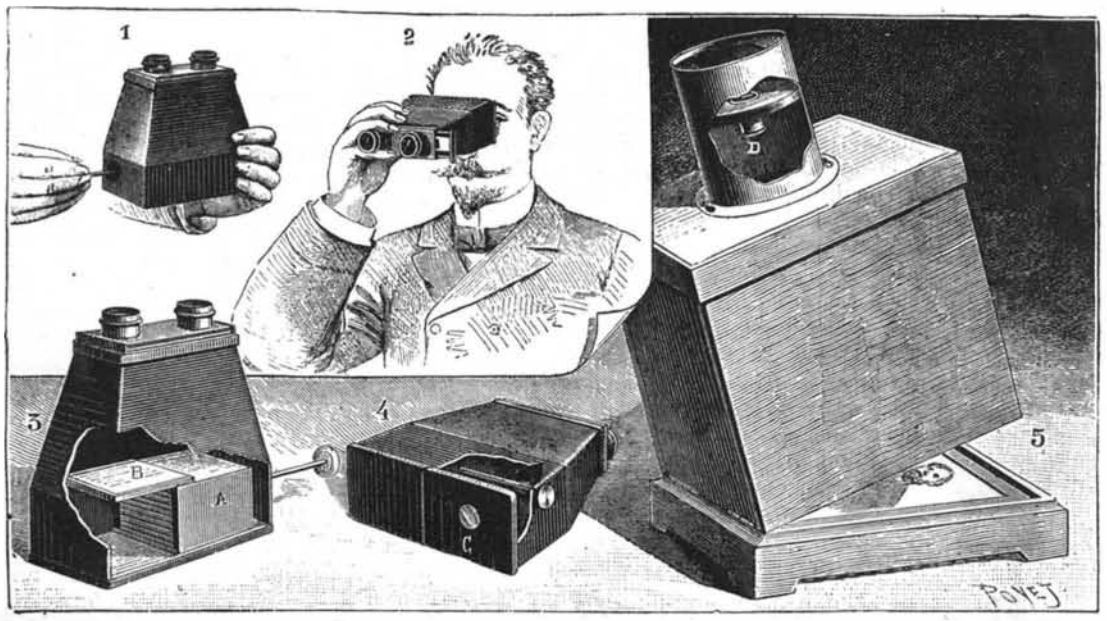
THE PHOTO-OPERA GLASS.

Photographic apparatus are now numbered by legions, and they are daily undergoing new modifications. It is very difficult for an amateur to make a selection, since every manufacturer has endeavored to meet a special requirement, and we believe that there is no universal apparatus. We shall always have three principal groups, viz.: the old model of bellows camera, uniting the conditions of long extension for the use of objectives of different foci, focusing, decentering, etc.; the magazine apparatus, containing, in the form of a rectangular box, all the material; and, finally, the pocket camera, which is one or the other of the two preceding of reduced dimensions. All these arrangements have their *raisons d'etre* and find their utility according to the times and places where they are to be employed. Another preoccupation of manufacturers has also sometimes been to so conceal the apparatus as to make it possible to take a photograph in secret. This has an interest especially for artists who are in search of truthfulness in the attitude of individuals. But, aside from a few apparatus that give almost microscopic images, there is nothing very complete in this respect.

Mr. J. Carpentier, an able electric engineer, who, in his spare hours, is a distinguished amateur photographer, has endeavored to solve this problem, and seems to us to have succeeded in it, by taking a mean term that consists in obtaining a negative of sufficient size (4·5 × 6) and in easily enlarging it to 15 × 18 by means of a special instrument of very simple manipulation. This apparatus consists of a double apparatus (Fig. 1) that may be carried in a case, provided with a strap passing over the shoulder, or even be put into the pocket. It contains twelve plates that are changed automatically. In order to operate, the opera glass is placed before the eyes (Fig. 2), and to a person not in the secret, the user seems to be looking at a landscape rather than taking a negative.

The apparatus is provided with two objectives: One of them, which is designed to impress the plate, possesses all the qualities of a good photographic objective, while the other, which is of the same focus, serves as a finder. The image that it gives is received on a plate of ground glass, and an aperture, C (Fig. 4) in the back of the opera glass permits of seeing it. This aperture is provided with a red glass that gives a monochrome image. This is a very happy arrangement, since it permits of obtaining a much better idea of the definitive negative. When, in an ordinary camera, we look at the image with all its colors, we run the risk of being deceived as to the relative value of the different tones that will be shown in the negative by a single color. It will be understood that we shall avoid such danger if we observe the image with a glass that permits of its being seen in but a single color. We recommend the use of this process, which is very easily put in practice and which, moreover, is already applied to a few finders capable of being adapted to any cameras whatever.



