VISUAL TELEGRAPHY.

For many years past scientific men have been familiar with the fact, that the reflected images of objects could be reproduced at a distance by the aid of electricity, but recently the matter has been again taken up, and is now being prominently brought before the public under headings of "seeing by telegraph."—

The general principle involved may be gathered from the description of the "*Diaphote*," an instrument introduced by Dr. H. E. Licks of Bethlehem, Penn., "for seeing by telegraph." He calls it by this name "from two Greek words, *dia*, through, and *phos*, light." He lately read a paper in Reading, and exhibited his instrument. This consists of a receiving mirror, the wires, a battery, and a reproducing speculum. The receiving mirror is an amalgam of selenium and iodide of silver; the reproducing speculum is a compound of selenium and chromium. The wires are numerous, as it is necessary for distinctness that a wire should be required to affect but a very small space. The instrument exhibited had a mirror six inches by four, composed of seventy-two small plates to each of which a wire was attached, the whole being wrapped by a fine insulated covering. These wires run to a common galvanic battery and thus connect with the reproducing plate. When the circuit is closed, the rays of light are conducted through an ordinary camera, and the accompanying heat produces chemical changes in the the amalgam of the mirror, which, modifying the electric current, cause similar changes in the reproducing speculum. In the experiments at the close of the explanatory lecture, an instrument was taken to a lower room of the building and operated from there to the stage in the presence of the audience. Before the mirror in the lower room the committee held in succession an apple, a pen knife, and a trade dollar, which were distinct on the platform above. The date on the trade dollar, thrown on an enlarged screen, was plainly visible, as well as the goddess of liberty. A watch was next used, and the audience could see the movement of the hands. An ink bottle, a flower, parts of a theatre hand-bill, were also shown, and when the head of a live kitten was exhibited, there was great applause, and the inventor warmly congratulated on his success. The opinions entertained of its practical value are very high—it being possible for a signal officer on a railroad to see hundreds of miles of track at the same instant."

We are informed by a gentlemen residing near New York, that during a visit to France a few years ago, his attention was called to the successful attempt of the police authorities aided by a Scientest, to reproduce at a distant city by telegraph the features of a criminal who was fleeing from justice. In this case the means employed were perfectly successful, and the results obtained identical to those claimed in the "*Diaphote*."

There are other methods by which "*seeing by telegraph*" can be accomplished. Professor Graham Bell has deposited with the Smithsonian Institute a sealed description of an instrument he has invented, which has caused Messrs. Ayrton & Perry of England, who have been working on the same problem, to offer the following statement, which indicates the means they employ:

"While we are still quite in ignorance of the nature of this invention, it may be well to intimate that com plete means for seeing by telegraphy have been known for some time by scientific men. The following plan has often been discussed by us with our friends, and no doubt has suggested itself to others acquainted with the physicial discoveries of the last four years. It has not been carried out because of its elaborate nature and on account of its expensive character. Nor should we recommend its being carried out.

Our transmitter at A—that is, the apparatus for receiving the light impressions and transmitting them electrically—consisted of a large surface made up of very small separate squares of selenium. One end of each piece was connected by an insulated wire to the distant place, and the other end of each piece with the ground, in accordance with the plan commonly employed with telegraph instruments. The object whose image was to be sent by telegraph was illuminated very strongly, and by means of a lens a very large image was thrown on the surface of the above transmitter. Now, it is well known if each little piece of selenium forms part of a circuit in which there is a constant electromotive force, say of a voltaic battery, the current passing through each piece will depend on its illumination. Hence, the strength of the electric current in each telegraph line will depend on the illumination of its extremity. Our receiver at the other end, B, was, in our original plan, a collection of magnetic needles, the movements of each of which (as in the ordinary needle telegraph) were controlled by the electric current passing through the particular telegraph wire with which it was in connection. Each magnet by its movement closed or opened an aperture through which light passed to illuminate the back of a sheet of frosted glass. There were, of course, as many of the illuminated squares at B as of selenium squares at A, and it is quite evident that since the illumination of each receiving square depends on the strength of the current in its circuit, and this current again depends on the illumination of the selenium at the other end of the wire, the image of a distant object might in this way be transmitted as a mosaic by electricity.

A more promising arrangement, suggested by Professor Kerr's experiments, consisted in having each square at B made of silvered soft iron, and forming the end of the core of a little electro-magnet, round which passed the current, coming from the corresponding selenium square at the other end. We proposed that the surface formed by these squares at B should be illuminated by a great beam of light, polarized by reflection from glass, and received again by an analyzer. It is then evident that since the intensity of the analyzed light depends on the rotation of the plane of polarization, by each little square of iron, and this depends on the strength of the current, and that again on the illumination of the selenium, we have another

method of receiving at B the illumination of the little squares at A."

Even this plan appears to have been anticipated in one sense two years ago, by Mr. J. E. H. Gordon of London, who says:

"I used an electromagnet consisting of an iron bar 2 feet 4 inches long and $2\frac{1}{4}$ inches in diameter, surrounded by 70 lbs. of wire, and excited by ten Grove cells.

The total *double* rotation produced, not by slightly altering the resistance, but by reversing the current, was never more than 26′ (twenty-six minutes of arc).

