AMERICAN INDUSTRIES.—No. 69.

THE BRUSH ELECTRIC LIGHT.

The most difficult problems in electric lighting have been: (1). To provide an efficient and economical means of converting mechanical power into electric energy, that is,a good dynamo-electric machine. (2). To devise a generator able to evolve an electric current capable of subdivision, to supply a series of lamps in one circuit. (3). To invent a self-regulating lamp adapted to such an electric circuit, and so constructed that any accidental disturbance of it, or its extinction, would have no effect upon the other lamps in the same circuit. The lamp to be at the same time easy to keep in order, durable, and economical in power. (4). To discover an automatic method of regulating the supply of electricity so that the current would be always exactly equal to the varying requirements of the circuit. Up to 1876, when Mr. Brush produced his first dynamo-electric machine, a large number of scientific investigators and mechanical inventors had been at work upon these problems. Individually and together they had accomplished much, but there was yet no machine that could be considered a commercial success, and no lamp —certainly no system of electric lighting—that had passed beyond an experimentally promising stage. There was no machine that could furnish a current for a number of lamps, much less sustain them in one circuit with steadiness and uniformity. Very soon after Mr. Brush entered the field, he presented to the public an apparatus which was free from the defects of all other systems, and the public, waiting for just such an apparatus, welcomed the new machine, and the result is that to-day the Brush Electric Light is practically the sole occupant of the field; at least forty-nine out of every fifty lights that have been sold in this country being Brush lights. Up to the present time over 6,000 Brush lights have been sold for regular industrial use, and the business has only just opened. An idea of the great superiority of the Brush system of lighting may be obtained from the fact that with the largest sized Brush machine forty powerful electric lights are burned in one circuit, with an absorption in the machine of thirty-six horse power. We believe that no other system of lighting can maintain one-fifth of this number of lights on one circuit; and most are confined to a single light to one machine.

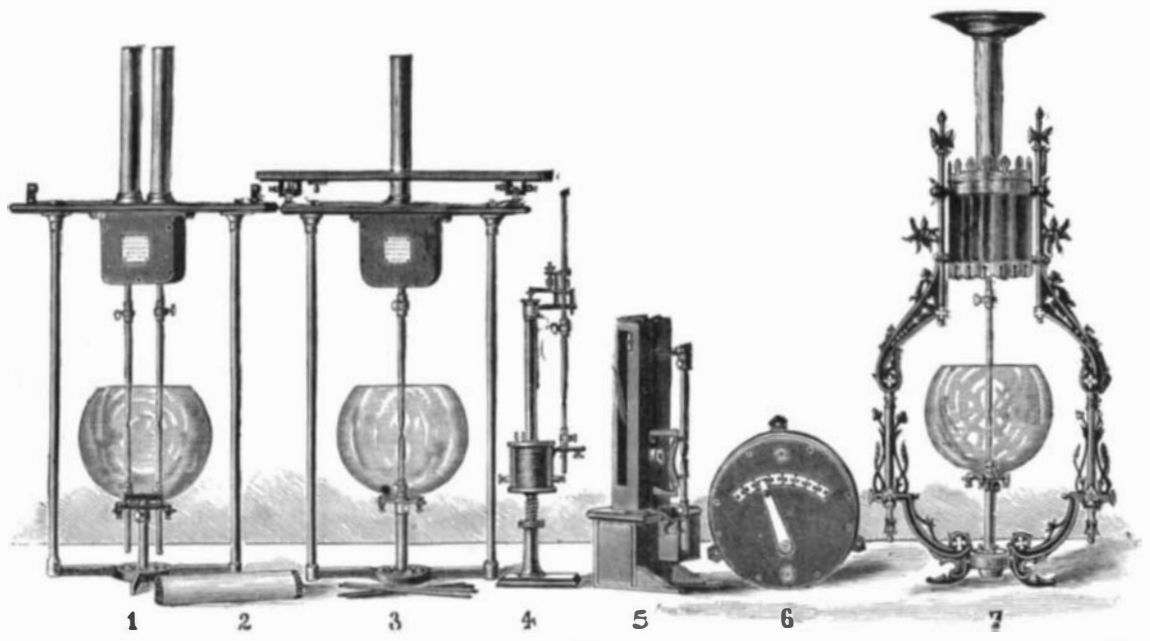
Although the Brush electric light has been introduced on an extended scale in other cities, it is only recently that it has been brought to the city of New York; but notwithstanding the tardiness of its appearance here, it is being largely introduced and used by both private individuals and the public.

