formed in the north, and continued to shine with more or less brilliancy for some time. The arc appeared to be a double one, by the presence of a dark band running longitudinally through it. Occasional streamers of equally pure white light ran upwards from either end of the bow. The moon was only a day old, but the old landscape was lighted up as if by the full moon; and the effect of Kyle Akin lighthouse, the numerous surrounding islands, and the still sea between, was a true thing of beauty, forming as it did a quiet contrast to the more brilliant but restless forms of auroræ generally seen. I particularly noticed a somewhat misty and foggy look about the brilliant arc, giving it almost a solid appearance. The space of sky between the horizon and the lower edge of the arc was of a deep indigo colour, probably the effect of contrast.

I regretted I had no spectroscope with me, as it would have been a fine opportunity to test the spectrum of an aurora of pure white light. I had a strong impression that the bow was near to the earth, and almost thought that the eastern end, and some fleecy clouds in which it was involved, were between myself and the peaks of some distant mountains. The eye is, however, deceptive in such cases, though instances are not wanting of auroræ close to the earth's surface. I shall be glad to know if other observations of this aurora were made.

Nairn, N.B., Oct. 3 J. RAND CAPRON

The Cry of the Frog

THE fact that the common frog (*Rana temporaria*) is capable of crying out lustily when he feels himself in danger, does not seem to have been frequently remarked. In my small walled garden there is a common frog who is persecuted by three cats. His residence is a heap of slates at the foot of an ivied wall, and here he is safe. But if he ventures far abroad his tormentors soon espy him, and though they seem nearly as much terrified as himself, they cannot resist the temptation to touch him with their paws. He immediately opens his mouth and utters a prolonged cry, which appears to be very surprising to the cats, who draw back for a few moments, and then pat him again, apparently out of mere curiosity, to be again scared by the same unusual sound. This sound is a shrill and rather sibilant wail, like the note of a small penny trumpet or the cry of a new-born infant. There can be no mistake about it, as I have repeatedly touched the frog with my own hand after driving the cats away, and the same cry has immediately followed, the lower jaw being dropped so that the mouth stands open about a quarter of an inch at the tip.

Leicester, Sept. 26 F. T. MOTT

The Woolwich Aëronautical Experiment

II.

IN order to discover the laws of the vertical motion, we must suppose that the balloon is resting in perfect equilibrium when on land; which means that the ascending power of the gas enclosed in the balloon is just equal to the weight of the canvas, netting, grapnel, ballast, passengers, &c. Under these circumstances the balloon will not ascend by itself, but it will with all the weight of the sand which may be thrown overboard, if a certain space is left for dilatation and the balloon is not quite full when resting on land. If the volume is V at the surface of earth, it will be $\frac{V H}{h}$ at an altitude where barometric pressure is h, being H at departure. When the balloon is quite full, gas escapes by the lower part under the shape of a whitish steam. If v is the additional volume which can be filled by dilatation, that phenomenon will take place at an altitude where the pressure is h given by the equation $\frac{V H}{V + v}$.

We suppose that the height h is never to be attained, and in fact it is desirable for the aëronauts to limit their altitude before starting, and not to fill their balloon with a gas which they are obliged to throw away by the valve or to see escaping by the *appendice* at some risk of their own safety; one of the greatest advantages of the vertical fan being to limit at will the ascent, as will be shown.

In our calculations we suppose that the canvas is not losing gas, that the sun is not affecting the balloon, and that no water is falling upon it, or no cloud concealing the sun. All these changes of temperature can be made the subject of special calculations, and the real motion of the aërostatic globe is the *mean* between all the different circumstances of the atmosphere.

If a balloon starts in an homogeneous air because a weight p of sand was thrown overboard, P being the weight of the air displaced by the balloon when resting on land, the motive power is $g' = \frac{g\,p}{P + p}$ and the laws of the motions of an Attwood machine are perfectly applicable to it.

