reaction, whether unequivocal (homodrome) or equivocal (antidrome) requires short strong currents for its manifestation. I have therefore always used induction shocks and condenser discharges, as stated even in the extremely brief Turin abstract quoted by Dr. Tompa.

I shall be surprised if Dr. Tompa does not repeat the experiments, and from the courteous tone of his account of the matter I think it probable that he will withdraw his stricture on my work when he has witnessed for himself the clear and indubitable results of the experiments.

### Can Carbon Dioxide be "Vitalised"?

THERE has long been present in my mind an idea to which I have hitherto hardly dared give expression. The query forming the above heading amounts to the raising of the question whether the carbon dioxide which is exhaled as a product of animal or vegetable vital processes differs in any way from the carbon dioxide of "inorganic" origin formed, let us say, from carbon by combustion in oxygen. The answer will probably be in the negative, since, on theoretical (stereochemical) grounds, an asymmetric structure is not possible in the case of this molecule. Nevertheless, it might be worth while to cross-examine nature on this point. It is, in fact, possible that the experiment may have been already tried with negative results, and that is why I venture into print, since I have been unable to find any record. Two ways occur to me for submitting the question to the test of experiment. Calling the carbon dioxide from the two sources "inorganic" and "organic" respectively for the sake of brevity, the "organic" gas might be obtained either from the brewer's vat or from a carbonate formed from the carbon dioxide of animal respiration. The rate of absorption of this gas might be carefully compared with the rate of absorption of a specimen of "inorganic" gas by a growing plant. This is a method which appeals to vegetable physiologists. The other method, which is more purely chemical, depends upon our being able to obtain some optically active compound sufficiently basic to absorb carbon dioxide. I cannot call to mind any such compound at the present moment, and from where I am writing I have no access to the usual sources of information. Given, however, an optically active base capable of forming a carbonate, would the gases from the two sources be absorbed at equal rates? Perhaps some of your readers may be able to dispose of these queries offhand. R. MELDOLA.

Easton Park Cottage, Dunmow, September 13.

### Effect of a Lightning Flash.

DURING the storm on Wednesday, September 10, a house opposite my rooms in Fulham was struck by lightning at 4.40 p.m. Curiously enough, at the moment of the occurrence I was looking at the exact spot, and it may be of interest to record what occurred. A stack of brickwork about ten feet high capped with two red-pot chimneys about three feet high was struck, and a hole was made in the slates of the roof on the south side of the stack. One chimney was shattered. The flash was extremely brilliant and left a perfectly straight line of light on the retina; the length of the flash appeared to be twenty feet, but its upper part was lost in the diffused daylight. The flash was of several seconds' duration and was followed by a thin column of smoke; both these facts are due in my opinion to the fusion of the soot in the chimney. The flash itself was a mere line, otherwise the appearance of the whole strongly reminded me of a cordite discharge from a big gun. There was a loud report, and the circumstances left little doubt in my mind that the electrical discharge was upwards in direction.

C. DAVIES SHERBORN.

### Bipedal Locomotion of a Ceylonese Lizard.

I HAVE frequently observed with interest the erect attitude assumed by the small Agamid lizard *Otocryptis bivittata*, Wiegm., when running rapidly, and have long suspected that the short front legs were not used at such times. But the rapidity with which the animal runs, and the nature of the ground which it usually frequents, have prevented very close observation. I have, however, recently fully satisfied myself that its action is truly bipedal. The lizard happens to be common in the Botanic Gardens here, and on several occasions one of them has crossed a smooth sanded road immediately in front of me. I have thus been able to see clearly that the anterior limbs are carried quite free from the ground, progress being effected solely by the long hind limbs.

It seems possible that the closely allied and similarly built lizard *Sitana ponticeriana*, Cuv., may have the same habit. Does the Indian species of Otocryptis (*O. beddomii*) progress in the same fashion?

At present the habit has been recorded only of one or more Australian lizards, notably the "frilled lizard" (*Chlamydosaurus kingi*), which has been very cleverly photographed in the erect attitude by Mr. Saville Kent. E. ERNEST GREEN.

Peradeniya, Ceylon, August.

