A MUSEUM OF BRITISH BIRDS.

Brighton, the Londoner's favorite seaside resort, has not only the largest and most complete aquarium which has yet been built, but also many other galleries of art, science and literature. Among these is a museum containing specimens of nearly all the birds native to the British Isles. The collection is the property of Mr. Booth; and the labor and expenditure must have been very large before so complete a collection was obtained. We select from the London *Graphic* four admirable engravings of subjects selected from Mr. Booth's Museum, the first of which shows a pair of those wonderfully wild and shy birds the herons, the European variety of which has furnished from time immemorial the game of the falconer. It will be seen that the neck is long and flexible, and the bill large, strong, and pointed; so that when the bird stands in a swamp or pool (as its habit is), with the long neck drawn down between the shoulders, the bill can instantly be darted forth and the passing reptiles or fish seized and swallowed.

The European heron (*ardea cinerea*) is of a bluish ash color, with a black crest on the hind head, the fore part of the neck being white with black dots. Its size and strength make it a noble quarry for the trained hawk, whose employment for sport is still practised in some parts of England. The falconer carries a square wooden frame suspended around him by straps over his shoulders. On this frame are perched the hawks, their heads being covered completely with leathern hoods, the caps of which, covering the eyes, can be raised. When a heron appears in sight, on the wing, the falconer raises the cap from a hawk, who is instantly on the alert, turning his brilliant eyes in every direction in search of a victim; the falconer then takes the bird on his hand and lets him go. The hawk flies with lightning speed toward the heron; and a struggle between the courage and skill of the one and the weight and strength of the other takes place, ending sooner or later in the death of the heron.

The peregrine falcons, shown in our second engraving, have been much used for the sport of hawking, as they are capable of being tamed without losing any of their power and courage; and when the battle is ended, they return to the falconer to receive the prize of victory. They are exceedingly handsome birds, the eyes being large and keen; the plumage is very compact, the head and neck in the adult male being grayish black tinged with blue, the rest of the upper parts being of a dark bluish gray with in distinct brown bars; the throat and front of the neck are white, and a broad triangular mark of blackish blue extends downward on the white of the cheeks from the corners of the mouth. The American bird most resembling the peregrine falcon is the duck hawk (*falco anatum*, Bonaparte).

The three owls shown in our third illustration are of the barn variety common in England. The tribe is known to science as *strix flammea* (Linnæus); it is somewhat smaller than the American barn owl, and is lighter colored, the breast being white. The singular look of wisdom of the whole owl family is well shown in the deep set eyes and the solemn, taciturn expression of countenance in this variety; and their zealous hunting after mice and small birds makes them useful in the barn and granary.

