some distance above it, while in Limnocodium the ridges are direct continuations of the tentacles whose structure they retain. They become narrower as they approach the margin.

The number of the tentacles is very large in adult specimens. The four tentacles which correspond to the directions of the four radial canals, or the perradial tentacles, are the longest and thickest. The quadrant which intervenes between every two of these carries, at nearly the same height above the margin, about thirteen shorter and thinner tentacles, while between every two of these three to five much smaller tentacles are given off from points nearer to the margin, and at two or three levels, but without any absolute regularity; indeed, in the older examples all regularity, except in the primary or perradial tentacles, seems lost, and the law of their sequence ceases to be apparent.

I could find no indication of a cavity in the tentacles; but they do not present the peculiar cylindrical chord-like endodermal axis formed by a series of large, clear, thick-walled cells which is so characteristic of the solid tentacles in the Trachomedusæ and Narcomedusæ. From the solid tentacles of these orders they differ also in their great extensibility, the four perradial tentacles admitting of extension in the form of long, greatly-attenuated filaments to many times the height of the vertical axis of the umbrella, even when this height is at its maximum; and being again capable of assuming by contraction the form of short thick clubs. Indeed, instead of presenting the comparatively rigid and imperfectly contractile character which prevails among the Trachomedusæ and the Narcomedusæ, they possess as great a power of extension and contraction as may be found in the tentacles of many Leptomedusæ (Thaumantidæ, &c.) These four perradiate tentacles contract independently of the others, and seem to form a different system. All the tentacles are armed along their length with minute thread cells, which are set in close, somewhat spirally arranged warts.

The lithocysts or marginal vesicles are, in adult specimens, about 128 in number. They are situated near the umbrellar margin of the velum, between the bases of the tentacles, and are grouped somewhat irregularly, so that their number has no close relation with that of the tentacles. They consist of a highly refringent spherical body, on which may be usually seen one or more small nucleus-like corpuscles, the whole surrounded by a delicate transparent and structureless capsule. This capsule is very remarkable, for instead of presenting the usual spherical form, it is of enlongated piriform shape. In its larger end is lodged the spherical refringent body, and it thence becomes attenuated, forming a long tubular tail-like extension which is continued into the velum, in which it runs transversely towards its free margin, and there, after usually becoming more or less convoluted, terminates in a blind extremity.

The marginal nerve-ring can be traced running round the whole margin of the umbrella, and in close relation with the otolitic cells. Ocelli are not present.

The generative sacs are borne on the radiating canals, into which they open at a short distance beyond the exit of these from the base of the manubrium. They are of an oval form, and from their point of attachment to the radial canal hang down free into the cavity of the umbrella. Some of the specimens examined contained nearly mature ova, which, under compression, were forced from the sac through the radial canal into the cavity of the stomach.

While some of the characters described above point to an affinity with both the Trachomedusæ and Narcomedusæ, this affinity ceases to show itself in the very important morphological element afforded by the marginal bodies. In both Trachomedusæ and Narcomedusæ the marginal bodies belong to the tentacular system; they are metamorphosed tentacles, and their otolite cells are endodermal, while in the Leptomedusæ, the only other order of craspedotal Medusæ in which marginal vesicles occur, these bodies are genetically derived from the velum. Now in Limnocodium the marginal vesicles seem to be as truly velar as in the Leptomedusæ. They occur on the lower or abumbral side of the velum, close to its insertion into the umbrella, and the tubular extension of their capsule runs along this side to the free margin of the velum, while the delicate epithelium of the abumbral side passes over them as in the Leptomedusæ. It is true that this point cannot be regarded as settled until an opportunity of tracing the development is afforded; but in very young specimens which I examined I found nothing opposed to the view that the marginal vesicles were derived, like those of the Leptomedusæ, from the velum.

Important points still remain to be cleared up regarding the development of Limnocodium and the determination of the question whether the Medusa be derived from the egg directly or only through the intervention of a hydranlid trophosome. I have arranged, with Mr. Sowerby, some methods of observation by which I hope to obtain data for determination of these points.

If this be the case Limnocodium will hold a position intermediate between the Leptomedusæ and the Trachomedusæ; but as the greatest systematic importance must be attached to the structure and origin of the marginal vesicles, its affinity with the Leptomedusæ must be regarded as the closer of the two. GEO. J. ALLMAN.

THE ELECTRIC LAMPS OF M. TCHIKOLEFF.

M. Tchikoleff, the head of the electric lighting department of the Russian artillery, has addressed to *La Lumière Electrique* a communication, of which the following is a translation, in which he claims that the application of derived currents which has been successfully adopted with the lamps of MM. Lontin and Siemens, was employed by him as far back as the year 1871.