### A Series Related to Bernoulli's Numbers.

THE following seems to be a useful and interesting series :–

$$\frac{r}{r+1} = \frac{D_1}{r+1} + \frac{D_2}{\underline{|2}} + \frac{rD_3}{\underline{|3}} + \frac{r(r-1)D_4}{\underline{|4}}$$
$$+ \ldots\ldots\ldots\ldots$$
$$+ \frac{r(r-1)\ \ldots\ (r-p+3)D_p}{\underline{|p}} + \ldots$$
$$+ \frac{r(r-1)D_{r-2}}{\underline{|4}} + \frac{rD_{r-1}}{\underline{|3}} + \frac{D_r}{\underline{|2}},$$

where

$$D_r = 1;$$
$$D_{r-1} = \tfrac{1}{2} = 3B_1;$$
$$D_{r-3} = -\tfrac{1}{6} = 5B_2;$$
$$D_{r-5} = \tfrac{1}{6} = 7B_3;\ \&c.,$$

and generally for all odd values of $p > 1$,

$$D_{r-p} = -\left\{(-1)^{\frac{p+1}{2}}\right\}(p+2)B_{\frac{p+1}{2}},$$

$B_1, B_2, \ldots$ being the numbers of Bernoulli.

Also

$$D_{r-2} = D_{r-4} = D_{r-6} = \ldots = 0.$$

I have been trying since last year, without success, to ascertain whether this is a known series previously published. If it is, perhaps some of your readers will be good enough to supply a reference. J. R. SUTTON.

Kenilworth, Kimberley, August 7.

## FREDERICK AUGUSTUS ABEL.

THE death of Sir Frederick Abel on Saturday, September 6, at the age of seventy-five, removes a conspicuous figure from the world of science and technology and brings to a close a long and useful public career. For some years he had been in failing health, but his sudden death, which came painlessly from cardiac failure following one of those attacks of shivering and rigor to which he had long been subject, was quite unexpected.

Frederick Augustus Abel was born in 1827, being the son of Mr. J. L. Abel, of Woolwich. The family, which appears to have been of Swedish origin, had already produced men notable in science, music and painting. Abel has given in the Hofmann memorial lecture, which he delivered to the Chemical Society in 1893, an amusing account of his unsuccessful attempts in the early 'forties to learn chemistry at the Polytechnic Institution of those days; and these recollections perhaps impelled him in the efforts he subsequently made to improve the quality of technical education in this country. In 1845, he entered the Royal College of Chemistry as one of Hofmann's first pupils, and was soon promoted to be an assistant, which he remained until 1851, when he was appointed professor of chemistry at the Royal Military Academy at Woolwich, succeeding Faraday in this position. In 1854, he became chemist to the War Office, a post which he held until 1888, when he retired under the regulations of the Civil Service. It was during this period of thirty-four years that he made his most important contributions to chemistry in its applications to explosives and to metallurgy. Foremost among these are his researches into the preparation and uses of gun-cotton as an explosive, which were summarised in a paper printed in the *Philosophical Transactions* of 1866 and in the Bakerian lecture which appeared in the *Philosophical Transactions* of the following year. Guncotton was already known at that time, but it was generally regarded, at any rate in this country, as a dangerous and probably inefficient substitute for gunpowder. Abel showed, as the result of a long series of carefully chosen and elaborate experiments, how the material may be safely prepared of constant composition, how it should be stored, and also indicated its value as an explosive agent. These papers are eminently characteristic of the practical bent of Abel's mind. Though interested in the progress of pure science, his own inclinations were in the direction of its applications. With the exception of a few of his early papers, written whilst he was Hofmann's assistant, nearly all his contributions have been to the applications of chemical science, and have been made with the express purpose of solving practical problems.

In connection with his other work on explosives, the researches, carried on in conjunction with Sir Andrew Noble, on the chemical changes resulting from firing gunpowder under various conditions and those on the detonation of explosives may be specially mentioned. In 1888, Abel was appointed chairman of the Government Committee on Explosives, and as a result of a series of experiments conducted under its auspices, the smokeless explosive known as "cordite," containing both guncotton and nitroglycerine, was patented by Abel and Dewar, and became the standard explosive of this country.

The influence of composition on the properties of steel and its analysis and the testing of petroleum also engaged his attention. The apparatus known by his name which he devised in connection with the Petroleum Acts of 1868 and 1879 for determining the temperature at which petroleum gives off inflammable vapour is still in general use, and he became a recognised authority on petroleum and its employment as an illuminating agent.