The elevation takes place with an increased velocity up to the moment where the resistance of the air is = to g'. Consequently,

$$K v^2 = \frac{p\,g}{P + p}.$$

K being a certain coefficient which depends on the form of the balloon, its diameter, its netting, and the density of the air. K diminishes as the altitude increases, but the diameter of the balloon enlarges gradually to its utmost. As the law of diminution of pressure is not known, we are obliged to suppose K = constant.

If we suppose a balloon of 60,000 cubic feet holding 50,000 cubic feet of gas when resting on the ground, the balloon can reach without losing gas (except by the loss through the canvas, which we suppose to be perfectly gas-tight) to a level where $h' = \frac{5\,h}{6}$ = about 6,000 feet in round numbers. Under these circumstances the weight of the balloon when resting on land may be supposed to be about 3,300 pounds.

If we suppose 20 lbs. of sand are thrown overboard in ascending, the motive power will be $\frac{g}{115}$. The uniform motion will be $K v^2 = \frac{g}{115}$.

Under these circumstances, as far as my knowledge goes, it is 4 ft. per second. If we suppose $g = 32$ feet.

$$K v^2 = 16\,K = \frac{32}{115} \text{ and } K = \frac{32}{115 \times 16} = \frac{2}{115}$$

If a static effort of 20 lbs. in the vertical direction can be produced by the working of the vertical fan, it is easy to understand that the ascent can be stopped before the balloon has reached the level where the gas is beginning to escape by working in the proper direction for it. That effort is not too much for two men working on a fan which is suitably constructed.

The same thing can be said as to the descent of the balloon, but K is much larger, as the shape of the lower part is not so well suited for moving in the air as the upper half. With *appendice*, netting, ropes, and car, it exerts a resistance which is much larger and may be compared with the force exerted by a *parachute* descending in the air. The difference is very great, as I observed several times in my ascents that it was difficult to give the balloon a descending impulsion towards the land. I should not wonder if it was partly the cause of the resistance felt by Mr. Bowdler when moving his fan in the direction where it ought to have caused the balloon to descend; at least such is the opinion that I am in position to hold from the concise and imperfect narrative I found in the public papers.

W. DE FONVIELLE

Is the Rabbit Indigenous?

WOULD you permit me, through the medium of NATURE, to ask on what grounds the rabbit is considered not indigenous in this country? The best authorities on British and German Mammalia seem agreed that it is a native of the Mediterranean basin. On what facts or writings is this opinion based, and at what time was it introduced into Great Britain? I am very anxious to determine whether the above statements are founded on authentic documents or writings, or are merely suppositions which cannot be asserted with certainty. N.

Sept. 30

THE SOCIAL SCIENCE CONGRESS

THE friends of social science have had a most successful meeting this year at Glasgow, and in the various addresses and papers there has been afforded ample evidence that the importance of the introduction of more scientific knowledge into the heads and daily life of the people is becoming more and more widely acknowledged.