"Having experimented for a lengthened period with the Foucault and Serrin regulator lamps, which were considered to be the best at the period when I took up the question, I was able to observe in them the following defects:

1. Several lamps, arranged in series or in multiple arc in a circuit, would not continue to work.

2. These lamps could be worked only by very powerful currents, whereas with a lamp regulated by hand the voltaic arc could be obtained with weaker currents, giving of course a less intense light.

3. They worked with regularity only when the current was constant, or varied within very restricted limits.

I traced the cause of these defects to the fact that the working of the regulating mechanism was based upon a kind of equilibrium between the attractive force of an electro-magnet and the counteracting force of a spring. Such a system does not regulate the distance between the charcoal points, but only the general force of the current in the circuit. Now under these circumstances it is possible that, when two or more lamps are placed in series in a circuit, one of them may have its carbons in contact, whilst the carbons of the other lamp or lamps are at a greater or less distance apart, without the equilibrium between the electro-magnets and the counteracting springs being disturbed.

Now it was to obviate this defect that I endeavored to devise an arrangement which, whilst allowing each lamp placed in a circuit to be independent of the general intensity of the current and its variations, would enable it to maintain constant the resistance of its own voltaic arc, and this arrangement appeared to me obtainable by applying to the regulator lamps the principle of the *differential action of derived currents*.

It was in 1869 that I made the first experiment on the foregoing arrangement with a regulator lamp of M. Foucault, the counteracting spring of which I replaced by a supplementary electro-magnet traversed by a very weak derivation of the current, parallel to the voltaic arc. This electro-magnet was wound with a wire of high resistance, and the current producing the voltaic arc passed through the other electro-magnet. The armatures of these electro-magnets were placed at the two extremities of a rocking-lever, carrying at its centre of oscillation an arm which controlled the mechanism for increasing or diminishing the distance between the carbons; and the rocking-lever was in equilibrium when the voltaic arc possessed its normal resistance.

It is easy to understand that, with this arrangement, as the resistance of the arc becomes greater, the strength of the electro-magnet through which the current passes decreases, whilst the other electro-magnet becomes more powerful; so that the arm no longer remains in its vertical position, and by its inclination influences the mechanism which brings the carbons closer together. The contrary effect is of course produced when the inverse action occurs. An arrangement which, like the one in question, maintains constant the resistance of the arc evidently does not exert any effect upon the general intensity of the current in the circuit; for the variations of this intensity, outside of the lamp, exert always the same effect upon the two electro-magnets which control the latter.* The experiment with the Foucault lamp gave such good results that I decided to undertake the construction of a new lamp as free as possible from the defects inherent to the Foucault regulator, and to those based upon the same principle.

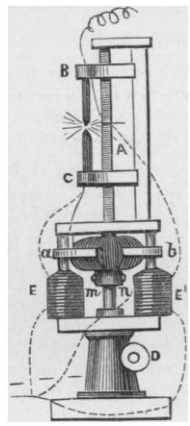

FIG. 1.

After some carefully made experiments with lamps having automatic regulation, and others regulated by hand, I ascertained that the latter would give a constant light with a much less number of battery cells than was requisite with the former. Thus with hand regulators I could obtain satisfactory results with 24 or even 20 Bunsen elements, whilst with the Foucault and Serrin regulators it was necessary to employ at least 40. The cause of this in the first place is that, in these regulating lamps the movements communicated to the carbons are always too sudden (*prompte*) for comparatively weak currents, and, in the second place, that these movements are constant instead of being proportionate to the intensity of the current passing by the voltaic arc. From this I naturally came to the conclusion that, in order to obtain a lamp suitable for practical working, it was necessary to apply the following three principles, which I consider as fundamental:

1. To maintain constant the resistance of the voltaic arc we should not employ a constant mechanical force such as that of a spring, but a weak derivation from the main current, parallel to the voltaic arc.

2. To obtain by means of a special derivation from the main current the movements augmenting or diminishing the distance between the carbons, in order that the rapidity of these movements may be proportionate to the intensity of the current producing the voltaic arc.

3. To make arrangements such that this rapidity of the movements communicated to the carbons should, at certain periods, be proportionate to the variations in their distance; that is to say to arrange the apparatus so that, in the case where the carbons have to be moved towards each other through an appreciable space, the movement communicated to them may be more rapid than when they have to be moved through a very short distance.

