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., Canada or Mexico.....$3 00
One copy, six months, for the U. S., Canada or Mexico..... 1 50
One copy,one year,to any foreign country belonging to Postal Union. 4 00
Remit by postal or express money order, or by bank draft or check.
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 the U. S., Canada or Mexico. $6.00 a year to foreign countries belonging to the Postal Union. Single copies, 10 cents. Sold by all newsdealers throughout the country. See prospectus, last page.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to one address in U. S., Canada or Mexico, on receipt of *seven dollars*. To foreign countries within Postal Union, *eight dollars and fifty cents a year*.

Building Edition.

THE ARCHITECTS AND BUILDERS EDITION OF THE SCIENTIFIC AMERICAN is a large and splendid illustrated periodical, issued monthly, containing floor plans, perspective views, and sheets of constructive details, pertaining to modern architecture. Each number is illustrated with beautiful plates, showing desirable dwellings, public buildings and architectural work in great variety. To builders and all who contemplate building this work is invaluable. Has the largest circulation of any architectural publication in the world.

Single copies 25 cents. By mail, to any part of the United States, Canada or Mexico, $2.50 a year. To foreign Postal Union countries, $3.00 a year. Combined rate for BUILDING EDITION with SCIENTIFIC AMERICAN, to one address, $5.00 a year. To foreign Postal Union countries, $6.50 a year. Combined rate for BUILDING EDITION, SCIENTIFIC AMERICAN and SUPPLEMENT, $9.00 a year. To foreign Postal Union countries, $11.00 a year.

Spanish Edition of the Scientific American.

LA AMERICA CIENTIFICA E INDUSTRIAL (Spanish trade edition of the SCIENTIFIC AMERICAN) is published monthly, uniform in size and typography with the SCIENTIFIC AMERICAN. Every number of *La America* is profusely illustrated. It is the finest scientific, industrial trade paper printed in the Spanish language. It circulates throughout Cuba, the West Indies, Mexico Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. $3.00 a year, post paid to any part of the world. Single copies 25 cents. See prospectus.

MUNN & CO., Publishers,
361 Broadway, New York

☞ The safest way to remit is by postal order, express money order, draft or bank check. Make all remittances payable to order of MUNN & CO.

☞ Readers are specially requested to notify the publishers in case of any failure delay, or irregularity in receipt of papers.

NEW YORK, SATURDAY, FEBRUARY 25, 1893.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 895.

For the Week Ending February 25, 1893.

Price 10 cents. For sale by all newsdealers.

THE TWO GREAT SHIP CANALS.

We give in another column an account, by an officer of the navy, of a recent visit to the Panama and the Nicaragua canal works. The descriptions given of the present condition of these great enterprises are especially interesting, coming as they do from the pen of a careful, disinterested observer. The U. S. S. Kearsarge, which conveyed our correspondent, lately reached Havana, from Greytown, Nicaragua.

THE BERLINER MICROPHONE PATENT.

The famous Bell telephone patent, to which the courts have awarded an unexampled scope, will on March 7, 1893, reach its last limit of life. The invention of the telephone, as far as covered by that patent, will after that day be public property. The claims of this patent, it will be remembered, were held by the courts to cover the use of the so-called undulatory current for telephoning. Next, in the practical application of this decision in numerous cases the courts held that no operative telephone was ever shown them which did not employ this current. Finally, no alleged anticipating device was ever allowed by the courts to show the transmission of articulate speech by an undulatory current of electricity. Sometimes it seemed as if the law was almost strained in this exclusion of prior devices. The old House telegraph patent showed a perfectly operative telephone, although the inventor had no idea that it could transmit articulate speech. The doctrine that a device when patented is patented for all possible uses was not allowed to apply to the anticipation of the Bell telephone. The courts seemed gradually to adopt the principle that the Bell telephone was entitled to the broadest possible scope. They protected it by their action as no patent has ever yet been protected. The public to a certain extent felt that special tribute was due to so wonderful an invention. Now the original patent lapses. Next year another fundamental patent expires, but the field is not yet to be open.

The Bell telephone, working by the currents induced by the motion of an armature in front of the poles of a magnet, is, when used as transmitter, of but little value. As a receiver it is of high utility. Right on its track came the microphone, which supplied the missing element. The microphone is an excellent transmitter, but is not a practical receiver. The two form a complete system, and all telephoning is now executed by the use in one circuit of both instruments.