Our large illustration represents the lighting station of the Brush Electric Illuminating Company of New York, at 133 and 135 West 25th street, and also shows a portion of Broadway between 14th and 34th streets, as it appears at night illuminated by twenty-one Brush electric lights.

In the same illustration we give a view of the immense factory of the Brush Electric Company at Cleveland, Ohio; also views of some of the lamps. The parent company at Cleveland controls the manufacture and sale of all of Mr. Brush's patented inventions relating to electric light or electro-plating apparatus and supplies.

The genius of the inventor of this system, and the energy and good business management of the Brush Light Electric Company of Cleveland, have done more since 1876 to place the business of illumination by the electric light upon a practical and substantial basis than has been done in this direction by all other inventors since the discovery by Faraday, at least so far as voltaic arc lights are concerned.

In every sense the Brush electric light is a practical, commercial success, and is no longer an experiment. No better proof of this could be required than the well known fact that no one can buy a Brush machine or lamp at less than regular prices. Makers of other machines may offer inducements of every kind, in the way of large discounts from regular prices, the privilege of a trial with no obligation to purchase, long deferred payments, etc., etc.; but the Brush Company takes the same ground held by George H. Corliss in regard to engines, and claims that the apparatus they furnish is no longer experimental, that it is well worth the price asked for it, and should not be compared with merely experimental systems whose principal recommendations are that they can be bought at the purchaser's own price, and may be returned if not satisfactory.



1. Double Lamp.—2. Carbons.—3. Single Lamp —4. Focusing Lamp.—5. Head-light Lamp.—6. Dial Attachment to Machine.—7. Ornamental Lamp.

BRUSH ELECTRIC LAMPS.