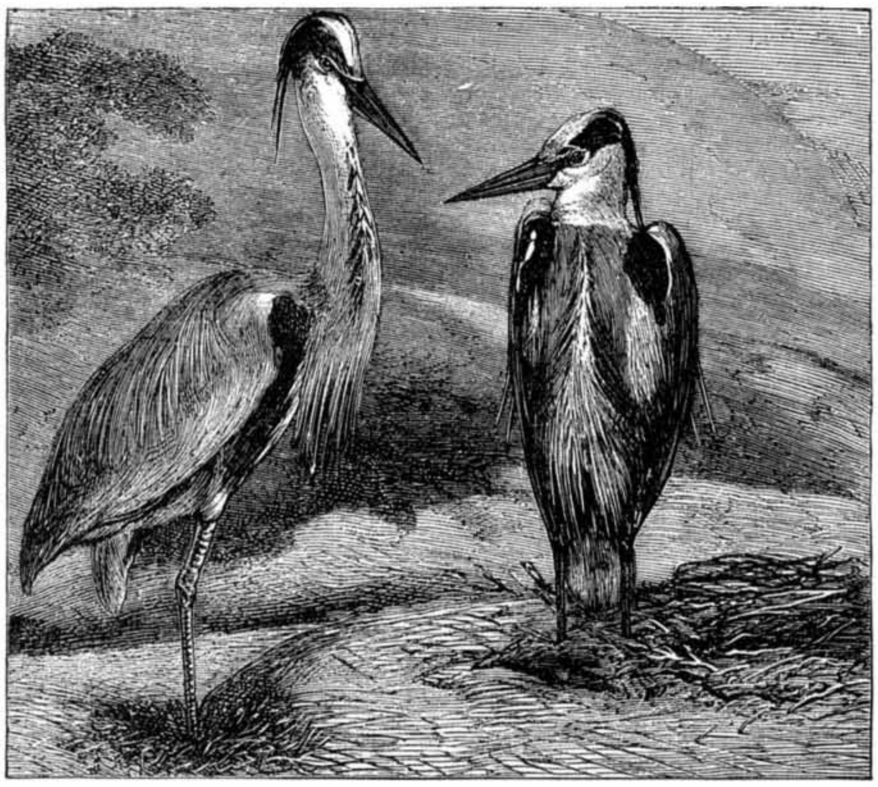
Our fourth engraving shows a family of kestrels, birds to which our sparrowhawks are very similar. The kestrel is about 14 inches long, with an extent of wing of 28 inches; the general color in the male is light grayish blue, the back and wing coverts being pale red with triangular dark spots. In the female, the upper parts are light red, with transverse dark bars and spots; the young of both sexes resemble the female. The kestrel hovers at a hight of about 40 feet above the ground, and pounces suddenly on small birds, mice, or reptiles, the numbers of field mice which it destroys being enormous. When not in search of prey it flies high, and is silent; in the breeding season, however, it becomes vociferous.

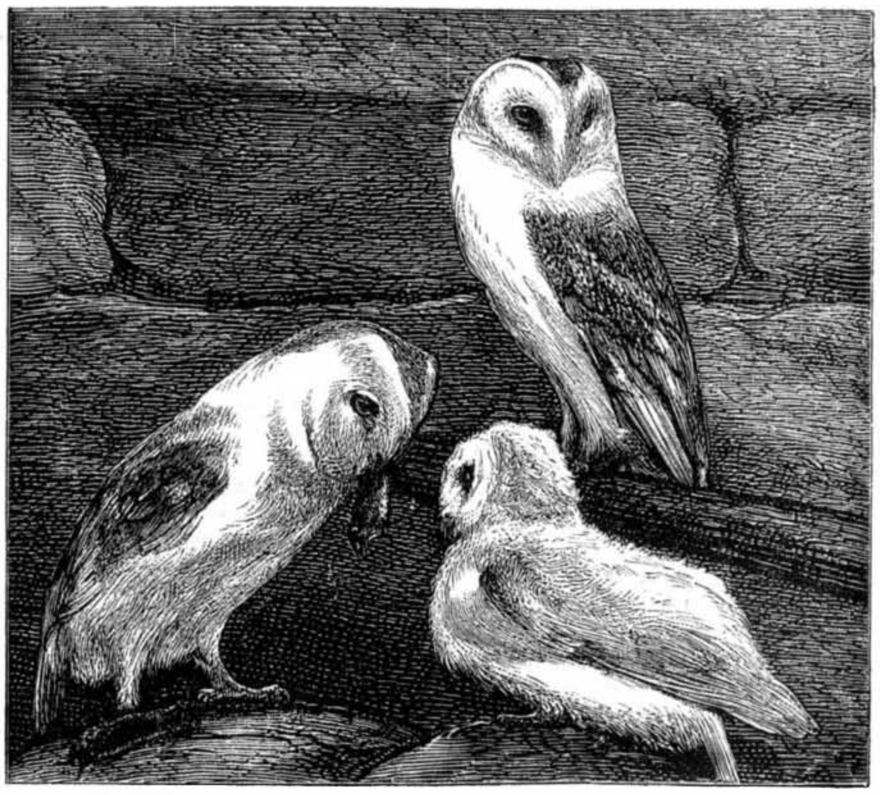
Alcoholic Solution of Shellac.