In the Health Section, Dr. Lyon Playfair in his address,

after referring to Franklin's aphorism, "Public health is public wealth," pointed out that taking the smallest part of the money saving, it is obvious that money judiciously spent in sanitary improvement is not unproductive taxation, but capital bearing abundant interest; and he then gave an idea of the present sanitary chaos. "In England, at the present time, there is a casual agglomeration of 1,500 separate sanitary authorities, without system or cohesion. Their areas of administration are diverse in the extreme, being neither bounded by counties, parishes, nor natural watersheds; and their duties are divided without meaning between authorities in the same district. They have been lately put under medical officers of health without preparation or qualifications for their duties, some well paid and devoting their time to this important work, others having little more than nominal payment, and giving little more than nominal time to their important duties. Notwithstanding this too sudden and unprepared universal appointment of medical officers, yet in the administration of the Health Acts there has been recently manifested a disposition to 'distrust the doctors,' and to work the Acts, at least at head-quarters, by lawyers and other persons not connected with the medical profession. This is the old error of making common sense the fetish for worship, which Archbishop Whately and others have so effectively condemned. Even the most fervent worshipper of common sense as opposed to technical training never relies on it in important emergencies of his life. He goes to the lawyer to make his will or to convey property; he consults the parson on religious doubts when on the sick bed, and he does not spurn the doctor to cure him of his grievous ailment. But it is well known that the Local Government Board are afraid of the doctors in the administration of Health Acts. Who beside them possess the knowledge? I can testify, from an experience of thirty years in sanitary work—and impartially, because I am not in the medical profession—that there is not a class of men in the country who labour so zealously for the prevention of disease as the doctors, though their training hitherto has been cure, not prevention. Certainly their private interests have never been allowed to stand in the way of their efforts to uproot disease, although their living depends upon its existence. This unselfishness in the application of their science to prevention has always been to me a source of high admiration. Why, then, is there this vulgar distrust of the doctors in the administration of our Health Acts? Extend this prejudice against technical knowledge, and how absurd it would be. Would you improve the progress of telegraphy in this country by suppressing electricians, or the law and justice of the country by putting down lawyers? Would the Secretary at War promote the conduct of war by suspecting soldiers, or the First Lord of the Admiralty the efficiency of fleets by distrusting sailors? Would our railroads and harbours be better governed if engineers were held at a discount? But this is actually the state of things at the Local Government Board—the Health Ministry of the country. The Privy Council handed over to that Board Dr. Simon and his associates, with a wealth of medical experience in public hygiene. Ever since, that wealth has been locked away from public use. Certain I am that their experience could not have guided the Board in the utter confusion of organisation in regard to medical officers of health. They have been appointed without any system. Some have a small parish to attend to, others have a thousand square miles. The last are appointed for combined districts, but are managed by uncombined authorities, and have neither assistants to aid them nor power to enforce their decisions. The officers of health are without any definite rule for obtaining available knowledge of prevailing sickness, even when it is treated at the public expense within their own districts; and they are not, universally at least, informed of the deaths as they occur. The medical officers of health have been appointed without any examination on their knowledge of State medicine, and in the majority of cases they do not possess this knowledge. I am perfectly certain that this utter confusion could not have resulted had the Local Government Board consulted the experienced State medical officers belonging to them. This distrust of the doctors in higher administration is simply a general mistrust of science. And the time has now arrived when science must be trusted in government. Science is entering into the higher education of the country, and the prejudice against it among legislators, who were educated in classical universities, will in time be removed. For the progress of a country depends upon the progress of science, and the welfare of a nation is secured by the most intelligent application of science to its manufactures and to its government. The health of the country—and that governs the productive power of its people—depends as much upon the application of medical science as the working of a machine depends upon a good application of mechanical laws. To trust the whole administration of Health Acts to Poor-law inspectors and lawyers is an amazing example of unbelief in the first principles of the laws of health. The well-being of the people depends upon physical causes, which, when intelligently understood, mean physical science, and the trained physician is the natural and most intelligent agent for extending its knowledge and application to the prevention of disease. What we want in the future is not new law, but more efficient administration of existing law. To heap up new sanitary law on the decaying mass of undigested sanitary law, which already forms a dismal agglomeration, is like the practice of our ancestors, who thought that a few clean rushes thrown upon the corrupt mass of foul rushes on the floor sufficed for sanitary purposes. What we want is superior organisation and efficient administration of existing law. But, in our happy-go-lucky style of government, are we likely to get it? I doubt whether it will be wise to continue the Local Government as a separate department of the State. Its functions in reality appertain to the Home Office, which, when properly organised, should divide itself into two great departments, the one dealing with police and justice, the other with the physical interests of the people. One Secretary of State might have the supreme responsibility, but each of the divisions should be scientifically administered. It would be as absurd to put a man trained in physical science at the head of the branch of police and justice, as it is to put a man merely trained in law in charge of the physical interests of the people. It is an exploded fallacy that only lawyers are good men of business, and that scientific men are not. Is my friend Sir John Lubbock a worse banker because he is an eminent man of science? Is Mr. Spottiswoode a worse printer because he has distinguished himself as a physicist? Is Mr. Warren De la Rue a worse stationer because he is equally conspicuous as an astronomer and as a chemist? The Local Government of the country, in as far as it relates to the physical interests of the people, will remain an example of arrested development, unless science receives a recognised position in its administration."

