EQUIPMENT OF THE BROADWAY CABLE LINE WITH ELECTRICITY.

In recent issues of the SCIENTIFIC AMERICAN we have described at considerable length the important changes which are being made in the great system of surface roads owned and operated by the Metropolitan Street Railway Company. These changes include the construction of four important north and south lines of railway on the underground trolley system on Second, Fourth, Sixth, and Eighth Avenues, with connecting cross lines at Fifty-ninth and Canal Streets, the changing of the Broadway and Lexington Avenue lines from the cable to the underground trolley system, and the equipment of a crosstown line from the Hudson to the East River with compressed air motors. When the work which the company has now in hand is completed, 90 miles out of the total of 228½ miles owned by the company will be mechanically operated. In the course of time it is intended to apply electric traction to the whole system, with the exception of some crosstown roads. If the use of the compressed air motor on the Twenty-third Street line shows good results, it will be adopted on other crosstown lines.

The electric roads are entirely new construction, the old horse car tracks having been removed in toto to make way for the cast iron yokes and massive 107-pound rails which are the standard construction for all the new electric roads. On the Broadway road, on the other hand, the whole of the original track construction is available, and the changes are confined to laying of the cable ducts and bolting the conductor rails to the lower flanges of the slot rails within the conduit.

The ducts are laid in a trench which is excavated at the side of the tracks and slightly under them, as shown in the accompanying illustration, Fig. 1. Two kinds of duct are used, one consisting of riveted sheet iron pipe about 4 inches in diameter, lined internally with cement, forming the top layer of twenty pipes, the other being made of terra cotta in short lengths of about 2 feet.

The object of these numerous ducts is to carry independent conductors to different sections of the road, providing current in case of accident to one section, to all the others reducing to a minimum the possibility of delay on long stretches of road at a time.

The terra cotta ducts are preferred for the high tension current cables. In laying the ducts, the bottom of the trench is leveled and covered with from 4 to 6 inches of concrete. The ducts are then arranged symmetrically in layers and cement grout is run in between them to fill up the voids and bind the whole mass together. The sides and top are also concreted in, thus insuring that the continuity of the several lines of duct shall be preserved unbroken. Piles of these ducts will be observed on the sidewalk to the left ready to be placed in position. This work of transformation is going on without the least interruption to the regular cable traffic.

The conductors consist of two lines of T-shaped rail weighing 21 pounds to the yard, which are suspended below the cable slot by means of insulators attached to the lower flanges of the slot rails. The insulator consists of a circular cast iron cup, provided with lugs by which it is bolted to the slot rails. Within this cup is another of porcelain, which is held firmly within the cast iron cup by cement. The porcelain cup holds a 1⅛-inch wrought iron shank to which the conductor T-rail is bolted.

To enable the conductor rails and their supports to be put in place, two handhole boxes are being placed, one on each side of the slot, at every 15 feet of the Broadway track. The conductor rails will be in 30 foot lengths, so that it will be possible to slide them into the conduit at the handholes. They will be supported at the ends and at the middle. After the insulators and conductors have been passed in through the handholes and bolted up and the wiring to the cables in the ducts completed, the Broadway road will be ready for the electric cars, which will commence running early in 1899.

The present Broadway cars can be utilized by equipping them with motors, and replacing the present grip by an electric plow. It is probable, however, that new and larger cars of the type at work on the present electric roads of the company will be supplied for this, the most important artery of travel in New York city.

In the underground trolley system as now being installed the track rails play no part in the electric circuit. The current is conveyed to and from the motor by means of the plow, one side of the plow receiving the current from the feed conductor and the other side delivering it to the return conductor. The shank of the plow consists of three steel plates, the outer plates being ⅛ inch and the inner plate $\frac{3}{16}$ inch in thickness. The conductors, which are wrapped copper ribbons, are carried down through the plow to the contact shoes or wipers, connection being made between them by flexible cables. The shoes are of cast iron and measure 4 inches by ½ inch. They are kept in contact with the conductor rails by means of side steel springs which keep the shoes 8 inches apart when free and 6 inches apart when they are in contact with the conductor rails. It has been found that a pressure of about 6 pounds is sufficient to insure good electrical contact between shoes and conductors.