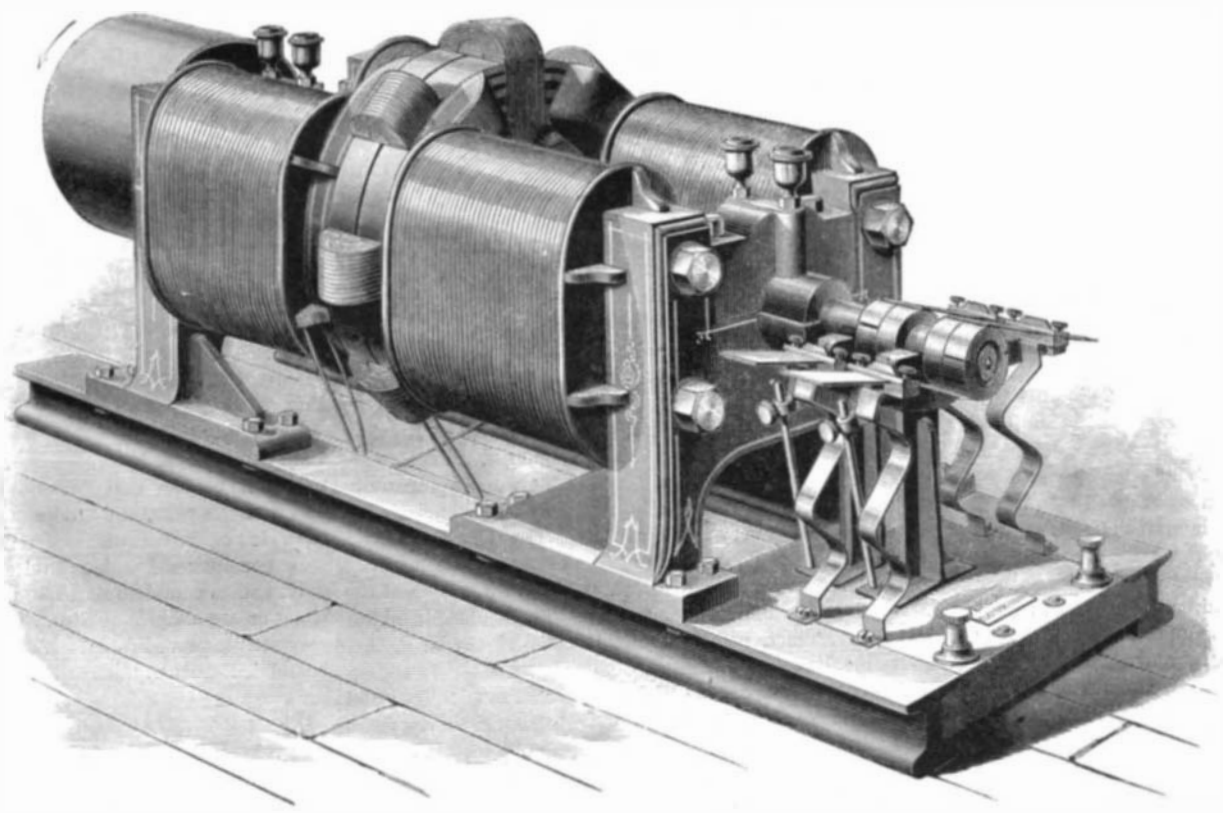
Not only has the Brush light practically monopolized the field in this country, but, if we may judge from reports, it is also rapidly doing the same abroad. It has made wonderful advances in England, where it is controlled by the Anglo-American Brush Electric Light Corporation, Limited, having a capital of $4,000,000. One year ago this company bought the English patents of Mr. Brush at a very large price, and we understand they have recently purchased all his other foreign ration—those for France, Belgium, Austria, Russia, Italy, Spain, Norway, Sweden, Denmark, etc., paying for them still larger prices than they paid for the English patents, and they now propose to commence the introduction of the Brush light into all these countries in the same business-like and thorough manner which has characterized its management from the first. The sums paid for these foreign patents are, it is claimed, greater than have ever been paid for any other foreign patents obtained by an American. As rapidly as arrangements can be made the Brush light is being introduced into every civilized country on the globe, and it seems to have found a field in every branch of industry, and in almost every imaginable situation, as the following partial list of users indicates:

There are 800 lights in rolling mills, steel works, shops, etc.; 1,240 lights in woolen, cotton, linen, silk, and other factories; 425 lights in large stores, hotels, churches, etc.; 250 lights in parks, docks, and summer resorts; 275 lights in railroad depots and shops; 150 lights in mines, smelting works, etc.; 380 lights in factories and establishments of various kinds; 1,500 lights in lighting stations, for city lighting, etc.; 1,200 lights in England and other foreign countries. A total of over 6,000 lights which are actually sold, none of them being on trial.

This system, we believe, is the only one by which a large number of powerful electric lights can be burned in series, upon a single circuit of wire, with steadiness and uniformity. The machine known as No. 8 maintains forty lights of 2,000 candle power each, upon a circuit ten miles in length of copper wire No. 6 English gauge. By using still larger wire the distance or length of circuit may be proportionately increased, it being possible to extend the circuit to twenty-five miles by using No. 1 wire. The smaller sizes of Brush machines are fully as efficient. A No. 7 machine is used in Montreal to light the harbor on a circuit of about three miles, using sixteen lights. Another peculiarity and advantage possessed by the system is that any number of lights desired, from one up to the number capable of being maintained by the machine, can be burned in circuit from the machine without changing its speed or adjusting the lamps.