The telephone used as transmitter is, properly speaking, a species of dynamo or generator. It produces electric impulses by the currents induced in a coil of wire surrounding a magnet coil. These currents are induced by the motions of a diaphragm of soft iron acting as armature of the magnet. The voice causes this to vibrate and so changes the field of force. Used as a receiver, the action is reversed. Varying currents passing through the coil throw the diaphragm into vibration. If these currents are of proper quality, articulate speech results.

The microphone operates by changing the resistance of the circuit. The apparatus includes in general terms two surfaces in contact. Against one of the contact pieces a diaphragm of iron rests. On speaking against the diaphragm it vibrates, alters the pressure between the contact pieces, and so changes the resistance. A battery being in the circuit, this causes changes in intensity of current, which operating on the telephone reproduce sound.

The fundamental microphone patents, which were applied for in the early days of telephony, and were granted to Blake and Edison, have all lapsed by the expiration of foreign patents. It would seem that this should end the *regime* of the telephone monopoly. But within the last few years a good deal has been published concerning an application for patent by Emil Berliner which dated back to 1877, which became the property of the Bell Telephone Co. in 1878, and which was very lately granted. By statutory action this application, it was alleged, was kept alive by the Bell Co. These assertions were confirmed on Nov. 17, 1891, when the Berliner patent was issued to Emil Berliner, assignor to the American Bell Telephone Co.

The patent shows and describes a microphone, such as might be used on a telephone circuit to-day. Aided by the apprenticeship of many years litigation, and by the many undulatory current decisions of the courts, six claims have been written for the patent, and have been allowed by the Patent Office. The first claim is for the method of producing in a circuit electrical undulations similar in form to sound waves by causing the sound waves to vary the pressure between electrodes in constant contact, so as to strengthen and weaken the contact, and thereby increase and diminish the resistance of the circuit.

This is the main claim of the patent. It covers the present form of transmitters. The only escape from it for any particular transmitter would seem to be in denying variation of pressure, and in holding that simple motion of the electrodes upon each other effects the result.

The other claims are for structures. They claim transmitters with vibrating plate and electrodes in constant contact. The force in law of this "constant contact" will be seen when it is noted that the telephone decisions have virtually been based on the assumed inability to telephone by the make and break current; the assertion that constant contact is essential to the transmission of speech by electricity has now the force of law.

Private corporations are very chary of attacking the Bell Telephone Co. The limitless pecuniary resources of the great company enable it to sustain litigation with great vigor. But in the matter of the Berliner patent the Federal authorities have taken the matter in hand. A brief has been filed in the United States Circuit Court by United States Attorney-General Miller, which marks the beginning of a proceeding to annul the patent. It is perfectly obvious that for the Patent Office to receive applications for two fundamental patents, to grant one of the patents outright and to permit the other application to be kept alive for fourteen years by dilatory motions is clearly inequitable. If the present law provides no way of preventing such proceedings, a new law should be enacted. On its face the Berliner patent continues the telephone monopoly up to 1908.

In his brief the Attorney-General holds that the Berliner patent, on various grounds, should be annulled. The delay of fourteen years in taking out the patent is alleged as contrary to equity and to the plain spirit and intent of the patent law. It is on such a ground as this that success in annulling the patent would be most acceptable. A decision to this effect would be a most valuable precedent. In this aspect the case seems to be a conflict between law and equity. Patent cases are tried in equity proceedings. It is to be hoped that the full powers of an equity tribunal will be exercised by the court.

Various other allegations are contained in the complaint. It is charged that the specifications and drawings were all struck out and new ones were substituted. The Patent Office objected to the turn the proceedings were taking, and eventually an affidavit by Berliner was filed, stating that the matter in the substituted application was invented by him prior to filing the original and formed part of that invention. The filing of the affidavit is claimed to be fraudulent and to give sufficient ground for annulling the patent.

Another very curious basis of attack is furnished by the Berliner patent of 1880. In this a microphone identical with the one of the 1891 patent is described, but although a microphone, it is claimed both as transmitter and receiver. This is cited as a prior patent, and seems to be for the same invention, and hence destroys the validity of the disputed patent. The law holds that two patents for the same invention cannot both be valid. One or the other patent must lapse.

The proceedings will be watched with much interest, as the points of law involved are very interesting. The case may lead to the enactment of new laws to prevent the recurrence of such proceedings as those complained of in this action.

Progress of Electric Railways.