The engraving, Fig. 2, shows a portion of the new underground trolley road in course of construction in Canal Street. Under the slot is seen the sheet iron drain tube and to the right another form of terra cotta ducts, each section having four tubes about 6 feet long. By comparing it with the view of the Broadway road it will be seen that the new track is considerably heavier. The rails, weighing 107 pounds to the yard, are not only the most massive used in any street railway, but they are several pounds heavier than the largest rails used on the steam railroads, where the most massive rails do not exceed 100 pounds to the yard. This is the weight of the rails on main line of the New York, New Haven, and Hartford Railroad and on certain stretches of the New York Central and the Pennsylvania Railroads.

Current for the whole of the underground system,

1.—LAYING DUCTS FOR ELECTRICAL EQUIPMENT OF BROADWAY CABLE ROAD.

2.—CONSTRUCTION OF NEW UNDERGROUND TROLLEY ROAD ON CANAL STREET, NEW YORK CITY.

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including the Broadway line, is eventually to be furnished from one great central station at Ninety-sixth Street and the East River. It will have a capacity of 70,000 horsepower, or over four times that of any existing power station in this country. The plant will consist of 87 water-tube boilers of 800 horsepower each; 11 cross-compound engines, each of 6,600 horsepower; and 11 direct connected three-phase alternating current generators. The current, at 6,000 volts, will be led to 8 substations, conveniently located with reference to the various lines. Here it will be converted by static and rotary converters to a pressure of 550 volts, at which it will pass to the conductors.

Military Firearms.

The military attachés of the United States army abroad report, says The New York Post, that a number of foreign countries have decided in favor of the adoption of the Spanish Mauser rifle, as a result of the showing made in the Spanish-American war. According to the information received, the following countries will use the Mauser rifle exclusively: Turkey, Argentine Republic, Chile, Mexico, Sweden, and Brazil. The only country to take up the Krag-Jorgensen rifles is Norway. Several of the first named countries were ordering a limited number of the Mauser rifles before last summer, but the decision to adopt this arm exclusively has, in a number of cases, been only lately reached. Brazil, Chile, and Mexico will employ the caliber of 0·276-inch; Turkey and the Argentine Republic have decided upon the caliber 0·301-inch. Sweden will use a caliber of 0·256-inch. The Krag-Jorgensen adopted by Norway will have a caliber of 0·256-inch. The caliber of the United States arm is 0·30-inch.

The Loewe works at Berlin have the orders for the majority of the Spanish Mausers. It was this establishment which first developed the gun, and the Spanish army was partially equipped with weapons made at the German works and partly at the arsenal at Oviedo, Spain. The Spanish Mauser is an improved Belgian Mauser. The gun is essentially a German weapon, the term "Spanish" being applied to the model which was adopted by the Spanish government. The gun is held to be free from objectionable features which characterize most magazine arms and it is considered by military men on the Continent to be the best army weapon in existence.

The militia and volunteers of Canada are now equipped with the Lee-Enfield magazine gun, which is an improvement on the Lee-Metford now in the hands of the British line regiments. The Lee-Enfield has but five grooves and the Lee-Metford seven, and the rifling is sharper and the depth of the grooves is increased from 0·003-inch to 0·005-inch. The alterations in the gun were largely caused by the erosive effect of cordite. One of the new rifles has been fired 13,000 times and still gives good results.

The Chief of the Bureau of Ordnance of the Navy Department, Captain Charles O'Neil, is making every effort to secure a common caliber for the guns of the army and navy of the United States, and he is backed in the matter by many ordnance experts. The present navy gun has a caliber of 0·236-inch. While the weapon gives splendid ballistic results, it is not a favorite for rough service. The necessity for a common caliber gun is almost too evident for discussion. Thus, while the vessels of Rear Admiral Dewey may have their magazines filled with cartridges of 0·276 caliber, yet these cartridges are useless to our troops in the Philippines should the latter run short of cartridges. The joint board appointed to consider the subject has just reported favorably, but does not deem an immediate change of vital importance.

Something About the Chinch Bug.

The United States Department of Agriculture has in press and will soon issue Bulletin No. 15, Division of Entomology, entitled "The Chinch Bug." The chinch bug is one of the most destructive insects with which the American farmer has to contend, and the department receives many requests for information about it. This bulletin is intended to meet this demand, and gives many new facts concerning the life history and distribution of the species, and the whole subject of the practical handling of its diseases in order to assist in its destruction is treated at length. It says few insects have caused such pecuniary losses as the chinch bug, and no other insect native to the western hemisphere has spread its devastating hordes over a wider area of the country with more fatal effect to the staple grains of North America. It is widely distributed over the world and hibernates in the adult stage. It is of gregarious habits and migrates in spring, summer and autumn. The bulletin states that it would appear that this pest first made its presence known in this country in North Carolina in 1783, and mentions several serious outbreaks of the bug in the West, the estimated losses from its ravages from 1850 to 1887 reaching $267,000,000. It also says that it is believed that the losses up to 1898 amounted to fully $330,000,000.

