has been exceeded in Dr. Berson's ascent, which is a matter of great doubt, the ascent of Messrs. Glaisher and Coxwell must have run it very close.

The memorable ascent fairly proved that at

about seven miles in the atmosphere there is the limit to human endurance of the rarified condition of the air. Perhaps, it might be slightly exceeded by inhalation of oxygen, but it is hardly likely that it could be to any great extent.

The photograph of Mr. Coxwell, which is reproduced with this article, was kindly placed at the writer's disposal for reproduction by Mr. Coxwell some years ago.

A Theory of Flight.

Read by Mr. Smyth before the Aeronautical Society, at their meeting at the Society of Arts, 28th July, 1899 :—

That the wings of all flying animals are the prime sustainers as well as the propellers of their whole systems is proved by the horizontal flying models exhibited after the reading of the paper, the speed of which models is about thirty feet per second.

As most people understand the powers concerned in sailing a cutter against wind, we may start by comparing the forces in flight with those that are analogous in the sailing of a boat, for example, a cutter. It must be known that in sailing the centre of effort (air pressure) and the centre of lateral resistance (water pressure) are very intimately connected as powers, both being the outcome of fluid pressure on surfaces, and both being absolutely necessary for the sailing of a cutter against wind.

If the wind has the power of propelling a cutter through a fluid much denser than air, and at the same time against the adverse aerial current itself, how much easier should it be to form a contrivance that could fly against adverse winds only? It is well known that a cutter of present-date construction cannot sail directly against the wind, and that a bird can. Why?

The boat is propelled by aerial pressure on one side of its surface area, depending for direction on its lateral resistance or water pressure; whereas a bird is propelled by aerial pressure on two surface areas, each counteracting the other and depending for direction on their positions relative to the vertical resistance of the whole body.

All the contrivances for forward motion in a cutter are so constructed that it would be impossible to sail her stern first against wind; for the same reason it would be impossible for a bird to fly tail first. Hence also, like boat-

building, the constructing of a flying machine must be a science and an art. A science inasmuch that it depends on the application of some of the powerful laws of nature, an art because it depends on the application of rules which are liable to frequent fluctuations.

The centre of power, which is called a centre of effort, in the sails of a cutter is similar to the centre of aerial resistance of a bird's wing. A cutter depends on the force of the wind to give it propelling means, whereas a bird creates its aerial pressure, the difference being that the sail area of a cutter receives its aerial pressure more or less horizontally, and the wings of a bird create aerial pressure more or less vertically, and since aerial pressure is equal in all directions the result is the same. When a cutter is sailing against wind, the side of its hull to leeward is the only side actively concerned in its propelling means, and this is why it cannot sail directly against wind; but a bird has an active vertical resistance on either side of its body of equal powers, hence it is not prevented from flying in that direction.

Now when a bird, in its normally horizontal position of body, has its wings outstretched, the resistance to the vertical motion is due to the unsuitability of construction for progress in that direction as compared with progress ahead, but there is motion transversely to the line of its body. This motion in sailing would be called leeway.

In a bird, the centre of gravity of its system is placed low, so that it may easily keep its equilibrium; for the same reason it is placed low in the cutter. Now when a bird's body is suspended between its outstretched wings fixed for a vertical resistance, as seen when descending from a height, all that is required of it for its forward and downward gliding movement is that it should keep the centre of gravity of its whole system as nearly as possible immediately below the centres of vertical resistance of its whole active surface. This it is able to do by placing its wings a little forward or backward instinctively, which would bring the angle of propulsion to a descending one, the degree of angle according to position of centres of powers of aerial pressure and gravity, and strength of rear portions of the wings. Now if the centre of gravity were immediately below in a vertical direction to the centre of vertical resistance of rigid wings, it would in still atmosphere naturally descend in an absolutely vertical direction, but as the wings are not rigid, this motion would be very difficult and would compare with a boat that was making no headway, but