Correspondence.

Photographing in the 50,000th Part of a Second.

To the Editor of the SCIENTIFIC AMERICAN:

In the article appertaining to the history of photography for the past fifty years, published in Sunday's Sun, May 19, 1901, by George G. Rockwood, mention is made of the fact of his having taken photographs in the twenty-four thousandth part of a second, by means of the discharge from a Leyden battery.

As the writer conducted the electrical part of the experiments referred to, and still retains the original apparatus used for the purpose, as well as data relating to the experiments made first at Mr. Rockwood's laboratory, in Union Square, then in the basement of Kurtz's studio—opposite the Post Office at that time—and later at the residence of W. E. Crampton, in Brooklyn, it may add to the history, in a more detailed manner, of this particular line of photography, if the following facts relative to the subject are brought forward.

It was at the suggestion of the late Josiah P. Fitch, a then well-known patent lawyer of New York, that the question as to whether it was possible to have plates made sensitive enough to receive impressions during the minute period of a Leyden battery discharge came up.

Mr. Rockwood was consulted, but, of course, could not guarantee that his plates would respond during the infinitesimal fraction of a second that the Leyden spark gave light.

However, he prepared a number of special plates, and one evening during the summer of 1881 an electro-static machine of French make, giving a spark, under favorable conditions, of eight inches, a battery of fifteen Leyden jars and the necessary mechanical and telephonic apparatus were set up and ready for use about 10 P. M.

A number of scientific men were present, one of whom would be talking in the transmitter, upon the contacts of which the camera was focused, while another would listen at the receiver, in a different apartment, and record the messages articulately received.

Mr. Rockwood figured the duration of the electric spark on the basis of Wheatstone's calculation, that a spark passing through a space of one inch and having the electro-motive force behind of ten Leyden jars would pass in the 24,000th part of a second.

As the electro-motive force of the spark used in these experiments was the product of fifteen jars, connected in series, and the space traversed was from one-quarter to three-eighths of an inch, the duration of the spark, according to the above calculations, was in the vicinity of the 50,000th part of a second instead of the 24,000th.

There was an anxious time spent while Mr. Rockwood was developing the first half dozen plates, as in case of their showing nothing, it would be useless to proceed further in that line of demonstration.

To the surprise, and gratification, of all, the photographs of the transmitter vibrating point came out as clear and distinct as if the exposure had been for a second instead of the 50,000th part of one, and many other fine impressions were taken that evening.

The stationary transmitter contact consisted of a half-inch length of carbon one sixty-fourth of an inch in diameter, and the vibrating one, of a platinum wire of the same dimensions, but tapering to a fine needle point where it contacted with the carbon.

The Leyden spark was discharged at a distance of one inch from the transmitter contacts, on the opposite side of which the camera was focused so as to be in a direct line with them and the center of the space over which the discharge took place.

Some of the photographs were taken with the jars connected in multiple and in multiple-series, but the best results were obtained when all were connected in series. Five of the jars were fractured, through the chains being too short to rest on the inner tin foil.

On examining the fractures with a microscope, they presented a funnel-like formation and had the appearance of being fused, a very surprising fact considering the enormous speed with which the sparks passed through the glass. One of the holes had the appearance of having been made by a bullet.

While the experiments were being conducted the laboratory was in absolute darkness, and the sensations experienced by those present when the discharge took place were of a very peculiar nature, especially when anyone, accidentally, got too close to the Leyden jars. Often, when seemingly safe for handling, a residual charge would assert itself to someone's discomfiture.

Among those present were Josiah P. Fitch, W. E. Crampton and T. A. Richards, M.E.

Subsequently to the above experiments, several nights in Mr. Kurtz's studio resulted in the production of many plates of varying quality.

It was then decided that micro-photography would be necessary for the proper elucidation of the object aimed at, and Mr. Crampton immediately had a room equipped for the purpose in Brooklyn, and went thoroughly into the study of rapid photography.