Each lamp of the Brush type is provided with an automatic cut-out, which is one of the valuable features of the system. If from any cause a lamp in circuit becomes deranged so that its carbons do not feed together properly, or if the carbons need renewing, the cut-out mechanism is called into action and this particular lamp is switched out of circuit without disturbing any other lamp in use. When this lamp has been supplied with carbons again and put in order it will burn as before. This simple cut-out mechanism effectually guards against all the dangers of general extinction of lights, a thing liable to occur in all other systems. We believe that no other system uses a cut-out.

When it becomes desirable to operate lamps more than seven or eight hours continuously, the double lamp shown in our large illustration is used, and two sets of carbons are employed. Both carbon rods are actuated by a single magnet, the same as that employed in a single lamp, and they are so arranged that when one set of carbons is completely consumed, the other set is automatically switched into circuit. In practice the transfer of the voltaic arc from one set of carbons to the other is instantaneous and scarcely noticeable. By means of these double lamps a system of lights may be maintained in continuous operation from fourteen to sixteen hours without requiring any attention, whereas other systems are limited to six or eight hours' continuous burning



BRUSH DYNAMO-ELECTRIC MACHINE.

The great simplicity and durability of the machines are points of importance in considering the wear and tear from constant use. The experience of the four years shows that one per cent allowance for wear and tear is ample to cover, and that with even a less amount annually spent upon the machines they will last indefinitely.

The business of the Brush light on Manhattan Island is in the hands of the Brush Electric Illuminating Company of New York, a corporation organized under the laws of the State, with a capital of $1.000,000. The officers are: W. L. Strong, President; A. D. Juilliard, Vice President; A. A. Hayes, Jr., Secretary; S. B. Sturges, Treasurer; C. M. Rowley, General Manager; R. J. Sheehy, Superintendent.

The first lighting station of the company is at Nos. 133 and 135 West 25th street. It contains at present five dynamo-electric machines, the largest of which is 89 inches long, 28 inches wide, and 36 inches in height, and weighs 4,800 pounds, and runs at a speed of about 700 revolutions per minute. It is believed to be the largest machine in the

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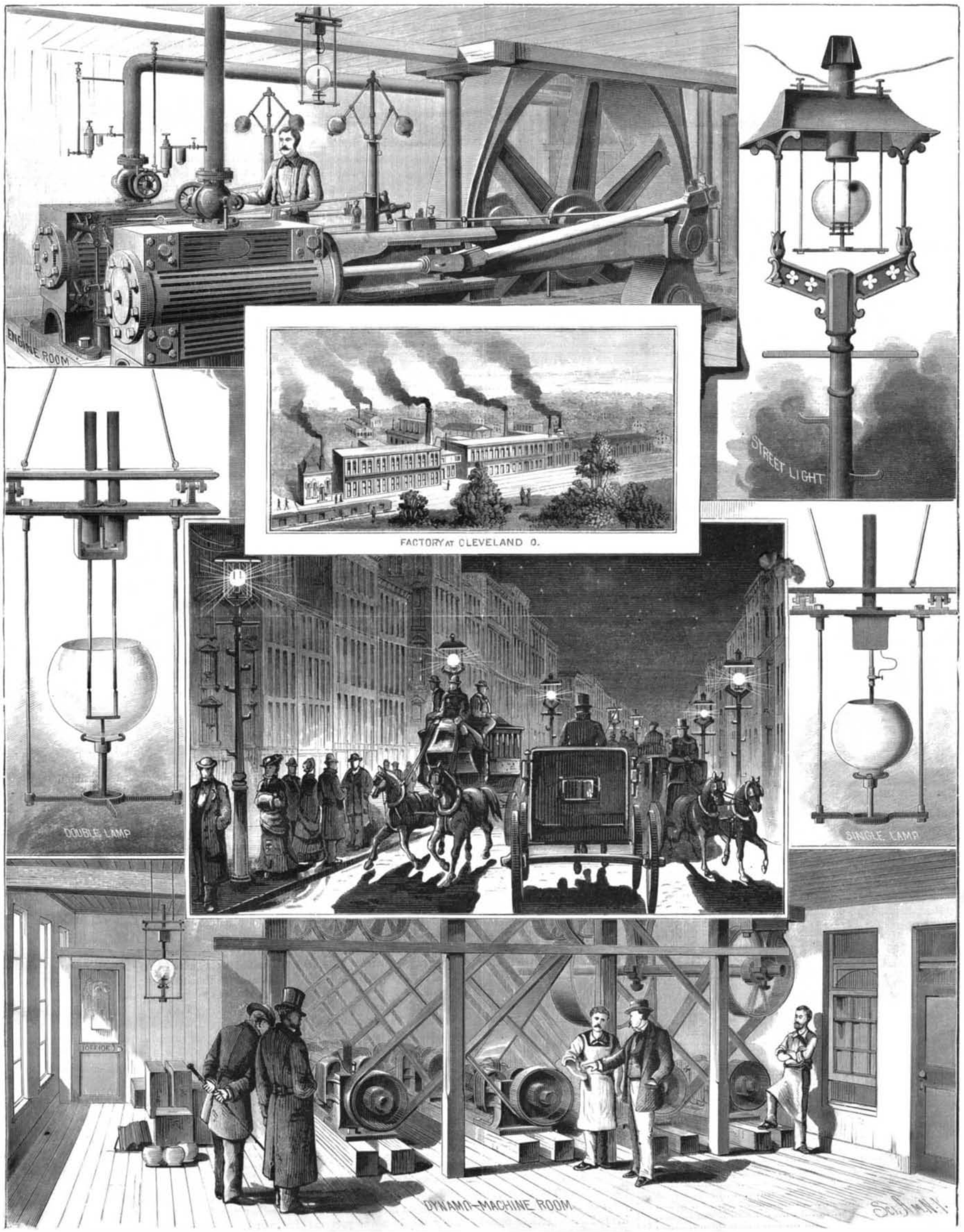