We are now, says Mr. Bonnett, using much larger and heavier cars and more powerful motors, and the improvements due to the great advance of the electric power industry tend to increase the efficiency of the motors and gearing employed. The development of the low speed motor will lead to one in which, for ordinary speed of street traffic, the armature can be placed directly on the driving wheel, thus dispensing with all outside losses. When this result is arrived at, which time is not far off, and either a light storage battery or a practical system of power transmission to do away with overhead wires and their attendant damages is developed, the electric street car will stand at the head of methods of surface rapid transit. As an instance of modern practice, I would quote one of the St. Louis suburban electric roads where, with modern cars and equipment, a run of 8 miles out from the city is made in 30 minutes schedule time.

Probably the largest electric locomotives yet constructed are those now being built by the Thomson-Houston Company for the Baltimore and Ohio Railroad Company to transfer passenger and freight trains through the city of Baltimore. These motors have the armatures directly on the driving axles and at a speed of 30 miles per hour make about 170 revolutions per minute.

Their principal dimensions are as follows:

Diameter of driving wheels	5 feet.
Service speed	30 miles per hour.
Size of conductors	8 sq. in. cross section.
Transmission of power	overhead trolley.
Pressure of current	About 700 volts.
Current	1,500 to 2,000 volts per motor.
Weight of locomotive	90 tons.
Electric H. P. developed	1,500 H. P.
Drawbar pull	40,000 lb.

THE Victoria railroad bridge over the St. Lawrence at Montreal is two miles long, cost over $5,000,000, and contains 10,500 tons of iron and 3,000,000 cubic feet of masonry.

[SPECIAL EDITORIAL CORRESPONDENCE OF THE SCIENTIFIC AMERICAN.]

Progress of the World's Columbian Exposition—Interesting Facts and Particulars.

When the World's Columbian Exposition is open to the public, visitors will find it difficult to realize what an active factor in completing the great Exposition women have been. From the inception of the Fair the rights of women to be represented have been fully recognized, and women have been regarded as part of the official organization, and not considered as a side show. Mrs. Potter Palmer, president of the board of lady managers, has now made a formal and official report to the board of control, in which she reviews the work done by the board of lady managers from its organization. Your correspondent has been permitted to see this report and make the following abstract:

The board of lady managers was formally organized on October 21, 1890, and Mrs. Potter Palmer chosen president. Rules and by-laws were adopted to govern the board, and a formal communication was sent to the executive committee stating the desires of the ladies as to what they considered best to do. Plans of work were immediately formulated and appropriations for a building for official and other purposes secured, and the plans of a Woman's Building, drawn by Miss Hayden, of Boston, accepted. The work of finishing and decorating the building was left to the board, and $6,000 was voted by the directors to be used for two large mural paintings for the tympans at the ends of the main gallery. These paintings are 14 feet high and 58 feet long, and their execution was awarded to Miss Casset and Mrs. MacMonnies. Since the building was completed the caryatides of Miss Yandell and the pediments and groups of Miss Ridout have been placed in position.

Women from various parts of the country and world have taken part in decorating the building. Cincinnati has donated wood carving and pottery, and furnished the main parlor. Other Ohio women have furnished and decorated a parlor. California women another room. Artists from New York furnish and decorate the library. Women from West Virginia, Kentucky and Texas have done much toward furnishing and decorating. Colorado women send Navajo blankets enough to cover the walls of the hall in which is the ethnological display. Iowa women furnish a corn palace. From the Illinois board comes $6,000 for the equipment and maintenance of an emergency hospital and exhibit of work of trained nurses. Women in France and Great Britain also have a share in decorating the building. Women from thirty-seven States, two Territories, Alaska, and the District of Columbia are interested in the work of the board of lady managers, while co-operation in the work is had by women in Italy, Germany, Austria, Russia, Algeria, Cape Colony, Cuba, Mexico, Nicaragua, Argentine Republic, Jamaica, Ceylon, and Brazil. Queen Margherita of Italy will send her choice collection of laces, containing specimens dating back 1000 B. C., while typical specimens of woman's handiwork will be exhibited from each of the countries named. Madam Diaz, of Mexico, will send an orchestra of Mexican girls in rich costumes, and they will play Mexican national airs.

The whole control and management of the Woman's Building is in the hands of women, as will also be the awarding of prizes.