MR. CARPENTIER'S PHOTO-OPERA GLASS AND ENLARGING APPARATUS.

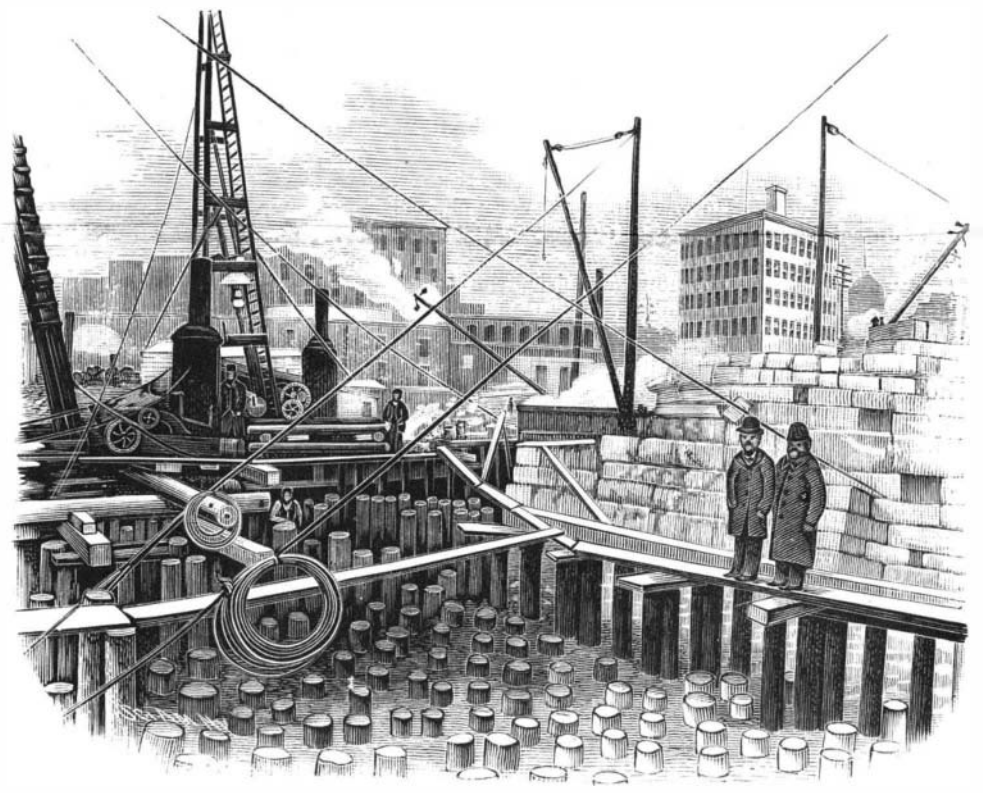
But to return to our opera glass: Behind the two objectives slides a metallic plate provided with an aperture. This is the simple drop shutter. It is so arranged that it can be set without uncovering the sensitized plate, and it is therefore useless to have a cap upon the objective; besides, it permits of seeing the image in the finder only when it is set - a second useful precaution, since in this way one cannot forget to set it at the moment of operating. The sensitized plates are contained in small independent frames of metal that are placed one upon another in the back of the apparatus in a drawer, A (Fig. 3). The first plate receives the impression as soon as the shutter is freed through pressure upon a button placed between the two objectives. In order to replace the impressed plate by another, one pulls a button placed upon the side of the apparatus, and thus displaces the drawer, A (Figs. 1 and 3). In this motion the first plate, B, remains held in place at first, and then, when the drawer is completely drawn out, drops to the bottom and becomes the last of the package after the drawer has been pushed back to its normal position. The top glass is then ready to receive an impression.

It will be remarked that in the motion that has just been effected the plates have been brought opposite the objective of the finder. But this is attended with no inconvenience, since at this moment, the shutter not being set, the finder is closed, as we have already explained. Moreover, in this motion, as each frame carries a number upon the back, such number presents itself opposite the red glass, C (Fig. 4), so that it is always possible to see how many frames remain to be used.