THE BRUSH ELECTRIC LIGHT STATION—STREET ILLUMINATION IN NEW YORK.—[See page. 211.]

world. Forty lights are fed by it, and it requires 36 horse power. Several circuits are connected with this station, one exclusively for lighting parks and streets. Broadway, from 14th to 34th street, is lighted from there. Among buildings in this district are the Sixth Avenue Elevated Railroad, the Sturtevant House, the Gilsey House, the Standard Theater, Daly's Theater, the Bijou Theater, the Aquarium, Aberle's Theater, Koster & Bial's, the *Herald* office, and many others. The company runs wires from this station to any point within a radius of two miles, putting up the light in any desired place, and renting in the same manner as is done with gas.

The street lighting is done by means of double lamps on iron posts twenty feet in height, and in plain glass globes. It is proposed to extend this materially and to use the larger lights, elevated on poles, for open spaces, as is now done in the West. This company has had much success in lighting large buildings for balls, such as the Academy of Music, Madison Square Garden, etc., using opal and lemon colored globes, giving a hue to the light which is approved by the fair sex.

The establishment of lighting stations in cities and towns for the illumination of streets, parks, open spaces, depots, docks, stores, hotels, factories, etc, is enlisting very large amounts of capital, and promises to be a business as profitable and as eagerly sought after by capitalists as gas companies have been heretofore. Companies have already been formed, or are about to be formed, for the establishment of such lighting stations in the following cities and towns: New York, Philadelphia, Boston, Baltimore, Washington, Providence, Albany, Hartford, New Haven, Meriden, Rochester, Buffalo, Cleveland, Cincinnati, Dayton, Indianapolis, Columbus, Middletown, Detroit, Grand Rapids, Chicago, St. Louis, Denver, Salt Lake City, Ogden, Butte, San Francisco, etc.

It is only a question of a few months before similar companies will be formed, and similar lighting stations established in every city and town of any pretensions in the country. In all of the above places the Brush light is to be exclusively used.