Another important work that this board has undertaken is the building and maintaining of a children's building. The funds for this building and exhibit were raised by the women themselves. This will be primarily an educational exhibit. Provisions have also been made with ample facilities for caring for children while their mothers are visiting the exposition buildings. A complete list is now being compiled of the charitable, philanthropic, literary, artistic, and other organizations of women. A salesroom will also be established for the sale of woman's work of all kinds. Many exhibits will be made by women in the various State and other buildings. Another important part that women will play will be in the several congresses that are to be held. All the formal meetings of these congresses are to be held in the new permanent Art Building, now building on the lake front in the heart of the city, so it is understood, and women hold not only several congresses of their own, but also take important part in the proceedings of nearly all the congresses.

The number of fake schemes that are being worked in connection with the Exposition seems to be almost limitless, and their variety shows that a great amount of ingenuity is being expended in this direction. These schemes boldly proclaim themselves as "official." One direction in which much harm may be done by these fakirs is in the line of boarding and lodging directories and bureaus. As was stated in a recent letter, there is but one "official" bureau of public comfort, and that one is under the immediate management of the Exposition authorities. It is organized for the comfort of visitors, not for gain, and it has secured the handling of the most desirable rooms to be had in all parts of the city. Visitors are cautioned not to pay for rooms in advance, except through the advice of this bureau, because of the many fraudulent schemes which are flooding the country with enticing promises. The greatest trouble yet encountered by the Exposition authorities in connection with fake schemes has been in the matter of guides and catalogues. Any number of so-called "official" publications of this nature are being worked, much to the injury of the Exposition's legitimate publications, and more to the disgust of Chicago business men. The catalogue, for which a concession was recently granted and for which a bonus of $100,000 was put up, is permitted to take advertisements under limited conditions, and a host of advertising solicitors has been turned loose upon the advertising public all over the country. But prospects for the success of this part of the venture are not encouraging, as solicitors for the fake publications have already pretty thoroughly solicited the field of advertisers. Hardly work enough has been done on this official catalogue to make it worth mentioning, and unless exhibitors report promptly exactly as to the nature of their exhibits, the catalogue cannot possibly be completed until long after the exposition is opened.

It would appear as though coffee drinking were to be no unimportant feature of the Exposition, as a contract is just reported as closed for 700,000 pounds of coffee to be delivered as wanted for the restaurant service. In connection with this restaurant service it will be welcome news to intending visitors at the Fair to learn that all varieties of epicurean tastes and all sizes of purses are to be provided for. The company that holds the concession for the restaurant service announces that in all the important buildings will be restaurants where a wholesome lunch can be had at a counter for a small sum, or a somewhat more pretentious meal had for a somewhat larger price, while there will be more luxurious accommodations, where expensive meals as elaborate as first-class hotel service can be had with wines and other extras. The restaurant service as now planned has seating capacity for 15,000 people at a time.

Director-General Davis proposes to take steps to put an end to all attempts to get up a cholera scare in connection with the Exposition. To begin with, the drainage of the Fair grounds and the method of disposing of the sewage have been made as complete as possible—in fact, are among the most instructive of exhibits, and will be considered as important features of the Exposition. But with all this perfect outfit, Colonel Davis proposes to take no risks whatever, and he has just made an official report in which he recommends the appointment of a special corps of sanitary police of twenty-five or so men, who shall examine the entire sewerage and drainage system of the grounds twice a day and enforce rigid observance of the rules. In connection with the efforts of the Exposition authorities a citizens' committee and representatives of the city government are planning a rigorous campaign to clean the city. It is fortunate for the Exposition that the grounds are in one of the most healthy parts of the city and several miles from the most dangerous pest-breeding localities in case there were an epidemic. The present indications are that nothing will be left undone to provide every precaution for the health of the city next summer.

The damage wrought by snowslides on the roofs of the larger buildings amounts to a few thousand dollars, but makes no appreciable interference with the progress of installing exhibits. As soon as the present accumulations of snow on the roofs are disposed of, the damage can be readily repaired. The big slide on the roof of the Manufactures and Arts Building is supposed to have been started by the motion and jar caused by running a train of cars into the building. The snow had gone a distance of nearly one hundred feet before it reached the roof of the annex, and the momentum it had obtained was quite irresistible with such light work as the glass framework of the roof. The structural part of the roof was in no way injured.

A committee of insurance men has just made an official inspection of all the work done on the buildings and of the facilities at hand for fighting fire. The engineering department took the precaution at the inception of work to be in harmony with the insurance interests, and the work of construction, the installation of the electric plant and wiring and all other sources of possible danger have been carefully watched. This strictness has caused some differences with contractors, but in no respect whatever has work been intentionally slighted. In every instance the question has been security, not cheapness. The fire department has grown as work has progressed and now comprises three steam engines, four chemical engines, forty hose carts, with an abundance of hose, over 1,000 fire extinguishers, and a powerful fire tug. This tug was constructed with special reference to service on the lagoons. So far as water is concerned, the pumping facilities will be ample for a city of thousands of inhabitants when completed.