In the Education Section there was nothing to call for notice in the address, but Mr. C. S. Parker drew attention to the Report of the Universities Inquiry Committee, and an interesting discussion followed.

The revenues of Oxford and Cambridge were reported by the Royal Commission appointed on the advice of Mr. Gladstone to be for the University, Colleges, and Halls of Oxford, 414,000*l.*, or, including prospective increase in the next fifteen years, 538,000*l.*; and for the University and Colleges of Cambridge, 340,000*l.*, or, including prospective increase, 380,000*l.* Making certain deductions from these totals, the net income was for Oxford 350,000*l.*, and for Cambridge 300,000*l.*; or, deducting again what was levied by taxation from their own members, the net endowments for Oxford and Cambridge Universities re-

spectively were 300,000*l.* and 250,000*l.* The largest item of expenditure was to Fellows of Colleges—Oxford, 102,000*l.*; Cambridge, 103,000*l.* The smallest item was for scientific institutions, being under 2,000*l.* for each University. Mr. Parker remarked that this was hardly what might have been expected by the general public. A satirical person might even suggest as an improvement the reversal of the order. Seriously, the distribution came to this. Taking the residents in the University at about 400 graduates and 1,400 undergraduates, almost all the former and about half the latter received substantial aid from endowments. Mr. Parker examined various schemes which had been put forward, and expressed an opinion that, provided the central life were maintained with vigour, it was much to be desired that the Universities should occupy themselves with extending their connections throughout the country. Looking to their examinations in every quarter, 44,000*l.* at Oxford or 33,000*l.* at Cambridge was by no means excessive for Scholarships and Exhibitions. Some Exhibitions should be separately competed for by the unattached students who were now pursuing their studies at the Universities with so much success and at so little expense—in many cases under 50*l.* a year. To carry out needed reforms some central guidance would be necessary, either from a body appointed by the Universities themselves or, more probably, from a Parliamentary Executive Commission. But if such a Commission should be appointed, it was desirable the public should understand that it had not to deal with a retrograde, obstinate, or lethargic corporation, but to co-operate with the Universities and Colleges. Oxford and Cambridge, in respect of learning, had not held their own against the great German Universities, but a change had begun, and in Mr. Parker's opinion they were yearly commanding more respect throughout Europe.

In the discussion which followed, the Hon. G. Brodrick deprecated an attempt to subsidise, at the expense of Oxford and Cambridge, wealthy towns which, had they existed in America, would long ago have provided Universities of their own. On no account should resources which ought to be concentrated upon Oxford be frittered away upon the great cities of England and Scotland.

Sir G. Campbell said that in his belief it was these endowments which seemed to render reform impossible. They acted as an immense bribe to a continuance of the old monkish form of education, which he believed to be a mere superstition. He believed that the devotion of the time and talent of our youth to the learning of the regular verbs of Greek and Latin, and even the higher mathematics, was a gymnastic, and not a practical education. If endowments were to be continued, they must be taken in hand and, apart from the wills of founders, devoted to those branches of education which experience showed to be really useful and practical.

An important paper On the place of technical education was presented to the Section by Mr. B. Samuelson, M.P. This we shall give on a future occasion.

PITCHER-PLANT INSECTS*

THE insect-catching powers of these curious plants, the Fly-traps (Dionæa), the Sundews (Drosera), and the Trumpet-leaves (Sarracenia), have always attracted the attention of the curious, but renewed interest has been awakened in them by virtue of the interesting experiments and observations on their structure, habit, and function, that have lately been recorded, and especially by the summing up of these observations in some charming papers by Prof. Asa Gray, which recently appeared in the *Nation* and the *New York Tribune* under the title of "Insectivorous Plants."

Through the courtesy of Dr. J. H. Mellichamp, of Bluffton, and of H. W. Ravenel, of Aiken, S.C., who have sent me abundant material, I am able to submit the following notes of an entomological bearing on the Spotted Trumpet-leaf (*Sarracenia variolaris*), which must henceforth rank with the plants of the other genera mentioned as a consummate insect catcher and devourer.