The general plan of operations in all these lighting stations will be similar to the one in New York, which, briefly described, is as follows: A location is first selected as central as possible with reference to the territory to be lighted; sufficient space must be provided for engines, boilers, heater, pumps, shafting, belting, pulleys, etc.; space is also to be provided for the dynamo-electric machines with the necessary wires and connections. As the steadiness and quality of the light are dependent entirely upon the steadiness of the power, care is taken to provide for this by the use of engines of approved make, with automatic cut-offs and other modern appliances for producing steady motion. The central station having been thus equipped, copper conducting wires are run from it on poles, on house tops, or underground, to the various points or places where light is needed.

The light is furnished and charged for in proportion to the amount used, and this is readily ascertained by noting the consumption of carbons in the lamps, which is sufficiently uniform for this purpose. When the engines in the lighting station are started the electric light machines are put in motion, and the electricity passes over the wires, and produces a light in each lamp in circuit. An automatic governor or regulator is provided for each electric machine, and this is so constructed and so connected to the machine that, without changing the speed of the machine, any number of lights from one up to the number capable of being produced by the machine may be burned without any disturbance or interference, either in the machine or in the lamps. By means of this simple and admirable contrivance any of the lamps in circuit may be turned off or turned on without increasing or diminishing the light in any of the other lamps in the circuit. From this description it will be evident that a lighting station of this character affords practically all the facilities provided in the use of gas, for the electric lamp may be turned on and off at the lamp itself as readily as if it were a gas burner. The lighting of interior spaces is in this way fully provided for in a practical manner.

In the matter of lighting streets and open spaces electric light possesses many advantages not possessed by any other illuminating agent. The electric lamps can be placed on top of lamp posts of moderate height, as in the lighting of Broadway, New York, each electric light providing for the illumination of a space two hundred to three hundred feet in diameter; or the lamps may be placed upon towers at a considerable elevation above the ground and above adjoining buildings, as is done in Wabash, Indiana, and Akron, Ohio; each light, or group of lights, providing for a general illumination over an area a mile or more in diameter. Either of these plans is perfectly practical and successful, and both have been thoroughly tested. For the lighting of cities and towns of moderate size the latter plan is the most economical, and will, no doubt, be very largely adopted. The town of Wabash, Indiana, was the first in the world to light its streets wholly in this way, and they find that four Brush lights, of 3,000 candle power each, placed on an iron flagstaff on the dome of their court house, at a height of about 130 feet above the ground, are sufficient for the general illumination of an area from one half to three quarters of a mile in every direction. Some of the streets are, of course, much better lit than others, although they are not nearer to the lights, because the light is not intercepted by intervening buildings. It is stated, however, that even in the streets where no direct light falls, and where the shadows are greatest, there is yet enough diffused light to permit of getting around without the use of other light. It is also stated that even at a distance of two miles from the lights there is a sort of general illumination produced which is of considerable value.

By placing a sufficient number of powerful electric lights upon towers high enough it is no doubt possible to produce an amount of light that would be practically as efficient as daylight for the lighting of all spaces within a reasonable distance of such towers. A sufficient amount of light could be thus provided to light the interior of buildings and dwellings sufficiently for ordinary purposes. This is the plan that has been proposed for the lighting of the Capitol and its surroundings at Washington.

It is proposed to place upon the dome of the Capitol, and upon six towers surrounding it, at a distance of 1,000 feet from it, no less than 450 electric lights, each of 6,000 candle power, or a total light of 2,700,000 candle power, equal to 200,000 four foot gas burners. The effect of such an enormous massing of light at such a distance above the ground and surrounding buildings would produce a surprising effect, and within a considerable area would, no doubt, be practically equal to daylight. If this plan is carried out the Brush light will be used. This subject will be brought to the attention of the next session of Congress.