In 1871 I had constructed a lamp which fulfilled the two first of these principles, and which was brought before the Moscow Society of naturalists. In this system I employed as motor a small electro-magnetic machine of Froment, worked by a derivation from the principal current passing by the carbons; and above this electro-motor, the axis of which was vertical, were placed the two electro-magnets of the differential system above referred to. An armature common to both and suspended between their poles like a pendulum, reacted upon a double system of gearing, the axis of which, furnished with two angle-wheels of unequal diameter, would present to the electro-motor one or the other of these wheels according as one or the other of the two electro-magnets was the more energetic. As the wheels in question corresponded to two opposite points of the driving wheel, the movements produced were in opposite directions and could increase or diminish the distance between the carbons with a rapidity greater or less according to the intensity of the current, since the working of the motor was dependent upon this intensity. The drawing of this lamp has been in the polytechnic museum of Moscow since the commencement of the year 1873.

At the end of 1873, M. Jablochkoff, who at that period had a mechanical workshop at Moscow, being convinced of the superiority of the systems of constructing lamps on the derived current principle, made in his workshop a lamp on this principle. I shall not refer to the experiments with this lamp, which gave full satisfaction to several persons. For my own part, I was but partially satisfied, on account of its complication, and because it did not fulfil the third of the fundamental principles I had laid down.

In 1874, I arranged a new lamp, the design of which I brought before the physical section of the Moscow Society of Naturalists, and which is represented by Fig. 1.

E E′ are electro-magnets disposed like those on the other systems and having poles, *a b*, spread out in circular form as in the Gramme machine. K is a Gramme or Siemens ring, the rotary motion of which causes the carbons to move through the intermediary of a double-thread screw, A, and two nuts, B C, which carry the carbons. Lastly, D is a regulating screw, for the purpose of raising or lowering the luminous focus.

The current passes from the positive pole of the generator to the negative pole by three derivations, one of which includes the arc and traverses the ring by means of the contact-pieces *m n*; whilst a second, also including the arc, excites the electro-magnet E (or both electro-magnets in a given direction); and a third which, without passing by the arc, influences the high resistance magnet E′ (or both magnets in contrary directions), so that the action of this magnet upon the ring shall be in a reverse direction to that of E.

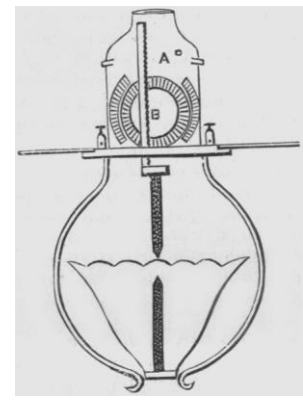

FIG. 2.

In consequence of this arrangement the action of the electro-magnets upon the ring K is almost *nil* when the arc possesses its normal resistance; but when the resistance of the arc augments the action of the electro-magnet, E becomes weakened, allowing E′ to preponderate, and the ring K will rotate so as to bring the carbons into closer proximity. The contrary effect will, of course, be produced if the resistance of the arc should diminish.

*This is somewhat obscure; what is meant, perhaps, is that the sum of the currents traversing the two magnets is, with the adjustments adopted, a constant value.—ED. *E*.

Experience has shown that with such a lamp it is possible to obtain, with regularity and safety, a good electric light with twenty-four Bunsen cells, and at first with even twenty cells. Some of these lamps have been in use in the Russian artillery since 1877. This lamp may also be constructed on the principle of the Wheatstone balance.

The form of my lamp intended for public lighting is represented by Fig. 2. The rod A, with the upper carbon-holder works by the effect of its own weight. When the current traverses the lamp the distance between the two carbons is maintained by the aid of helical coils, but these coils and the toothed wheel which controls the movements are worked, as in the former case, on the principal of derivati ons. When the current is interrupted, the carbons come into contact by the effect of the weight of the rod A.

I omit here certain details of construction which are of importance in order that the lamp may work properly.

To sum up, the advantages of my lamp may be enumerated as follows:

1. Its construction is extremely simple, it is free from clockwork mechanism, springs and electrical contacts.

2. It does not require preliminary regulation nor any manipulation before or during its working.

3. Several of these lamps may be arranged in series in a circuit, and they are always in due relation with the intensity and the tension of the current which is to act upon them.

4. The lamp can work with comparatively weak currents, and also produce a very powerful light when the power of the current is augmented.

I am convinced that the problem of the divisibility of the electric light by means of lamps having a voltaic arc can be solved only with the lamps based on the principle of the derivation of the current, which I discovered prior to Messrs. Lontin and Siemens.

Lamps with movable carbons offering a certain resistance between their polar extremities are moreover far preferable, from the point of view of divisibility, to lamps with fixed carbons (with carbons at a fixed distance?) which may offer great variations in the resistance of the arc, in consequence of impurities, the action of the wind, &c. These variations may in fact be greatly reduced in the former description of lamp, and it is not necessary with them to employ currents of such high tension or, if such currents be employed, additional lamps may be inserted in the circuit.

W. TCHIKOLEFF.

GENERAL NOTES.