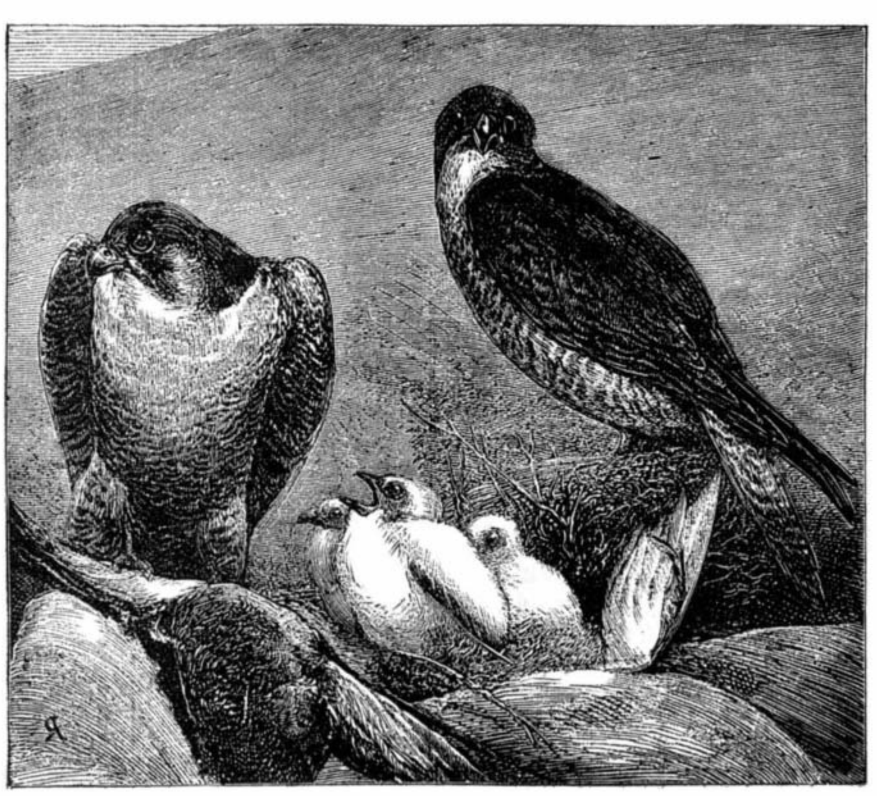
The production of a clear solution of shellac has been the subject of numerous experiments, but hitherto none has turned out satisfactorily except slow filtration. As is known, by digestion of one part of shellac with six or seven parts 70 per cent of alcohol, a solution is obtained which, when warm, is almost clear, but upon cooling becomes turbid, and is only partially clear after standing a week. The plan of pouring sufficient alcohol over coarsely powdered shellac to form a thin paste yields, upon the addition of more alcohol after the lapse of eight or ten hours, a liquor that does not deposit any more, but which is not clear. Another method suggested, of boiling the alcoholic shellac solution with animal charcoal, gives a clearer liquid, but there is always loss through absorption by the animal charcoal.