The leaf of Sarracenia is, briefly, a trumpet-shaped tube with an arched lid, covering, more or less completely, the mouth. The inner surface, from the mouth to about midway down the funnel, is covered with a compact decurved pubescence which is perfectly smooth and velvety to the touch, especially as the finger passes downward. From midway it is beset with retrorse bristles, which gradually increase in size till within a short distance of the bottom, where they suddenly cease, and the surface is smooth. There are also similar bristles under the lid. Running up the front of the trumpet is a broad wing with a hardened emarginate border, parting at the top and extending around the rim of the pitcher. Along this border, as Dr. Mellichamp discovered, but especially for a short distance inside the mouth, and less conspicuously inside the lid, there exude drops of a sweetened, viscid fluid, which, as the leaf matures, is replaced by a white, papery, tasteless, or but slightly sweetened sediment or efflorescence; while at the smooth bottom of the pitcher is secreted a limpid fluid possessing toxic or inebriating qualities.

The insects which meet their death in this fluid are numerous and of all orders. Ants are the principal victims, and the acidulous properties which their decomposing bodies give to the liquid doubtless render it all the more potent as a solvent. Scarcely any other Hymenoptera are found in the rotting mass, and it is an interesting fact that Dr. Mellichamp never found the little nectar-loving bee or other Mellifera about the plants. On one occasion only have I found in the pitcher the recognisable remains of a Bombus, and on one occasion only has he found the honey-bee captured. Species belonging to all the other orders are captured, and among the other species that I have most commonly met with, which, from the toughness of their chitinous integument, resist disorganisation and remain recognisable, may be mentioned *Asaphes memnonius* and *Euryomia melancholica* among Coleoptera, *Rentatoma higens* and *Orsilochus variabilis*, var. *complicatus*, among Heteroptera; while kyatids, locusts, crickets, cockroaches, flies, moths, and even butterflies, and some Arachnida and Myriapoda, in a more or less irrecognisable condition, frequently help to swell the unsavoury mass.

But while these insects are decoyed and macerated in order, as we may naturally infer, to help to support the destroyer, there are, nevertheless, two species which are proof against its siren influences, and which, in turn, oblige it either directly or indirectly to support them.

The first is *Xanthoptera semicrocea* Guen., a little glossy moth, which may properly be called the Sarracenia Moth. It is strikingly marked with grey-black and straw-yellow, the colours being sharply separated across the shoulders and the middle of the front wings. This little moth walks with perfect impunity over the inner surface of the pitcher, which proves so treacherous to so many other insects. It is frequently found in pairs within the pitchers soon after these open, in the early part of the season or about the end of April. The female lays her eggs singly, near the mouth of the pitcher, and the young larva, from the moment of hatching, spins for itself a carpet of silk and very soon closes up the mouth by drawing the rims together and covering them with a delicate, gossamer-like web, which effectually debars all small outside intruders. It then frets the leaf within, commencing under the hood and feeding downward on the cellular tissue, leaving only the epidermis. As it proceeds the lower part of the pitcher above the putrescent insect collection becomes packed with ochreous excrementitious droppings, and by the time the worm has attained its full size the pitcher above these droppings generally collapses. This worm when full grown is beautifully banded transversely with white and purple or lake red, which Dr. Mellichamp poetically likens in brightness to the Tyrian dye. It is furthermore characterised by rows of tubercles, which are especially prominent on the four larger legless joints. It is a half looper, having but six prolegs, and keeps up, in travelling, a constant restless, waving motion of the head and thoracic joints, recalling *paralysis agitans*. The chrysalis is formed in a very slight cocoon, usually just above or within the packed excrement. The species, kindly determined by Mr. A. R. Grote, was many years ago figured by Abbott, who found it feeding on *Sarracenia variolaris*, in Georgia. Guenée's descriptions were made from these figures, for which reason I append [the more technical matter relating to the species is here omitted] a few descriptive notes from the living material. It feeds alike on *S. variolaris* and *S. flava*, and there are two broods each year,

* A paper read by Prof. C. V. Riley, of St. Louis, Mo., before the American Association for the Advancement of Science, August 1874.