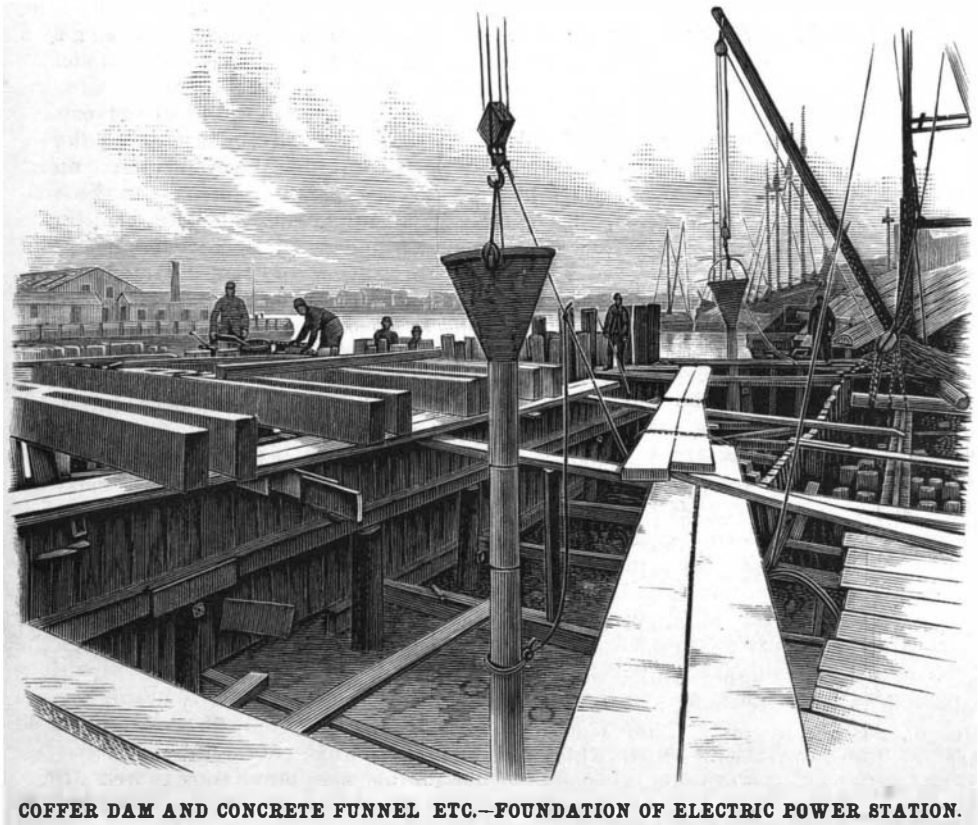
As may be seen, there is nothing easier than to obtain a series of negatives with the opera glass under consideration, and that, too, without being remarked. Printed of actual size, they will constitute a sufficiently valuable document, but with Mr. Carpentier's enlarging frame it is easy to at once obtain a 13×18. The enlarging apparatus (Fig. 5) consists of a square box whose bottom is hinged and carries a frame that permits of placing a sheet of paper sensitized with gelatino-bromide. This operation, of course, is performed in the laboratory. The upper part of this box is provided with a cylinder in whose extremity there is a recess for the reception of the small negative. An objective, D, immutably fixed, reproduces the enlarged and positive image upon the sensitized paper. To this effect, it suffices to step out of the laboratory and expose the apparatus for an instant to either diffused or artificial light. There is no need of focusing, etc., as all that is regulated in advance. It is thus possible to obtain a series of negatives or several positives from the same negative. Nothing remains to be done but to develop and fix by the ordinary processes.

On the subject of the photo-opera glass we have hitherto spoken only of instantaneous negatives, but it may prove useful to have an exposure. In such a case we employ a special arrangement occupying but little space and that permits of fixing the instrument upon a foot. The operation is then performed either with a cap or a folding shutter which is fixed to the extremity of the objective. The operator may thus obtain good results.

It may be seen that the apparatus devised by Mr. Carpentier is complete and well answers the object that he proposed to himself, that is, to have a compact apparatus that permits of obtaining a negative without attracting attention, and a positive large enough to constitute a useful document.—*La Nature.*



PILE FOUNDATIONS ELECTRIC POWER STATION BROOKLYN CITY RAILWAY.



COFFER DAM AND CONCRETE FUNNEL ETC.—FOUNDATION OF ELECTRIC POWER STATION.