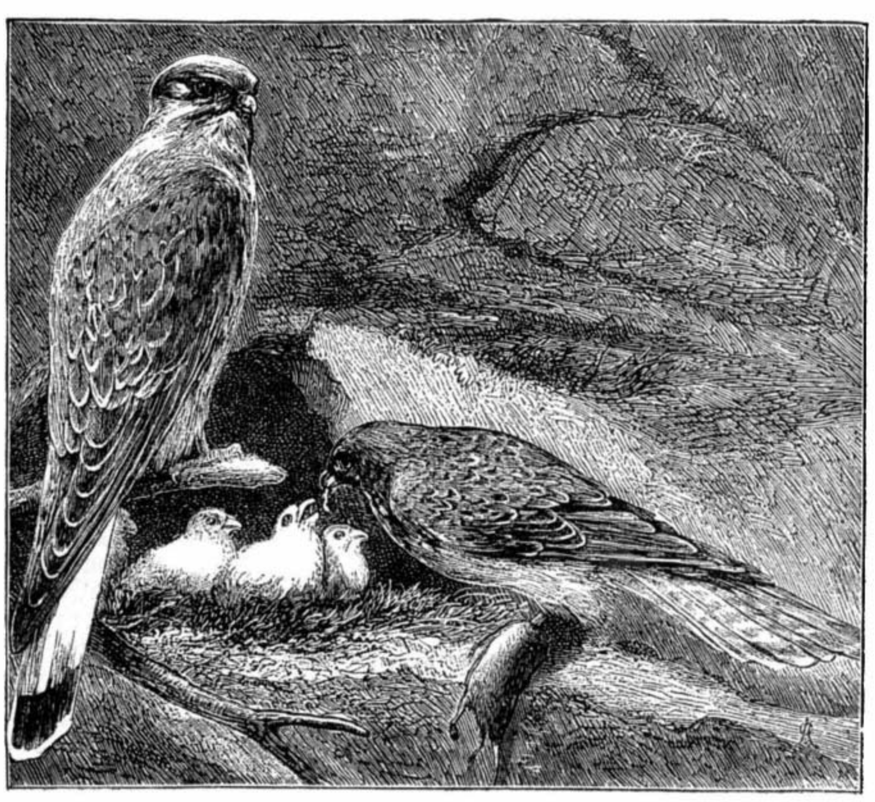
The object sought by the author was to obtain a clear alcoholic solution in a short time without much loss. Previous communications upon the substance occurring in shellac to the extent of five per cent, which renders its alcoholic solutions turbid, and is described by some authors as wax, and by others as a fat acid, suggested an attempt to effect its removal before dissolving the shellac. The shellac, therefore, was boiled with water, from one to five per cent of soda or ammonia being added, but without satisfactory result; a somewhat larger addition of the alkali caused the solution of the shellac. The author next prepared a solution with one part of shellac and six parts of 90 per cent alcohol at the ordinary temperature, which was effected with frequent shaking in ten or twelve hours. To this he added carbonate of magnesia to about half the weight of the shellac used, and heated the mixture to 140° Fah. The solution so obtained cleared more rapidly than a solution to which magnesia had not been added, and filtered in less time; but it did not supply what was sought. When powdered chalk was substituted for magnesia, the solution, after standing some hours, became three fourths clear, while the lower turbid portion could be rapidly filtered. It only required a little alcohol to wash the filter, and a clear alcoholic solution of shellac was obtained. Further experiments—for instance with sulphate of baryta—did not give a better result. When such a solution is made on a large scale, it would be best filtered through felt.

Notwithstanding that the object of the author had thus been attained, one or two other experiments were tried. To three parts of the above mentioned shellac solution, one part of petroleum ether was added, and the mixture was


HERONS NESTING


A FAMILY OF BARN OWLS


PEREGRINE FALCONS AND YOUNG.


KESTRELS AND YOUNG.

vigorously shaken. After standing a few moments, the liquid separated in two layers; the upper light-colored layer was the petroleum ether with the wax dissolved in it, the lower yellow brown layer was a clear solution of shellac with only a little petroleum ether adhering. Upon allowing the petroleum heat to evaporate spontaneously, the wax that had been dissolved out of the shellac was obtained as a white residuum. By using alcohol at 95 per cent to dissolve the shellac, and then adding petroleum ether, a perfectly clear solution was obtained that only separated into two layers after water was added. Consequently an alcohol weaker than 90 per cent should be used.

The shellac solution obtained by means of petroleum ether, however, has the advantage that the shellac is left, after evaporation, in a coarser form, and easily separates: this may be obviated by adding one to three per cent of Venice turpentine.—*A. Peltz.*

[For the Scientific American.]

THE GAS MICROSCOPE.

BY HENRY MORTON, PH. D.

The projection of images from microscopic objects directly upon the screen with the gas microscope has always been a thing much desired by all those who have made use of the magic lantern as a means of demonstration; but the difficulties attending this experiment have been found much more serious than was anticipated beforehand. This is especially the case to one who has been accustomed to use the solar microscope, in which the advantage offered by the parallelism of the solar rays is of no great value. On account of the smallness of the object illuminated, as compared with the errors of focalizing or concentration in the cone of rays coming from the condenser, all the advantages in the use of a lens in a magic lantern, as compared with its use in a camera or the like, disappear, and the lens of the microscopic attachment is left to its own resources*, without any of that aid from the condensers which they afford so effectively to the objective of the magic lantern in its best form of construction.