To see this at all with a very delicate Jellett analyzer, it was necessary for the observer to increase the sensitiveness of his eye by sitting in total darkness for some ten minutes before each observation.

Your readers can judge what chance of obtaining visible changes of illumination there would be with 'little' magnets and mere variations in a current not powerful enough to fuse a selenium resistance."

Lastly we may offer an apparatus arranged by Mr. Middleton of Cambridge, England, who gives the following account of it:—

"A lens is used to throw on a plane or suitably curved receiving plate (inclosed in a camera) the image of any object. The receiving plate of the camera is composed of thermopile elements, ground to a smooth surface, and having their posterior faces put in electrical communication by a system of wires, with a somewhat similarly constructed plate. The heating, &c., effect of the image on the first plate generates currents of electricity, which flow through the wire system, and on reaching the second thermopile plate are reconverted into heat, &c., according to the law discovered by Peltier, the amount of heat, &c., being directly proportional to the amount of electricity.

Moreover, according to the manner in which the elements of the plate are arranged with respect to each other, we can get a 'positive' or 'negative' (to use the ordinary phraseology of photography) picture on the second receiving plate, since the Peltier effect here holds, and the copy of a picture depends solely on establishing a constant ratio in the radiant heat and light which corresponding points of the picture and copy send to the eye.

Furthermore, these images can be either viewed directly or by reflected light (after the fashion of the the Japanese mirrors and projection on a screen), or by suitable apparatus they can be retained as a photograph, a thermograph, or chemicograph, the details of which will be found in the paper alluded to, and of which an abstract will, I believe, soon appear in the Proceedings of the Cambridge Philosophical Society. Also, I touched upon the method of attacking the problem of photographing in colors, and in conclusion pointed out a striking anology between the camera of the instrument and that of the human eye; the thermo-electric elements of the instrument and the rods and the cones of the eye; the conducting system of insulated wires emanating from the plate of the instrument and the optic nerve (or bundle of conducting fibres of the eye)—supposing that as the electric currents in the instruments effected a registration on the sensitive paper, so in the eye the nerve currents of the optic nerve probably leave some brain trace on the mind."

It will thus be seen that while "seeing by telegraph" is not by any means a new invention, the principle involved is one full of interest, and as yet but partially developed; in this field of research ample scope will be found for those working in this direction and valuable results may be anticipated.

THE COMING OF AGE OF THE ORIGIN OF SPECIES.[1]

Many of you will be familiar with the aspect of this small green-covered book. It is a copy of the first edition of the "Origin of Species," and bears the date of its production—the first of October, 1859. Only a few months, therefore, are needed to complete the full tale of twenty-one years since its birthday.

Those whose memories carry them back to this time will remember that the infant was remarkably lively, and that a great number of excellent persons mistook its manifestations of a vigorous individuality for mere naughtiness; in fact there was a very pretty turmoil about its cradle. My recollections of the period are particularly vivid; for having conceived a tender affection for a child of what appeared to me to be such remarkable promise, I acted for some time in the capacity of a sort of under-nurse, and thus came in for my share of the storms which threatened even the very life of the young creature. For some years it was undoubtedly warm work, but considering how exceedingly unpleasant the apparition of the new-comer must have been to those who did not fall in love with him at first sight, I think it is to the credit of our age that the war was not fiercer, and that the more bitter and unscrupulous forms of opposition died away as soon as they did.

I speak of this period as of something past and gone, possessing merely a historical, I had almost said an antiquarian, interest. For, during the second decade of the existence of the "Origin of Species," opposition, though by no means dead, assumed a different aspect. On the part of all those who had any reason to respect themselves, it assumed a thoroughly respectful character. By this time the dullest began to perceive that the child was not likely to perish of any congenital weakness or infantile disorder, but was growing into a stalwart personage, upon whom mere goody scoldings and threatenings with the birch-rod were quite thrown away.

In fact, those who have watched the progress of science within the last ten years will bear me out to the full when I assert that there is no field of biological inquiry in which the influences of the "Origin of Species" is not traceable; the foremost men of science in every country are either avowed champions of its leading doctrines, or at any rate abstain from opposing them; a host of young and ardent investigators seek for and find inspiration and guidance in Mr. Darwin's great work; and the general doctrine of Evolution, to one side of which it gives expression, finds in the phenomena of biology a firm base of operations whence it may conduct its conquest of the whole realm of nature.

History warns us, however, that it is the customary fate of new truths to begin as heresies and to end as superstitions; and, as matters now stand, it is hardly rash to anticipate that, in another twenty years, the new generation, educated under the influences of the present day, will be in danger of accepting the main doctrines of the Origin of Species with as little reflection, and it may be with as little justification, as so many of our contemporaries, twenty years ago, rejected them.

Against any such a consummation let us all devoutly pray; for the scientific spirit is of more value than its products, and irrationally-held truths may be more harmful than reasoned errors. Now the essence of the scientific spirit is criticism. It tells us that to whatever doctrine claiming our assent, we should reply, take it if you can compel it. The struggle for existence holds as much in the

1 A Lecture delivered at the Royal Institute, Friday, March 19,