The Brush Company have not yet taken up that branch of electric illumination known as incandescent lighting, because the voltaic arc system has so far proved vastly more economical than any possible incandescent system for the lighting of streets and large parks, buildings, manufactories, or halls. A single example will illustrate this fact. None of the advocates of incandescent lighting claim that their usual size of lights are any more powerful than an ordinary four or five foot gas burner; and wherever incandescent lights have been used at all practically, as at the Equitable Building in New York, each incandescent light has not certainly more than replaced one gas burner. The usual claim made by those who are interested in this system of lighting is that from five to seven lights of this size can be produced by the expenditure of one horse power. Others claim that four lights per horse power is as much as can be realized in practice. Assuming, however, that five can be produced from one horse power, it would appear that no less than 29 horse power would be required to supply 144 incandescent lights in the place of the 144 gas burners formerly used in the dining room of the Continental Hotel in Philadelphia. It is a fact, however, that this dining-room has for a long time been lit, much better than with gas, with two Brush arc lights, which, by actual dynamometer measurement, require *two horse power*—one for each light, or 15·48 horse power for the 16 lights used in the hotel. The Grand Pacific Hotel, in Chicago, replaces 571 gas burners with 16 Brush arc lights, requiring 16 horse power. If lit by the incandescent light no better than by gas, 114 horse power would be required, or, according to the figures of one prominent inventor in this line—7 lights per horse power—it would require about 82 horse power. This enormous difference in favor of the arc lights, where much light is required, will necessarily confine the small incandescent lights to small uses, where but few gas burners or lamps are now used. We are assured that when in the opinion of the Brush Company incandescent lights can be profitably and economically used they will take up that branch and be prepared to supply the market.

The officers of the Brush Electric Company (the home company) of Cleveland, Ohio, are as follows: General Mortimer D. Leggett, President (formerly Commissioner of Patents); George W. Stockly, Vice President, Treasurer, and Business Manager; F. K. Collins, Secretary; Nathan S. Possons, Superintendent; W. J. Possons, Assistant Superintendent. Agencies for the sale of apparatus and supplies have been established in all sections of the country. The most important of these are: the Brush Electric Light Company of New England, who control all territory east of 77° longitude, except Manhattan Island, of which company Mr. Lyman P. French, of Boston, is President, and Mr. Charles M. Rowley, of New York, Treasurer and General Manager. Mr. Rowley has been of the greatest assistance to the home company in the management of their Eastern business, of which he has certainly made a very great success. The Brush Electric Illuminating Company of New York controls the territory of Manhattan Island, and is pushing the introduction of the Brush light in this city vigorously. Their office is at 860 Broadway, which is also the main office of the N. E. Co., above mentioned. The N. E. Co. has branches at 5 Pemberton square, Boston; 430 Walnut street, Philadelphia; and in Baltimore and Washington. At Pittsburg the business for that vicinity is managed by Ridall & Ingold, 224 Liberty street. Chas. E. Stockly, at Rochester, is the agent for Western New York and Northwestern Pennsylvania. Other agencies are the Brush Electric Light Company, of Cincinnati; W. W. Leggett, 88 Griswold street, Detroit; M. C. Bullock, 84 to 90 Market street, Chicago (for the Northwest); the Brush Electric Association, 421 Olive street, St. Louis (for the Southwest); Colorado Electric Company, of Denver, Colorado; Salt Lake Power Light and Heating Company, of Salt Lake City; California Electric Light Company, of San Francisco, and others.

We publish in SUPPLEMENT 274, April 2, a monograph by Mr. Brush, giving a full scientific description of his apparatus and its mode of operation, illustrated with cuts and diagrams; also profusely illustrated articles from foreign journals on the same subject.

AGRICULTURAL INVENTIONS.

Certain improvements in that class of sulky plows having the plow beam supported by adjustable hangers arranged on a suitable frame extending back of the seat, and provided with vertical adjustment for raising and lowering the plow, have been patented by Messrs. Samuel M. Robertson and Augustus A. Hamilton, of Lynnville, Iowa.