Among the errors, which thus become conspicuous, the most manifest and vitally important is the want of flatness of field. By reason of this, while the center of the image is well defined, the edges are indistinct and unsatisfactory. To obtain lenses free from this defect has been the continuous effort of some of our ablest opticians for the last ten years; but the success so far has been very limited, and indeed it would seem as if the problem was one for whose solution we could hardly hope, for it must be remembered that lenses whose flatness of field in the table microscope leaves nothing to be desired in that direction, are entirely unsatisfactory when used in the gas microscope.

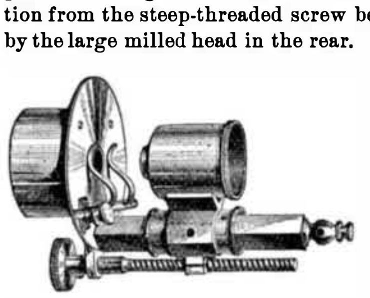
One of the most influential causes of this we shall notice presently; but we will here only remark that, as the result of a larger experience, we have become convinced that one must be contented with a moderate amount of success in this direction, and not expect what is, at present at all events, impossible.

The second great defect that we encounter in the use of the microscopic lens for projection is the irregularity of distribution of light upon the screen. By reason of this we may have a field of light, with a small bright area at the center, rapidly fading off into darkness, with no well defined margin. The causes of this are, among others, the confusion or want of accurate concentration of the cone of rays from the condensers, and the smallness of the objective, causing it to cut off oblique or marginal rays, more or less according to their obliquity. To remedy this difficulty we can work in two directions. In the first place we may improve the spherical correction of the condensers or the concentrated character of the source of light. The first of these improvements, as we have shown in another place†, has already been carried to its practical limit in the best sort of condensers, and the second involves the use of the electric light or of sunlight.

In the second place, any increase in the diameter of the microscopic lenses, without a corresponding increase in their actual length, insures a great gain as regards the equal illumination of the field. With this view alone, therefore, a simple uncorrected or single corrected microscopic lens, such as accompanies the regular gas or solar attachment made for the last 50 years and still made by Duboscq and other French manufacturers, would be the best form, and, as regards the equal distribution of light on the screen, this is true; but when such lenses are thus used, and are of sufficient size to secure this result, their errors of spherical aberration and want of flatness become unendurable. We are then fenced in on either side by the necessity of a large and short lens to secure an equal illumination, and the difficulty in securing flatness or correction under these conditions. The most successful compromise which we have yet found in this connection is the gas microscope objective of 1½ focus inch by Mr. J. Zentmayer, the well known manufacturer of microscopic stands and lenses. With one of these a well defined object, such as a lady bug, mosquito, or the like, may be thrown on the screen with a clear image, pretty well defined up to the margin, and a field of light so brilliant and regular that it is hardly distinguishable from that of an ordinary magic lantern projecting a colored glass slide of the same object. Of course with such a power very minute objects must be rejected; but by a judicious selection, a large series of interesting ones can be secured, such as the lady bug or mosquito already mentioned, the ant lion, field spider, and various water insects, or larvæ of mosquitos and the different sorts of flies, also wood sections, and even objects so small as the eye of a dragon fly; but above all with this power may be most successfully shown what are by far the most popular illustrations with the gas microscope, such living specimens as the various larvæ above mentioned, and such other things as are to be found in stagnant water. For these the very simple and effective form of live slide devised by Mr. S. Holman, Actuary of the Franklin Institute, Philadelphia, is invaluable. It consists of an ordinary microscopic glass slip, of greater thickness and size than usual, with a spherical cavity about $\frac{3}{4}$ of an inch across and $\frac{1}{16}$ of an inch deep, ground and polished in the middle of one face. This, when in use, is closed by a thin glass cover, which is kept in place by adhesion and atmospheric pressure, the cavity beneath it being filled with water containing the insect or other object. If it is desired to use higher powers, we must be contented with a limited selection of objects, choosing such as are strongly defined and well colored. Diatoms, blood disks, or other objects which are delicately tinted or colorless, are quite unfit for such use. A strongly colored eye of a fly or sting of a wasp, or other parts of insects, such as a claw of a spider, answer well.