A very powerful microscope was attached to the camera used, and necessitated the use of very minute contact points on the transmitter, as it had to be brought to within the thickness of a piece of cardboard from the lens, to get the proper focus, and the handling of the apparatus had to be conducted with extreme delicacy and care, through one of the contacts being made from a piece of carbon filament taken from an incandescent lamp and the other from a very fine platinum needle.

The minute contact points were magnified to about one inch in diameter and showed results far ahead of the previous experiments, and seldom were the points caught in actual contact.

By several months' hard work, a beautiful collection of negatives was obtained, showing the contacts at varying positions relative to each other, every negative being taken while articulate speech was being transmitted and received over the telephone.

Those experiments showed visually and conclusively that mechanical contact could be and was broken to a minute extent between the transmitter contacts, while articulate speech was being transmitted, and without impairment of its quality, but, of course, the Bell telephone people argued that it was not by reason of, but in spite of, the mechanical breaks that speech was transmitted, and if the quality of speech was not impaired it was for the reason that, although the circuit might be broken mechanically, it was closed electrically, through the current bridging the gap.

There is little doubt but that Mr. Rockwood is entitled to the credit of making the first photographs by means of a spark from a Leyden battery, and that Mr. Crampton was the first to make micro-photographs by similar means. The same electrical apparatus was used in both cases.

After going the length he did, Mr. Crampton decided to have made the most powerful microscope that could be focused on the transmitter contacts, and use it for the purpose of examining with the eye the actions that took place between them. The microscope was of 4,000 diameters and the contacts had to be flattened to allow of its being brought within range. It was rigidly fastened to the same base as that of the transmitter, but even then, owing to its great magnifying power, the least touch would throw it out of focus, and it required a great deal of perseverance and skill to use it at all.

A minute incandescent lamp was placed behind the contacts, and when speech was being transmitted the vibrations were too rapid for the eye to catch the contacts together, a thin streak of light appearing between them, all the time that speech was being transmitted.

When the incandescent lamp was extinguished a most beautiful halo of bluish, purple light, radiating from the points, was seen. Magnified as it was, it seemed to extend about half an inch around the contacts, melting into the darkness in a very gradual and misty manner, that would seem to confirm the theory of some experts that a luminiferous ether conducted the current when the points were separated. These effects could, of course, not be distinguished with an ordinarily powerful microscope.

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The Nernst Arc Light.

Somewhat more than a year ago the Nernst incandescent lamp was brought forward with a filament of refractory, earthy material instead of the usual carbon, and heated in the open air instead of in a vacuum. In the Elektrotechnische Zeitschrift of February 14 an arc lamp with pencils of similar refractory material is described. This new electric arc is similar to the Jablochkoff candle of long ago, in that the arc length from point to point of the electrodes for the case reported is about 0.04 inch and nearly constant. The most important feature reported for this new arc is its comparatively high efficiency. Good incandescent lamps with carbon filaments show an efficiency of 3 watts per mean spherical candle power. Open-arc direct current lamps show an efficiency of about 0.3 watt per candle power in the direction of greatest intensity of light, but this rises to about 0.6 watt per mean spherical candle power. This great variation between mean and maximum candle power is partly due to the shape of the carbon points, which form so as to produce the greatest illumination at an angle of about 45 degrees below the horizontal. The new arc lamp above mentioned is reported to have given a horizontal candle power of 556 units with an expenditure of 154 watts at the arc. This corresponds to a horizontal illumination of 0.27 watt per candle, or about that of present direct current arcs at 45 degrees below the horizontal. While the ordinary arc is maintained between carbon points, one of which is convex and the other concave, this new arc takes place between points of refractory material, both of which are convex. Moreover, the pencils of refractory material for this latter arc are only 2.5 times as great in diameter as is the arc length, while the diameter of carbon points is generally as much as six times the lengths of their arcs. These conditions make it appear that the arc with pencils of refractory material may have a much wider field of maximum illumination than does the direct current arc with carbon points, and consequently that the mean spherical candle power of the new arc may be nearer that at the horizontal or maximum point than is the case with carbons and direct current. With alternating current the mean spherical candle power of the arc between carbons of convex points is about 70 per cent of the maximum intensity. If this relation holds good for the new lamp, its mean horizontal candle power for the case reported should be $556 \times 0.7 = 389.2$ units, and the efficiency $154 \div 389 = 0.4$ watt per mean spherical candle power. Another important feature of the new lamp seems to be its adaptation to moderate rates of watt consumption and candle powers, because of its simplicity. The considerable amount of mechanism incident to the arc of varying length in a lamp with carbon points, and the lower efficiency of very small lamps of this kind, has tended to confine their use to points where large candle powers are desired.

