

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors

PUBLISHED WEEKLY AT NO. 37 PARK ROW, NEW YORK.

O. D. MUNN.

A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, postage included. \$3 20
One copy six months, postage included 1-60

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at \$3.20 each; additional copies at same proportionate rate. Postage prepaid.

Remit by postal order. Address MUNN & CO., 37 Park Row, New York.

To Advertisers.—The regular circulation of THE SCIENTIFIC AMERICAN is now Fifty Thousand Copies weekly. For 1880 the publishers anticipate a still larger circulation.

The Scientific American Supplement

is a distinct paper from THE SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, with handsome cover, uniform in size with THE SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, \$5.00 a year, postage paid, to subscribers. Single copies 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of seven dollars. Both papers to one address or different addresses, as desired.

The safest way to remit is by draft, postal order, or registered letter. Address MUNN & CO., 37 Park Row, N. Y.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1.) Most of the plates and pages of the four preceding weekly issues of THE SCIENTIFIC AMERICAN, with its splendid engravings and valuable information; (2.) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, \$5.00 a year, sent prepaid to any part of the world. Single copies 50 cents. Manufacturers and others who desire to secure foreign trade may have large and handsomely displayed announcements published in this edition at a very moderate cost.

The SCIENTIFIC AMERICAN Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO., 37 Park Row, New York.

NEW YORK, SATURDAY, JANUARY 10, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

Table listing various articles such as 'Basket fish, the', 'Cold? what is it', 'Drown, why', 'Eggs, silkworms', 'Electric light, Edison's latest', etc.

TABLE OF CONTENTS OF THE SCIENTIFIC AMERICAN SUPPLEMENT No. 210.

For the Week ending January 10, 1880.

Price 10 cents. For sale by all newsdealers.

Table of contents for the supplement, categorized into sections: I. ENGINEERING AND MECHANICS, II. TECHNOLOGY AND CHEMISTRY, III. ELECTRICITY, ETC., IV. MEDICINE, HYGIENE, ETC., V. AGRICULTURE, ETC., VI. MISCELLANEOUS.

THE FUTURE OF THE TELEPHONE.

There is nothing more characteristic of the present age than the avidity with which it seizes upon and puts to practical use the discoveries of science and the infinite marvels of invention. To-day the experimental student wrests from the secret treasures of the universe a new truth, a new law, a new manifestation of force. To-morrow a countless host of printing presses spread a knowledge of the discovery to the earth's remotest bounds. Directly it is made a working factor in the world's best thought and action; in a little while some practical mind puts the harness of utility upon the new truth, and straightway the world is the richer by another useful invention. What would formerly have taken centuries to accomplish—or what the most fearless minds would scarcely have dared to dream of undertaking—is now done in a day. The invention is achieved, and finds a world pre-disposed to receive it with gladness, even though its adoption should necessitate many and radical changes in the whole range of national and social customs. It took the steam engine centuries to pass from the stage of science unapplied to that of practical utility. The telegraph was not so many years in rising from the level of scientific experiment to that of a useful factor in the daily affairs of nations. What the telegraph accomplished in years the telephone has done in months. One year it was a scientific toy, with infinite possibilities of practical use; the next it was the basis of a system of communication the most rapidly expanding, intricate, and convenient that the world has known.

One of the most notable occurrences of our Centennial year was a little gathering of scientific men from various parts of the world to test the performance of a new scientific invention of which wonderful stories had begun to be told, especially with regard to what it was going to do. To the astonishment of all it did do marvelous things. A little disk of metal could be made to speak; still more, the operator might be miles away, and exerting power only through his vocal organs. With a couple of magnetic cups and a slender wire spoken messages were transmitted through considerable distances and delivered in tones so like those of the speaker that his personality could be detected by the sound of his voice, if it had ever been heard before. Though far from perfect, the speaking telephone was an assured fact, and a new era in social and business communication had dawned. Scores of active minds at once set to work upon the problems to which the telephone gave rise, and hundreds soon joined them. In a little while the telephone in various forms was in the hands of progressive men in every part of the world.

It was tried as a means of uniting more or less widely detached portions of business houses, as the salesroom and the factory, and proved a great success. As a means of social and professional communication it was equally satisfactory. The next step was to form little clusters of telephonic communicants; the wider and more varied the business callings of the members of the group and the more numerous its membership the greater was found to be the utility of the system. But it soon outgrew manageable proportions without some system of centralization. The telephonic exchange, or central office, was a natural and necessary result.

Thus a new business sprang into existence almost in a day, with no end of scientific and practical problems to solve. The machinery and working methods of the telephonic exchange are sufficiently explained and illustrated in another portion of this issue of THE SCIENTIFIC AMERICAN. With the information there given one can form some idea of the present and prospective development of the system. From the little room figured, as many as six hundred lines (with an aggregate mileage of 650 miles) reach out to the offices and homes of as many subscribers in various parts of New York, Brooklyn, Jersey City, Newark, Orange, and connections are making or in immediate prospect with all other adjacent towns of any size. New lines are being added at the rate of five a day, and every new wire widens the range and increases the value of every other wire in the system. Very soon the Philadelphia exchange will be connected with that of New York, and then any subscriber in either city or its suburbs will be able to communicate directly with any subscriber in the other. Already from four to five thousand calls are made upon the exchange daily, during business hours, and the system has scarcely begun to occupy the vast field that lies open for occupation as rapidly as telephones and connecting wires can be set up.