A dozen or two carriages have been doing a thriving business for several months in carrying visitors about the grounds. But these and all other vehicles are now shut out of the grounds, so that there shall be no hinderance from them to the rush of installing exhibits that is now so evident. The temporary drives that have been used by the carriages cross the railway tracks in several places and would interfere more or less with the running of trains. The many trucks which handle exhibits will now have full use of the driveways at each of the buildings. This order also prohibits visitors in the grounds from entering any of the buildings, both as a protection to exhibits and to prevent interference in the work of placing the exhibits.

The cold weather and heavy snow storms during the first half of the month very materially affected the progress of the work at the park. Very little out-door work could be done, and the force of men employed was less than 5,000. Many car loads of exhibits got delayed on the road, still further hampering progress. These belated exhibits are now coming into the park by trains, and the number of men employed is being rapidly increased. It is expected that they will aggregate about 15,000 men by March 1. A customs department has been established, with a force of inspectors that will soon aggregate 20 men.

An occasional threat comes from "organized labor" to boycott the Fair because it cannot dictate as to how things shall be run. Cigar makers are aggrieved because the authorities would not rule that only union-made cigars should be sold in the grounds. In this connection, it should be said that smoking will be closely restricted because of possible dangers by fire. Another threatened labor trouble has been with the painters. They are aggrieved because of the use of a small machine for painting. Two men, with one of these machines, can do as much work as 25 or 30 men with brushes. There are not painters enough in Chicago to complete the work without the use of these machines, so that the excuse for a strike is very slim.

Auditor Ackerman has made a statement of the finances of the Exposition, in which he shows that $14,593,317.14 have been spent. Of this amount, construction alone has cost $12,649,072.59. The expenses for the month of January were $1,131,284.30.

The work of construction is now practically done, except in the case of some minor structures. The great passenger station at the railway terminal still has much staff work to be done, as the intensely cold weather came at a time when this work was scarcely begun. The staff, however, has been made ready, and it is only a questton of two weeks or so in putting it in place. Music Hall is only in the frame as yet.

Dr. Norvin Green.

On February 12, at 7 A. M., Dr. Norvin Green, president of the Western Union Telegraph Company, died at his home in Louisville, Ky. He was born in New Albany, Indiana, April 17, 1818. Early in life he was taken by his parents to Kentucky. There he received his early education. In 1840 he graduated with honors from the University of Louisville, as a doctor of medicine. He soon became physician to the Western Military Academy, Drennon Springs, Ky. James G. Blaine was then one of the junior instructors there. For a number of terms he was a member of the State legislature, and in 1853 he was United States commissioner in charge of the construction of the national building in Louisville. While holding this position he became one of the lessees of the United Morse and People's Telegraph wires, connecting Louisville and New Orleans. The companies were united under the title of the Southwestern Telegraph Company. This marks the beginning of his connection with the telegraph interests of the country. In 1866, when the Western Union, United States, and American lines consolidated, he was chosen vice-president. With some intermission he held this and a similar position until on April 23, 1878, he was elected president of the Western Union Telegraph Company. This position he held to his death. He was a man of high executive ability, having the art of doing a great deal without exhausting himself under the great responsibilities of his position.

Esparto Grass.

Esparto grass has recently been recommended for introduction into the United States as a fiber plant. It is a native of Spain, Portugal, Greece, and Northern Africa, thriving upon sand and gravel in arid situations, and growing especially well on limestone and gypseous soils. It is not cut, but pulled, sometimes twice a year. It can be grown either from seeds or divisions of the roots. Ten tons of dry esparto, worth from $20 to $25 per ton, can, under favorable circumstances, be obtained from an acre. In Spain, where now the product amounts to from 70,000 to 80,000 tons annually, it formerly ran to waste or was used only as fuel. Now, such is the demand for it, that land considered valueless a few years ago is worth thousands of dollars. About 60,000 tons are sent to Great Britain annually from Spain. In the latter country it is used in the manufacture of ropes, baskets, sandals, matting, etc., while in England it is largely used in making ropes and paper. Good writing paper is made from it without the admixture of any other material, and the price of this paper varies from $200 to $250 per ton. There is certainly an opening in this country for some enterprising individuals to grow this grass.—*J. F. J.*