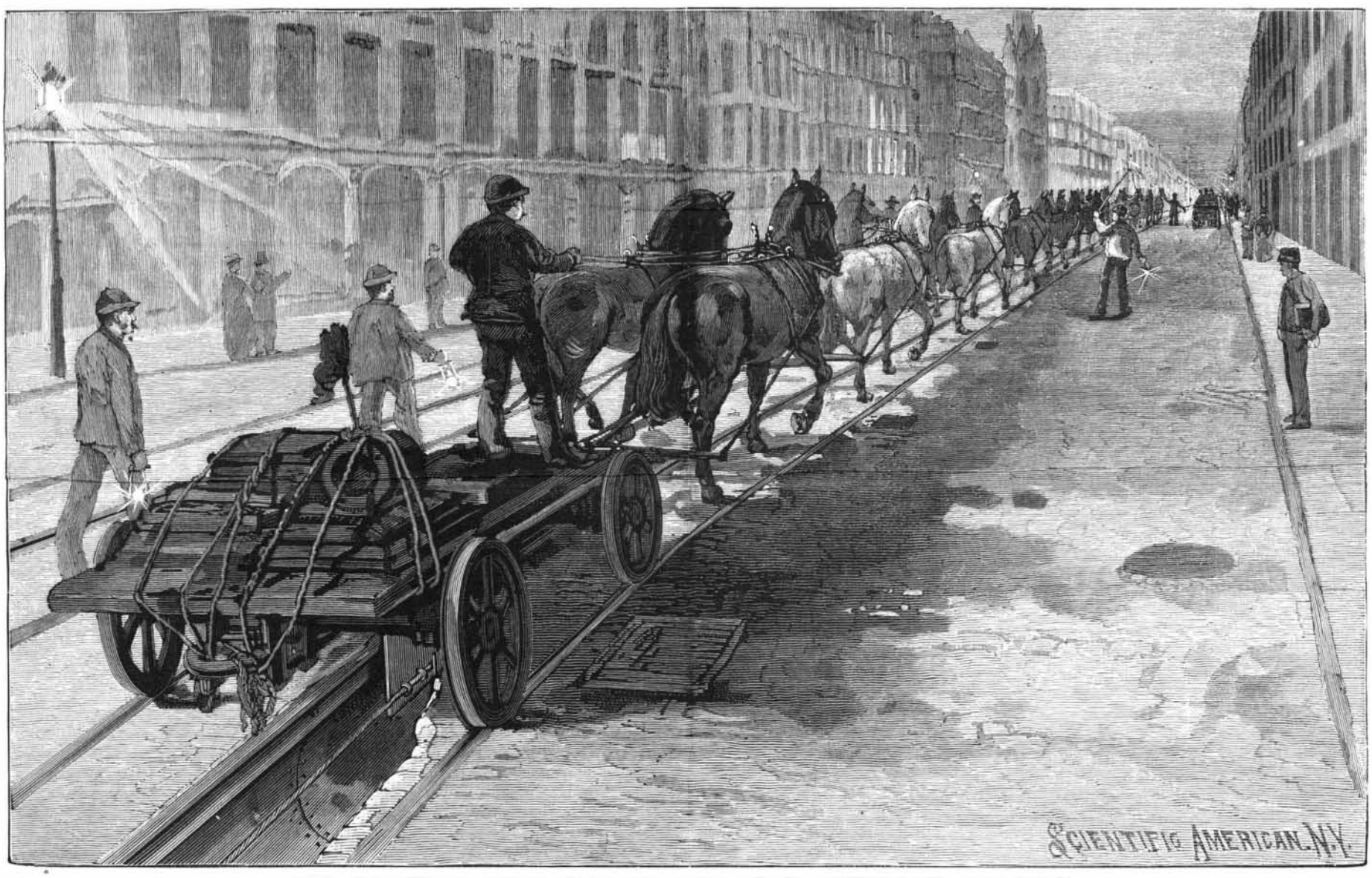
THE CONCRETE FOUNDATIONS FOR THE ELECTRIC POWER HOUSE OF THE BROOKLYN RAILWAY COMPANY.

The Brooklyn City Railway Company is building a power house for their electric railroad at the corner of Division and Kent Avenues, Brooklyn, N. Y., near the edge of the East River. The greater portion of the foundation rests on piles and concrete. There will be three detached buildings—engine house, boiler house, and house for economizers.