Science Notes.

Some interesting experiments on the velocity of sound were recently made by M. Frot, near Bourges. Two sets of experiments gave for the velocity in air at 0° C. mean results of 330·6 and 330·9 meters per second. The times were measured automatically by electric chronographs.

As is well known to botanists, but not so well known to the general public, says Prof. C. E. Bessey in Science, the white powdery coating on some leaves and fruits is waxy in nature and is called "bloom" in technical works on botany. Its function has received some attention, Mr. Darwin having made it the object of some studies in his later years. In a recent number of The Laboratory Bulletin, of Oberlin College, is a short paper by Miss Roberta Reynolds, giving the results of a series of experiments which show that when the bloom is removed from the epidermis the transpiration of water is greatly increased. Thus in case of Agave utahensis the loss was about two and a half times as much from the leaf which was without bloom as from that with the bloom. It was observed, also, that on damp days the difference between the leaves was less than on dry days; so, too, there was less difference in the case of young leaves than when old ones were used.

Medical statistics of the American-Spanish war, as reported by the Surgeon-General of the United States Army, stands as follows: From May to September, inclusive, and representing an army of 167,168 men, there were reported in full 1,715 deaths. Of this number, 640 were due to typhoid fever, 97 to malarial fevers, and 363 to diarrhea and dysentery. The death rates of May and June—0·46 and 0·70—were not in excess of those of the army in peace times; in July the rate reached 2·15 for the month, or 25·80 per 1,000, which does not much exceed that of well-cared-for cities. But in August the rate became excessive, or 4·08 per month, or 48·96 per 1,000 per year. In September the conditions improved and the death rate fell to 2·45, or 29·40 per year. The records of the civil war show that a high death rate in August was generally continued for months after, and Dr. Sternberg ascribes the improvement noted in September to the stricter sanitary measures adopted.

"The fate which he dreaded has already overtaken Luccheni," says The British Medical Journal, November 5. "The criminal anthropologists have naturally marked the murderer of the Empress of Austria for their own as a subject of scientific study. The corpus vile of the criminal will doubtless be reserved for Prof. Lombroso or some expert of equal rank, but in the meantime some eager investigators have been studying photographs of Luccheni. To the eye of the ordinary observer he looks a commonplace ruffian, but the criminal anthropologists, we are assured, at once see even in a photograph complete asymmetry of the body. Amyotrophy of the face, neck, trunk, arm, and leg on the left side is very marked. These stigmata are the consequences of grave cerebrospinal lesions occurring in infancy, and due to heredity, alcoholic atavism, misère physiologique, or some disease of infancy, perhaps an encephalomyelitis or lateral sclerosis, from which complete recovery never took place. Luccheni is pronounced to be a type of the asymmétrique déséquilibré. It would have been more satisfactory if the criminal anthropologists could have recognized all these evidences of criminality before Luccheni had perpetrated the crime which has given him the notoriety of infamy which he coveted."

To speak of a color-blind artist sounds like joking, said a noted London oculist; but strange as it seems, there are several persons so affected who can nevertheless paint extremely well. Numbers of color-blind people there are, of course, who draw perfectly in pencil, ink, and crayons, but I myself know a scene painter attached to a provincial theater who, though "color-blind," paints all its scenery, and has quite a local name, not only for his "interiors" and oak chambers, but even for landscapes. I can tell you also of two London ladies who consulted me for color-blindness who paint really beautiful pictures. One is the daughter of a late famous artist, and was taught painting by her father. She is quite unable to distinguish red from green, but her colors are labeled with the names, and she has been taught which to use for certain effects. Possibly her painting may seem to her eyes, as it were, drawing with a brush and "shading" with the colors. The other is a lady artist of some celebrity, who has for years exhibited annually in London. The public are not aware that she is color-blind. She painted the "Wedding Group" for a certain noble bridegroom a year or two ago, and also several public men's portraits, and one of an eminent physician fetched 500 guineas. There is a gentleman residing at Kensington who, having years ago left the navy through finding his advancement hopelessly barred by his color-blindness, is at present making several hundred a year by his brush as an artist, designing most artistic and brightly colored picture "posters" for advertisement boards.