The limits of our space forbid any attempt even to summarize the infinite range and variety of possible telephonic communication. Its scope is as wide, as limitless indeed, as is the range of communication possible between men. Any question that a business man may have occasion to ask of another, any instruction he may wish to give to a distant subordinate, any message that a boy can carry, and that may be written, falls within its province. Even at the low average of a mile for the distance between the widely separated subscribers in this city the five thousand daily communications mean five thousand miles of travel saved for somebody. And the time gained by the saving of those five thousand miles of travel means not less than a thousand hours of the most valuable portion of the day, an average of over an hour and a half daily to each subscriber. The increase of business efficiency due to such savings of time and trouble is beyond computation.

In its infancy, with the inertia of custom to overcome, the system has developed a capacity for growth that has distanced the expectation of the most sanguine, and its

utility as well as its capacity for further development increases with every new wire, more especially with every new connecting link between central stations. Who, then, can have courage to predict even the immediate future of the system, or to attempt to forecast the social and commercial changes which the annihilation of time and trouble, and the doing away with the mediation of forgetful or erring servants, will bring in their train? Soon it will be the rule and not the exception for business houses, indeed for the dwellings of all well-to-do people as well, to be interlocked by means of the telephone exchange, not merely in our cities, but in all outlying regions. The result can be nothing less than a new organization of society—a state of things in which every individual, however secluded, will have at call every other individual in the community, to the saving of no end of social and business complications, of needless goings to and fro, of disappointments, delays, and a countless host of those great and little evils and annoyances which go so far under present conditions to make life laborious and unsatisfactory. The time is close at hand when the scattered members of civilized communities will be as closely united, so far as instant telephonic communication is concerned, as the various members of the body now are by the nervous system.

PROGRESS OF ARTIFICIAL ILLUMINATION.

The new year opens with unusual promise in regard to the future lighting of our homes and places of entertainment and business. Two novel and radically distinct systems of interior illumination are now before the public, both agreeing in offering strong assurances that relief from the inconvenience and imperfection of illumination by means of kerosene and gas is not very far away. Whether either or both will fulfill the promise of the day only time can tell. Both display a high degree of experimental success; but it is a different matter to meet successfully the more exacting requirements of every day use at the hands of all sorts of people.

One system is based on the division of light, however generated, the other on the division of the electric current and its conversion into light by incandescence. The first is the system experimentally developed by Messrs. Molera & Cebrian, of San Francisco, and illustrated in these pages some months ago. These gentlemen undertake to distribute radiant light, not the means of making light, such as gas or electricity. The system involves a central generator, whence light is transmitted in parallel beams through tubes to the places to be illuminated, and there thrown out by prismatic reflectors, and dispersed by proper lenses. In this way, the inventors claim to be able to disseminate the radiant energy of light with no greater loss of power than is experienced when the electric current is divided or when gas or oil is burned in separate lamps or jets. The system has been tried in San Francisco, and is said to work well. The inventors propose to light city streets and houses, as well as isolated dwellings, shops, churches, and the like, and are sanguine of success. To our mind, however, the system seems likely to exhibit its highest utility and economy in places where a single building is to be illuminated, and no facilities are offered for the economical employment of incandescent electric lights; this, of course, under the assumption that what is possible in laboratory experiments is practicable on a large scale and under the varying conditions of every day use. The sanitary and other advantages offered by this method of distributing light are such as to justify the strongest wishes for its practical success.

The other promising system of domestic illumination is that just brought forward by Mr. Edison, as described and illustrated on another page of this paper. To all appearances, Mr. Edison has got the lamp he has so long been searching for, and curiously it is not at all what he thought it would be a few weeks ago. In other words, the light is generated in a strip of carbonized paper and not in a spiral of platinum or other refractory metal. The light produced is perfect; the lamp is inexpensive and apparently durable; the economy of the general system in which it is used is tolerably clear; and all its details seem to have been worked out with Mr. Edison's usual cleverness and practical skill. The only question that remains undetermined at this writing is whether the lamp will stand the test of time. It seems almost incredible that a slender thread of carbon can withstand the intense heat of the lamp, even in a perfect vacuum, without volatilization or fracture; but the lamps are stated to have stood action of the current, both in ordinary and in extraordinary strength, long enough already to upset all reasonable opinion as to the behavior of carbon under such conditions, and there is now nothing to be done but to wait for time to determine what the ultimate issue will be. The fact that all its predecessors in the field of incandescence have sooner or later come to grief is the chief, if not the only one, compelling a suspension of judgment in the present case. We sincerely hope that no hidden flaw may discountenance the inventor's confident assurance of victory. The light is exactly what the world wants to see; and if it will only wear long enough to pay for itself, both the inventor and the public at large are to be heartily congratulated.

At this point it is proper to note the extreme simplicity of the new lamp and the lack of any startling novelty in its materials or construction. If the lamp justifies present expectation, it will have but one radical peculiarity, and that is success. And success, in a field beset with so many difficulties which men of science and practical experience have pronounced insurmountable, is the highest as well as the final proof of a great invention.