

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S. or Canada. \$3 00
One copy, six months, for the U. S. or Canada. 1 50
One copy, one year, to any foreign country belonging to the Postal Union, 4 00

Australia and New Zealand.—Those who desire to receive the SCIENTIFIC AMERICAN, for a little over one year, may remit £1 in current Colonial bank notes. Address MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

Is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, \$5.00 a year, for U. S. and Canada. \$6.00 a year to foreign countries belonging to the Postal Union. Single copies, 10 cents. Sold by all newsdealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to any address in U. S. or Canada, on receipt of seven dollars.

The safest way to remit is by draft, postal order, express money order, or registered letter.

Australia and New Zealand.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for a little over one year on receipt of £2 current Colonial bank notes.

Address MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

NEW YORK, SATURDAY, MARCH 2, 1889.

Contents.

(Illustrated articles are marked with an asterisk.)

Table listing various articles such as Apparatus, reactionary; Appliances, railway; Barometer, iodide of mercury; Beetle, elm; Bell, signal, Olsen's; Books and publications, new; Box, match, watertight, wanted; Bridge, St. Louis; Business and personal; Carrier, luggage, bicycle, Credebaugh's; Cars, heating, apparatus for; Ceilings, how to save; Coal in Argentine Republic; Congo, ten years' progress on; Consolidations, electrical; Copra or cocoonut meat; Crane, locomotive, ten-ton; Diphtheria, germ of; Emmensite; Experiment, welder's; Fire burns brightly in winter, why; Flats, danger in; Garments, dyeing of; Gas, damper of; Gas, natural; Gas, natural, in Indiana; Gas, natural, waste of; Guns, great, cost of; Guns, modern; Guns, thirteen-mile; Incendiarism, strange; Inventions, engineering; Inventions, index of; Inventions, mechanical; Inventions, miscellaneous.

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT No. 687.

For the Week Ending March 2, 1889.

Price 10 cents. For sale by all newsdealers.

Table listing detailed contents of the supplement, including I. CHEMISTRY, II. CIVIL ENGINEERING, III. ELECTRICITY, IV. ENTOMOLOGY, V. GEOGRAPHY AND EXPLORATION, VI. GEOLOGY, VII. MECHANICAL ENGINEERING, VIII. MEDICINE AND HYGIENE, IX. MINING ENGINEERING, X. NAVAL ENGINEERING, XI. PHYSICS, XII. TECHNOLOGY.

THE DAFT ELECTRIC LOCOMOTIVE.

The trial of the Daft electric motor or locomotive is now in progress on the Ninth Avenue elevated track between Fourteenth Street and Fiftieth Street, a distance of one and four-tenths miles. The electric locomotive, with a train of four cars, switches in between the regular trains, and gaining on the schedule time of the steam trains, which is 13 1/4 miles per hour, the electric train often making a speed of 15 or more miles up a grade of 98 feet to a mile without apparent effort, the puffing of the steam cars being no part of the hard work with the electric locomotive. The highest speed yet attained when the track was unobstructed by other trains has been 30 miles per hour. This locomotive, weighing only ten tons, has drawn a train of eight cars up the grade of 98 feet to a mile below Fiftieth Street, at a speed of 7 1/2 miles per hour.

The conductor is of copper rods on insulated pedestals, at a level with and a few inches outside of the timber guard rail, the return being one of the tracks. The completing of the electric circuit through the driving wheels and the track seems to increase the traction largely, as the wheels do not slip on starting, which otherwise would take place with any locomotive of such light weight.

The train has been running regularly during the past ten days, with the exception of an interruption of two days caused by the frequency of the regular trains during the strike.

The electric current is derived from four dynamos, driven by a Wright engine, 22 in. x 42 in., located in Fifteenth Street, near Tenth Avenue.

The indicated power of the engine for running the four dynamos for the track current and a dynamo for lighting was 240 horse power.

The electric facilities for handling the train seem to be perfect. Slowing and reversing with the slightest movement, for coupling the cars, is as much under the control as in a steam locomotive.

THE GERM OF DIPHTHERIA.

It is claimed that "two professors connected with the Pasteur Institute have discovered the generative microbe of diphtheria, and that a preventive of this disease by means of vaccine virus is expected to follow." Should this expectation be realized, the discovery and its successful application will certainly take rank among the most important triumphs in the realm of medical science. The prevalence of diphtheria, especially in the principal cities, and the very large proportion of fatal cases, is little dreamed of excepting by those who are giving special attention to the subject. In Brooklyn, N. Y., for instance, there were in 1888 984 deaths from diphtheria, which probably represented 3,000 cases. It is safe to say that if the same number of deaths had occurred in the same time from cholera, smallpox, or yellow fever, Brooklyn would be put down as a pest-ridden city indeed.

From four weekly statements of vital statistics issued by the Brooklyn Board of Health, commencing with the date January 12, 1889, and ending February 2, 1889, the following number of deaths from diphtheria appear to have taken place in six of the large cities of the world:

Table with 2 columns: City, Deaths. New York 182, Philadelphia 39, Boston 43, Brooklyn 124, London 92, Paris 118.

It so happens that the new Hoagland Laboratory connected with the Long Island College Hospital, of Brooklyn, is now conducting a series of investigations in bacteriological science, having been especially equipped for this purpose through the munificence of Dr. C. N. Hoagland, the donor of the institution.