Miscellaneous Notes and Receipts.

To Keep Violets Fresh.—If one desires to use violets for the toilet, the following way of keeping them fresh has been found excellent: Surround the stems with wadding, after dipping them in salt water, and cover with a layer of tinfoil. If they are used for interior decoration, place the stems in salt water and besprinkle the flowers. At night cover them firmly with tissue paper and see to it that they are not kept in too warm a place. In this manner they can be kept fresh for several days.

In order to prevent the yellowing of the coatings in water closets, stables, etc., where the exhalations are so strong that the paint turns yellow in twenty-four hours, no white lead paint should be employed, says the Deutsche Malerzeitung. Use only zinc white with a suitable mixing color, thinned with turpentine and water. It is true zinc white is also attacked by strong exhalations, but not in such a degree as white lead, which even under wood-color becomes black and spotted in a short time.

The Faerben Zeitung gives the following receipts:

Polish Varnish.—Mastic, 120 grammes; wood spirit, 1 liter; oil of turpentine, 250 grammes; linseed oil, 200 grammes. Stand away for a few days, shaking frequently, then filter off.

Excellent Polish.—Pale colophony, 1 part; larch turpentine (Venetian turpentine), 3 parts; bleached shellac, 15 parts; alcohol (95 per cent), 40 parts. Allow to stand for three to four weeks in a warm place, shaking frequently before filtering.

Picture Varnish.—Mastic, 350 grammes; Venetian turpentine, 75 grammes; camphor, 15 grammes; oil of turpentine, 1·5 liters.

Mining in Japan.—Regarding gold, silver, copper, and coal mining in Japan, the Zeitschrift für praktische Geologie furnishes the latest statistics. The development of the mining industries in Japan, since the termination of the last war, has been a rapid one, and that country now furnishes considerable quantities of precious and useful metals, although little is heard abroad of this production.

The gold production since 1893 has risen almost 5,000 ounces, and in 1896 reached the yield of 28,300 ounces. The nineteen existing gold mines are partly in the emperor's possession, partly in that of private parties. The most important are those of Sado and Ikuno. Latterly gold has been discovered near Nikko, and the gold production will therefore rise considerably more in the near future. Nikko bids fair to become the center of the Japanese production of precious metals, since besides gold, strongly argentiferous lead ores have been found. By virtue of the Japanese laws, foreigners are permitted to participate in mining undertakings.

Silver is found in forty-five places in Japan, and in 1896 afforded a yield of 1,500,000 ounces, which is equal to an increase of almost 650,000 ounces since 1893.

Very considerable is the copper production of Japan, there being at present seventy mines. During the fiscal year ending June 30 last, 35,000,000 catties, or about 500,000 centners, of copper, valued at 5,800,000 yen (about $3,000,000), were mined. Since 1875 the copper production has increased almost ninefold. Most copper is sent to Hong-Kong, then to China and to England, the total export amounting to 350,000 centners, i. e., five-sevenths of the whole production.

Coal mining has, since the war, risen about 1,500,000 tons, and in 1897 more than 2,000,000 tons of coal, valued at about $6,000,000, were exported. The companies carrying on coal mining are in a very good financial condition. Altogether there are one hundred and twenty coal mines, of which, however, only about fifty are of importance. The most productive is the Miike mine, in the province of Chikugo, yielding 600,000 tons per annum. A new coal field was discovered in 1896, and work has now been commenced on it. It is situated in the province of Iburi, on the river Mukawagawa, and is said to contain 40,000,000 tons above, and 30,000,000 tons below, the level of the sea. Aside from this last discovery, however, it has been computed that the coal stores of Japan, at the present rate of production, will be exhausted in forty-five years.

Heroic Deed of an Engineer.

William Carney, an engineer at the Richmond Rolling Mills, Richmond, Ind., met his death on December 10 by falling against a large gear wheel, which tore off one of his legs. He was alone in the engine room and knew that possibly no one would enter it for hours. Realizing that disaster would result if the fire under the boilers were left burning, he dragged his mutilated body 50 feet to the boiler room, turned off the natural gas which was used as fuel, and then lapsed into unconsciousness. Twenty minutes later the machinery stopped, caused by a lack of steam, and the employes rushed to the engine room to ascertain the reason and found the brave engineer dying.

"WAIT A WHILE," a railroad station in New South Wales, has just won a fight to retain its name, which the railroad company wished to change.

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