CLIMATIC influences have of late been rather against phylloxera, which has shown, therefore, a decreased activity for a time. According to M. Boiteau, the treatment with sulphide of carbon and sulphocarbonate of potassium these past three years past seems to have had even a stimulating effect on the vines (besides ridding them of the insect). Some of the vines thus treated are flourishing better than before the parasite appeared.

M. CHARNAY, the leader of the expedition recently sent to Central America under the auspices of the governments of the United States and France, the expenses of which are to be largely borne by Mr. Pierre Lorillard, telegraphs that the Mexican government has signed a treaty giving him all the privileges and facilities he needs in making explorations and has appointed a representative to accompany him.

MARIE EKUNINA describes, in the *Journal für Praktische Chemie*, an investigation conducted in Professor Nencke's laboratory at Berne, on the causes of acid reaction of the animal tissues after death. This reaction is attributed to the decomposition of tissue juices, after death, by fungi. Volatile fatty acids first arise through commencing decomposition of albumin, but very soon the two lactic acids proceeding from glycogen are associated with these. The richer the tissue in carbohydrates, the longer does the acid reaction continue after death; this is especially the case with liver, muscles, and lungs. The shortest and weakest acid reaction is that in the pancreas. Sooner or later, in all tissues, the acid reaction passes over into an alkaline, while the decomposition of albumin increases, and there is much formation of ammonia.

CORRESPONDENCE.

We have been requested by a correspondent of Lieutenant Colonel Ross to publish the annexed letter, which at present may be accepted as an *ex-parte* statement, which complains of a wrong done to him by certain members of the Royal Society. But while placing our columns at the disposal of Col. Ross, we disclaim any personal responsibility in the matter, and will afford ample space for any reply which Professor H. E. Roscoe, or others concerned, may decide to forward to us for publication. Lt. Col. Ross is well known for his works on Blow-pipe Analysis, and has recently published a small manual on this subject, which we find favorably spoken of by the English Scientific press.—[ED.]

LONDON, 11th June, 1880.

To the Secretary of the Royal Society.

SIR.—In forwarding a copy of my new work on the Blowpipe, for the Library of the Royal Society (which I did yesterday), I have the honor and pleasure to inform you for communication to them, that I have now, beyond reasonable doubt, discovered the coloring principle of the *Sapphire*, and can produce stones made chiefly of alumina, of almost any required tint of blue, green, or "amethyst," *without using any chromatic oxide whatever*, a discovery I believe to be quite unique, for, although a Belgian or French chemist has made real "rubies," he is obliged to color them with manganese or other metallic oxide. I do not propose, however, to communicate this secret to the Royal Society, as I at first intended, for the following reason: When in the Spring of 1873, the Secretary of your Society, with the discriminating perception of the useful and novel which is characteristic of men of genius, came to Woolwich to examine experiments which I was then (as a Captain in the Royal Artillery) making in blow-pipe analysis, and eventually read a paper on the subject before your Society. I little thought that influential opposition instituted by Fellows of your Society, would be the chief cause of retarding my humble efforts in the progress of this new science for nearly ten years. I have, however, the most reliable evidence to prove that Professor H. E. Roscoe, F. R. S., and another Fellow of your Society whom I need not mention here, circulated the most disparaging and depreciatory opinions regarding the novel statements on this subject contained in my work "Pyrology," (a detailed exposition of the views first propounded in the paper read before your Society,) the MS. of which was offered by me to Messrs. Macmillan & Co., in 1874, for publication and declined by them, presumably on the advice of Prof. Roscoe.

Of course I have no right, nor do I for a moment wish to complain of the adverse opinion of eminent men of science, though perhaps such opinions would be more suitably expressed in public so as to give me an opportunity of reply; but what I venture most respectfully now to complain of, is that one of my inventions in Blowpipe Analysis—the use of Aluminium plate—which had been disparaged as above mentioned, has now been *adopted* by that department of Owens College, Manchester, over which Prof. Roscoe so eminently and justly presides, and that a German work on the subject, translated in that department, has interpolated in it an account, spread over thirteen pages, of the very Aluminium plate reactions rejected by Prof. Roscoe in 1874, and, worst of all, the invention is attributed to somebody else in the index of the book, which has been adopted as a text book by the Owens College.

As I have sustained a serious loss by the publication of my work on the subject, chiefly through the opposition above referred to, I would most respectfully ask the council of your society whether they do not think it fair that I should reap any benefits *now*, derivable from my inventions or discoveries? I have the honor to be, Sir,

Your most Obedient Servant,
W. A. Ross, Lt. Colonel,
Royal Artillery (retired list).

The Secretary Royal Society,
Burlington House, Piccadilly W.