A. D. A.

Automobile News.

Motor carriages are possessed by King Edward VII., by Queen Alexandra, the Czar, the Emperor of Germany, the King of Belgium, the King of Italy and the Shah of Persia. Queen Alexandra uses an electric motor car.

Automobile omnibuses are to be run between Huntington, Northport and Oyster Bay, L. I. They will carry fourteen to eighteen passengers. The steering is done by means of compressed air. Both power and hand brakes are used. The motor is of sixteen horse power.

According to The Automobile Magazine, when a horse has been injured in the steeplechases at Auteuil, France, and is unable to rise, a specially constructed motor car is brought up and the wounded animal deposited in it and transported away to the care of the veterinary surgeon.

A novel type of motor war machine is being built by Vickers, Sons & Maxim, Limited. It is an armored car intended for the protection and inspection of railways. It runs on the rails and is propelled by a petrol motor, the armament consisting of a one-pounder Maxim gun. Each machine is constructed to be manned by one officer and two or three men.

The Fifth Avenue stages of New York city are all to be operated by electricity. The development of the electric omnibus has been long delayed by the difficulty of finding a satisfactory storage battery. The new vehicles which have been ordered will be ready about August 1, and they will be capable of holding thirty-four persons. The top of the old stages were so low that they were uncomfortable for tall persons. This defect has been remedied in the new ones. They will be double-decked affairs and will be equipped with rubber tires.

Observations of the Giacobini Comet—Nice Observatory.

M. Perrotin has communicated to the Académie des Sciences a series of observations made upon the comet discovered by M. Giacobini at the Nice Observatory on the 20th of last December. These observations, which were made at Nice from the 24th of December to the 11th of January, are shown in the table.

APPARENT POSITIONS OF THE COMET.

Date.	Mean Time of Nice.	α	D. P.
December 24 ...	7 h. 38 m. 23 s.	22 h. 57 m. 19.60 s.	112° 42′ 12.3″
December 25....	9 34 59	23 3 22.50	112 49 30.5
December 26....	7 49 38	23 9 28.06	112 55 59 6
January 6... ...	6 36 13	0 13 5.88	113 7 38.2
January 11	6 51 8	0 40 10.40	112 40 53.2

These observations do not as yet advance very much farther the present knowledge of the orbit, whose parabolic elements were at first calculated by Messrs. Kreutz and Möller, of the Kiel Observatory, and later by Mr. Campbell, of Mt. Hamilton, but since the recent atmospheric troubles the heavens have again become clear, and the observations will be taken up again with the hope of making new calculations. This comet is likely to be of especial interest, owing to its direct movement and the value of certain of its elements, which make it resemble a singular type of comets whose number is continually increasing. M. Perrotin thinks that we shall soon be edified upon this point if the new body, whose brilliancy is decreasing, may be followed long enough to permit the determination of elements having for base an arc of some extent. The tail of the comet extends at an angle of position near 45 degrees, and measures from 2 to 3 minutes of arc in length; the nebulosity of the head, which is regularly rounded, surrounds a well-characterized nucleus of about the 11th magnitude.