Mr. Owen Davis, of Sullivan, Ind., has patented a separator for grain, etc., so constructed as to drive off the chaff and straw, separate the larger and smaller kernels of wheat, separate the split kernels of wheat, and the cockle and cheat from the grain, separate red clover seed, timothy seed, and red top seed from the grain and from each other, and to separate the larger kernels of oats from the smaller kernels.

Mr. Fred Aldred, of Glencoe, Ontario, Canada, has patented a swinging churn, having supporting springs, made in S shape, and attached to the ends of the churn above the central line; by this means the churn body is supported and allowed to vibrate.

An improved method of raising tobacco plants has been patented by Mr. James M. Dunkum, of New Canton, Va. The object of this invention is to protect the plants from the ravages of the tobacco fly or bug. The invention consists in protecting tobacco plants from the tobacco fly by surrounding the bed with logs, covering the bed with brush, and applying to the logs a mixture of whisky or alcohol, gum camphor, oil of peppermint, and linseed oil.

Mr. Lorenzo P. Teed, of Erie, Pa., has patented an improved ladder, designed especially for use in picking fruit from trees, but which may be used to advantage for any of the purposes for which ladders are required.

Mr. Philip H. Long, of Newark, N. J., has patented a separable button so constructed that the head and foot can be readily connected and disconnected, that the buttons will not turn in the button holes, and in which the fastening mechanism is connected with the foot, so that any kind of heads can be used.

Treatment of Carbuncle by Carbolic Acid.

In the Toledo *Medical and Surgical Journal*, December, 1880, Dr. J. T. Woods writes:

It is now about two and a half years since a patient presented with two carbuncles, one on the back of the head, the other below it, on the neck. They were of moderate size only, the upper one open in three places, while in the lowest the skin was unbroken.

Having considered the various known properties of the carbolic acid, I determined to use it vigorously instead of inserting it in meager quantity. I loaded my hypodermic syringe, and passing the point through the openings and into the sloughing mass in every direction, I completely saturated it with the pure acid and awaited results. In a minute the smarting disappeared and with it all pain and all sense of soreness.

By this result emboldened, I again charged my instrument, and thrusting it through the skin over the other carbuncle, in a variety of places, I soaked the whole carbunculous mass beneath the skin, enough of necessity escaping to fully bathe the borders, modify inflammation, and destroy any septic elements then developed. I waited, not without concern, and was delighted to learn in a few moments that all the pain and soreness was gone in this also. The skin over the mass became quickly white, hard, and dead, and in a few days detached, in the form of a slough, the interior mass also becoming rapidly loosened, only requiring the cutting of a few shreds to remove it, when the cavity was found to present a satisfactory appearance and rapidly filled up, leaving an exceedingly small cicatrice. The remarkable feature in this case was that after the complete saturation of the carbunculous mass no pain occurred, my patient going about his ordinary labor without discomfort. It is now one year since I treated a very painful case, the same method bringing about similar results, the party suffering no pain or even soreness after the lapse of one minute following the injection.

In making this suggestion, which, so far as I know, is new, I am conscious of the insufficiency of my cases, but I am so sure of its efficacy that I shall at once resort to it when case and occasion offer, and advise others to do so, at least until the value of the measure is determined.

In conclusion, I would advise the use of the pure acid only, and to complete saturation. Dilution would increase, if not create, danger of absorption of the acid, converting a very simple procedure into a condition of great danger, and insufficient quantity defeat the purpose for which it is used.

The Tides of Electricity.

Mr. Alex. Adams, one of the officers of the British Post Office Telegraph Department, has discovered the existence of electric tides in telegraph circuits. By long continued and careful observations he has determined distinct variations of strength in those earth currents, which are invariably present on all telegraphic wires, following the different diurnal positions of the moon with respect to the earth.

The Geological Survey.

Mr. Clarence King has resigned the directorship of the Geological Survey. The reasons given for the step are two: The administration of the office left him no time to pursue his investigations, and he believed that he could be of greater service to geology if unencumbered by executive duties and responsibilities. Major J. W. Powell is named as the probable successor of Mr. King.