In this case I have obtained the best results with Zentmayer's $\frac{4}{10}$ objective, using an extra condenser consisting of a plano-convex lens of about 3 inches focus and 1½ inch diameter, placed about an inch back of the object. This greatly increases the illumination of the field.

In using the gas microscope much depends upon the efficiency and convenience of the support for lenses and the stage, or what is known commonly as the gas microscope attachment. After many experiments and the frequent alteration of other forms, I have settled upon that represented in the accompanying woodcut as the most desirable. The portion holding the lens slides on a square bar receiving motion from the steep-threaded screw beneath, which is turned by the large milled head in the rear. This gives a very easy, smooth, and steady motion, abundantly delicate and yet admitting of rapid adjustment. The stage is perfectly flat and unobstructed; and two very elastic spring clips, whose tension can also be adjusted by a screw at the side, enable objects of almost any size or thickness to be held in position.



Within the large ring, terminating the apparatus toward the left, and which serves to attach it to the lantern, is a smaller ring which carries the extra condenser when required. This form of microscopic attachment is manufactured by Messrs. George Wale & Co., Hoboken, N. J., who are instrument makers to the Stevens Institute of Technology, of that place.

*On the subject here referred to, see SCIENTIFIC AMERICAN, 1873, volume XXIX, page 163.

†SCIENTIFIC AMERICAN, 1873, page 163, volume XXIX.

Minute Time Intervals Measured by Frictional Electricity.

An invention which will enable us to estimate the velocity of a projectile during its passage through the bore of a gun is one which the great advances which have been and are constantly being made in the science of gunnery has long rendered desirable. To meet this requirement, Dr. William Siemens recently renewed investigations into the subject, undertaken as early as 1847, and his studies have resulted in probably the most delicate and accurate chronoscope ever devised. To understand the nature of the novel principle introduced by Dr. Siemens, it is necessary to review briefly the previous labors of others in the same direction.

The first attempts date from 1837, and were made by Pouillet, who measured the time employed by a projectile to traverse a given path by estimating the intensity of the electric current provoked by the pulsations of a magnetized needle. Wheatstone, in 1840, Konstantinoff and Breguet, in 1842-3, and later De Brettes and others, sought an analogous solution of the problem in the use of magneto-electric registering apparatus, to which the names chronograph and chronoscope were given. Among these was included a device invented in 1845 by Leonhardt, which consisted in a clockwork movement, the index of which was moved by an electric current.

All these attempts, Dr. Siemens thinks, failed because the electric current marks intervals of time, not directly, but through the medium of magnetic or mechanical apparatus. He proposed, in the beginning, to use frictional electricity: but as at the time of his proposition experiments in that species of electricity were little investigated, the methods in vogue were continued. Subsequently these have been greatly improved; but recourse has always been had to the intermediary apparatus. This is the case in the Nobel and Boulenger machines, in which small errors in construction lead to greater ones in the indications. Recently Dr. Siemens has perfected and successfully tested his frictional electricity apparatus, which is constructed as follows. We translate the description from the *Revue Industrielle.*

A very light and highly polished steel cylinder is rapidly rotated by means of gearing, provided with a very sensitive regulator, and capable of being instantly arrested in its movement at will. The mechanism is so regulated that the cylinder makes exactly 100 revolutions per second. The completion of each hundred turns is suitably indicated so as to correspond with the beat of a seconds pendulum. Near the polished surface of the cylinder is fixed a conducting needle connected with the exterior armatures of an insulated battery of Leyden jars. The interior armature of each jar is in contact with a wire, insulated by rubber or gutta percha, which enters the bore of the gun through a hole made for the purpose. The battery is provided with a commutator, which allows of the jars being simultaneously charged by a Ruhmkorff apparatus.

When the gun is fired, the projectile successively destroys the insulating envelope of the wires which end in the bore; the exterior armatures of the jars are then put in communication with the gun, and hence with the earth. As the rotating cylinder is itself in connection with the earth, the jars instantaneously discharge through the needle and mark dots on the cylinder with great depth and distinctness.