The experts connected with the laboratory are pursuing investigations which lead in the same direction as the discoveries claimed to have been made at the Pasteur Institute in Paris. The laboratory has sent to Europe for cultures of what are claimed to be diphtheria germs, which will be compared with those obtained here. Dr. G. T. Kemp, associate director of the bacteriological department of the laboratory, when consulted, said that the discovery of the real diphtheria microbe, and the adoption of vaccination as a means of prevention, was by no means improbable.

The prosecution of the search for a diphtheria germ, which has engaged the attention of scientific experts for the past few years, does away entirely with the popular theory that the disease can be caused by sewer gas or filth conditions. The advanced investigators now generally agree that the disease is carried by a microbe or germ. Filth and gases emanating therefrom are a means of cultivating the same, and may carry it from person to person and from house to house. In other words, that the cause of diphtheria is diphtheria, and not sewer gas or filth.

As an outcome of the germ theory, Drs. H. C. Wood and H. F. Formad, of Philadelphia, were commissioned by the government to investigate the subject in its relation to diphtheria, and the results of their extended investigations were published in 1882, as an appendix to the report of the National Board of Health. They

obtained specimens of micrococci (germs nearly round in shape) from persons suffering from diphtheria and representing the disease in various stages. Rabbits, Guinea pigs, and rats were inoculated with the micrococci, and the result was that they soon manifested symptoms of diphtheria—fever, formation of membrane, paralysis, and, finally, death. Later investigations demonstrated the fact that there is still an undiscovered germ, the means for investigating which were not perfected when Drs. Wood and Formad made their inquiries in 1882. The publication of Loeffler's treatise on the germ of diphtheria, which appeared in 1884, and which fills seventy pages of the quarto volume of the "Kaiserlichen Gesundheitsamte," worked a very great advance in the search for the true germ of diphtheria. Strange as it may seem, this treatise has never been translated, but its contents are known to those who are giving special attention to the subject. It describes the minute, masterly, and exhaustive investigations into this difficult field of bacteriology, which resulted in the author designating the bacillus (a rod-shaped germ) as the genuine diphtheria microbe.

If the work referred to in the dispatch from Paris is the same as that done by Profs. Roud and Yersin, and published in the last number of the "Annales de l'Institut Pasteur," then it is merely a research confirmation of the work already done by Loeffler.

Having assumed that the true germ of diphtheria has been, or that it will eventually be, discovered, the interesting question presents itself whether the introduction of the virus into the human system can prevent the person so inoculated from taking the disease. A number of scientific gentlemen who have been consulted on this point express themselves as having faith in the new process, while others claim that inasmuch as a person who has had diphtheria may have it again, the introduction of diphtheria virus into the system by means of vaccination can give no greater immunity from future attacks. On this point it may be said that when the experimenters inoculated sewer rats with diphtheria virus it was found that they did not take the disease, but when field rats were subjected to the same treatment, the usual symptoms of diphtheria soon appeared. It has been urged against the germ theory, as applied to diphtheria, that if there are innumerable deadly microbes constantly floating in the air, how does it happen that one person is affected by them, and not another? The answer is, that the development of the germ, like the development of the seed, depends upon the soil into which it falls. Of thirty healthy children examined by Loeffler, the diphtheria bacillus was taken from the mouths of four of them.

When the system becomes reduced from various causes, it may be from breathing sewer gas, over-exertion, improper nourishment, or neglect, or other causes, then the microbe develops rapidly and diphtheria is the final result. This may explain why, in apparently healthy and well guarded homes, cases of diphtheria frequently occur. The germ may be communicated by one child talking with another on the street. Its development depends upon the physical condition of the child to whom it is communicated. If it is well and vigorous, it successfully baffles the effects of the dangerous germ, while if other conditions exist, the germ acts like a spark falling into a pile of shavings.

It will certainly not add to our quietness of mind if it be demonstrated beyond peradventure that the cause of diphtheria is an insidious, an invisible microbe floating in the air, to which all persons are more or less subject. But if coupled with this demonstration it can be shown, as a result of recent investigations, that immunity can be given by vaccination, then every lover of his kind will rejoice, and the discovery will be ranked among the greatest achievements of science.

CHAS. D. BAKER.

STRANGE INCENDIARISM.

A curious story of supposed incendiarism is reported from Pennsylvania. Near Harrisburg a number of barns have been destroyed by fire, until from \$20,000 to \$30,000 worth of property has been burned. The farmers naturally have become very excited, the more so as a mystery overhangs the cause of the conflagrations. No footsteps have been found that would indicate the incendiary, and no tangible clew has been obtained.

To make it still stranger, an account is given of the finding of a mysterious egg in one of the buildings. The egg was picked up by a girl, who found it remarkably heavy. As she held it up, some black material issued from its end and fell to the ground. She took it into the house and it was examined by a physician, who was hastily called as the most accessible scientific representative. He emptied it, and it proved to be full of a black substance resembling gunpowder. On touching a match to it, it burned with a vivid and very large flame. Suspicion has been fixed upon a chemist, who, it is believed, may have evolved some kind of an occult explosive, that for many hours would lie at rest, to eventually explode spontaneously. It will be recollected that an attempt was made some years ago to burn or injure a British ship as she lay at her pier in this city. The agent used was probably in the