As a member of the Royal Commission on Accidents in Mines, he investigated the cause of the explosion at the Seaham Colliery in 1881, and its connection with the presence of coal dust in the air.

No account of Abel's career can be complete without some reference to what he regarded as the most important work of his life. From the first he took a leading and responsible part in the movement which led to the foundation of the Imperial Institute. He was the secretary to the first organising committee, and in a lecture delivered at the Royal Institution in 1887 he gave an account of the work which the Institute proposed to accomplish. It is noteworthy that the need for further provision in this country for scientific research in connection with art and manufactures was one of the principal points in this lecture. On the opening of the Imperial Institute in 1893, Abel was appointed its secretary and director, a post which he held, latterly in an honorary capacity, until his death. Although already far advanced in life, Abel threw himself with great courage and determination into the difficult task of organising the operations of the Institute, and continued to do so even in the face of steadily declining health. In relation to the history of the Imperial Institute, it need only be noticed here that in 1894 a laboratory was equipped on a small scale for the chemical examination of Indian and Colonial products. In 1896, a scientific and technical department, including extensive laboratories, was established with Prof. Dunstan as director, but the necessary funds were supplied by the Royal Commissioners of the 1851 exhibition, all the available funds of the Institute having been allocated to other purposes. Although it was Abel's intention to retire from official connection with the Imperial Institute on its transfer to the Board of Trade at the end of the present year, he characteristically expressed his intention of continuing to take an active part in its proceedings as a member of the advisory committee.

Abel was an influential member of many scientific societies. He was elected a Fellow of the Royal Society in 1860, and was awarded a Royal medal in 1887 for his researches on explosives. He became at an early age a Fellow of the Chemical Society, and filled several offices in the Society, in which he was always deeply interested; at the time of his death he was one of the oldest of its past presidents. Abel took a leading part in the foundation of the Institute of Chemistry, of the Society of Chemical Industry and of the Institution of Electrical Engineers, of all of which he became president. He was also president of the British Association in 1890 and of the Iron and Steel Institute in 1891. He had filled the offices of vice-president and chairman of the council of the Society of Arts, which awarded him the Albert medal in 1884. Abel took an important part in the foundation of the City and Guilds of London Institute, and was at the time of his death chairman of its executive committee. He was an influential member of the court of the Goldsmiths' Company, of which he became prime warden in 1895. Abel's distinctions were numerous and varied. He was a D.C.L. of Oxford and a D.Sc. of Cambridge. He was made a C.B. in 1877 and was knighted six years later. The K.C.B. was conferred in 1891, and he was created a baronet on the occasion of the opening of the Imperial Institute in 1893. The last honour, that of the G.C.V.O., was conferred by the King soon after his accession, in recognition of Abel's personal services to the Royal Family.

Highly endowed with a practical mind, great common sense and a prodigious power of work, Abel was invaluable as a member of committees. His large experience in drafting official papers made him an excellent critic, and it may be safely asserted that few of the many documents submitted to him, by the institutions he was connected with, left his hands without substantial improvement As time went on, routine work became a confirmed habit and the idea of a holiday positively repugnant to him, so much so that he found himself unable at the last to take rest and change, the necessity for which his friends and medical advisers so repeatedly urged on him. W. R. D.

## *AN INSTRUMENT FOR AIMING GUNS UNDER COVER.*

THE advantage of cover in military operations has been shown over and over again during the recent war in South Africa. But even when cover is available, the head of the soldier is exposed, while in the act of aiming, to the fire of an enemy. By means of the hyposcope the marksman is able to aim with considerable accuracy, while protected by a cover of earthwork or stones. Apparatus for sighting ordnance by means of mirrors has been employed by the war departments of several nations.[1] But the inventor of the hyposcope, Mr. W. Loulten, has dealt with the problem of furnishing any existing rifle with a system of mirrors, whereby the act of aiming may be performed from a point several inches below the trigger-guard. The hyposcope is shown in Fig. 1 attached to the service rifle, which is placed in position over the edge of a rough mass of stones used as cover. The marksman aims the rifle by looking into the mirror at the lower end of the vertical tube, his head being protected by cover. In this form of instrument, four mirrors are employed; on looking into the instrument, the sights of the rifle are

[1] "Treatise on Service Ordnance." (London, 1893).