The intervals between these points is measured with a micrometric screw, and the cylinder is previously covered with lampblack. Each of the black dots is then surrounded by a pale ring, and is easily recognized. The axis of the cylinder carries a gear, in connection with which the micrometric screw is disposed. The gear has 100 teeth, and the head of the screw is divided into 100 parts, so that at the rate of 100 turns per second each division of the head of the screw corresponds to 0·000001 second, an interval which can be subdivided. With a little practice in manipulation, the apparatus is made to give, for each shot fired, a number of indications of velocity proportional to the number of jars in the battery, and of communications with the gun.

The great precision thus reached in gunnery experiments has determined Dr. Siemens to apply the same principle to the estimate of velocity of electricity even in suspended wires. The usual method has been that of Wheatstone, according to which electricity in copper wire travels at the rate of 62,000 geographical miles per second. Wheatstone, in in his experiments, used a rapidly revolving mirror, in which he observed three sparks, of which two came from the two ends of a conductor destined for the discharge of a Leyden jar, while the intermediate spark came from the middle of the conductor. Were the velocity of electricity infinitely great, the three sparks observed in the mirror would appear on a right line, parallel to the axis of rotation. But such is not the case, and Wheatstone deduced the velocity of the electricity from the intervals noted between the extreme sparks and that at the middle. It is evident that this kind of estimate is very uncertain, especially since results obtained later, by Fizeau, Gould, Gonnelle, and others, by different methods, differ greatly from those obtained by Wheatstone. Dr. Siemens' method of measuring the velocity of electricity in telegraphic lines consists in causing the electric discharge from a Leyden jar to reach the revolving cylinder, part directly and part through the length of wire. The interval between the two marks then gives a measure of the time occupied in traversing the wire. The indications have been noted with great accuracy, and they show that the velocity of electricity is just half that announced in Wheatstone's estimate, or 31,000 geographical miles per second.

Pneumatic Tubes.

The Western Union Telegraph Company, in its annual report to its stockholders, just issued, says, of the experiment in adopting the tube system of transmitting messages, that during the past year the central office in New York has been connected with the branch offices at No. 14 Broad street, No. 134 Pearl street, and the Cotton Exchange by pneumatic tubes. The tubes are made of brass, each 2¼ inches internal diameter and ⅜ of an inch thick, and are laid under the pavements in the streets at a depth of three feet.

Messages are sent from the central office to the several branch offices by compressed air, and from the branch offices to the central office by atmospheric pressure or vacuum. The motive power is furnished by a 50 horse power duplex engine situated in the basement of the central office, which operates two double acting air pumps communicating with the compressed and vacuum mains terminating in the operating room. These are connected to the tubes extending under the streets by means of double sluice valves, which are so constructed that carriers containing messages may be sent through the tubes in either direction by turning a cock connected with the compressed or exhaust air mains.

With the usual pressure employed—6 lbs. to the square inch—the time occupied in transmitting a box or carrier containing messages between the central office, corner of Broadway and Dey street, to the office at No. 14 Broad street (700 yards) is about 40 seconds; and between the central office and the offices at No. 134 Pearl street and the Cotton Exchange (900 and 1,100 yards) about one minute and five seconds and one minute and twenty seconds respectively.

The operation of the pneumatic tubes is very satisfactory, resulting in a material saving of both time and money.

The total cost of the system is less than $30,000, and about one half of the outlay will be saved annually, to say nothing of the saving in time, by the decreased cost of performing the service by pneumatic tubes between these stations as compared with the former cost by wire.

There are several other offices in the city where the traffic is large enough to warrant their connection by pneumatic tubes with the central office, and it is probable that the system will be extended to some of them after its value has been more fully ascertained.

A New Phylloxera Remedy.

M. Gachez recently announced to the French Academy of Sciences that red Indian corn (maize) is an efficient remedy against the phylloxera, and that when it is planted between the rows of vines in a vineyard, the vines are never injured. The insect, he says, leaves the vine roots in order to attack those of the corn. This is a new way of combating the phylloxera, and is easily tested.