The boiler house is to be 143 feet long and 91 feet wide, and will rest on piles. The strength of this foundation is shown by the method of building. Along the water side a coffer-dam, 143 feet long and 29 feet wide, was built, as shown in our illustrations. Piles were driven inside the

dam, 10 inches apart, 14 feet below high water; the water was pumped from the dam until it was only about 1 foot above the heads of the piles. The work was carried on during the severest weather of last winter. The water in the dam was heated slightly by means of steam pipes, then concrete was poured in by means of funnels and pipes, as shown, until the mass of concrete was 7 feet above the top of the piles. A granite foundation, 12 feet high, was then built upon the concrete, 8 feet 2 inches wide at the base and 5 feet 2 inches at the top. The piles for the remainder of the foundation were driven about the same distance apart, but only 1 foot below the water. A concrete mass 8 feet 6 inches thick was formed upon the piles. This concrete mass extends under the entire buildings. Two granite piers, 41 feet by 47 feet at the base, 44 feet 8 inches by 35 feet 5½ inches at the top, and 6 feet 8 inches high, were built as a foundation for the engines. The engine house will be 128 feet by 168 feet and 70 feet high. All of the buildings above the foundations will be of brick and three story.

The chimney will be the highest in Brooklyn, being 325 feet high. Stone foundations for chimney at the base, 60 feet square; five layers of stone, the upper layer 42 feet square. Brickwork at the base, 38 feet. Flue of chimney, 17 feet diameter.



THE BROADWAY CABLE RAILWAY NEW YORK—RUNNING IN THE CABLE.

The method of making concrete in winter time is of interest, as heat is important to prevent freezing until it can set properly. In this case the sand was heated by being packed around a large boiler, in which a fire was kept going all the time.

The broken stone was heated by being placed in a large tank of hot water. Hot water was also used in the mixing machine. By these means the concrete mass was kept warm until it had set. The granite blocks placed on the concrete were also heated by having fires built around them.

These particulars were kindly furnished by Mr. W. A. Tenney, C.E. W. H. Ward, of Lowell, Mass., has the contract for building, and Mr. P. Casseday is the superintendent.

THE BROADWAY CABLE RAILWAY, NEW YORK.

The change of the power of the Broadway street railroad, New York, from horse power to cable driving, which has been going on for over a year past, is now completed, and the cable cars will soon be in motion. The construction of the cable line proved to be one of the most difficult works of its kind that has yet been undertaken—not so much in the construction of the road proper as in overriding the vast network of pipes for water, gas, steam, pneumatic, telegraph, and telephone service which occupy this great thoroughfare. In uncovering the subway a bewildering combination of pipework was exposed. Pipes had to be depressed or carried to one side. Manholes for sewers, water pipe valves, and the telegraph subway had to be readjusted to clear the trackways. The engineers' fight was a severe one, but, by perseverance and persistence, the great work has been accomplished, and now Broadway, with its great cable road, involving an outlay of millions of dollars, and with its grand buildings, stands forth as the leading thoroughfare of the world.

The road extends from the south end of Central Park, at 59th Street, New York, along Seventh Avenue to its junction with Broadway at 42d Street, thence along Broadway south to the Battery and South Ferry, the extreme southern point of the city, where the waters of the Hudson and East Rivers unite on their way to the sea. The distance is between five and six miles.

The cables in their present limits embrace four principal divisions, each capable of being driven independently, and covering a total cable length of over 60,000 feet—more than eleven miles of running cable.

Throughout the whole line a spare cable will be laid ready for use in any emergency.

There are two power stations, where are assembled some of the most perfect and remarkable examples of driving mechanism ever constructed. One of these stations occupies the great stables formerly devoted to the welfare of the 2,000 horses heretofore employed by the company, on the block between Sixth and Seventh Avenues, 50th and 51st Streets.

Two of the cable divisions are here operated. The other power station occupies the lower part of the company's great building at the corner of Broadway and Houston Street.

We illustrate on our first page the magnificent engine room and power plant of the 51st Street power station.

The engines are of the latest style of Corliss type, made by the Dickson Manufacturing Company, Scranton, Pa. Cylinders 36 inches diameter, 60 inches stroke, each of 1,000 horse power.

The fly wheels are 24 feet diameter and weigh 80,000 pounds each. The main shafts are 18 inches diameter in the bearings and 20 inches in the swell, coupled to the main driving shaft with flanged couplings with bolts and cross keys. Upon the main shaft are four grooved driving wheels, each actuated by a friction clutch, making the use of any one or all of the driving gear under control for running or stopping, the driving pulleys hanging like a loose pulley on the running shaft when not in use.

The four driven wheels are grooved to match the drivers, are 32 feet in diameter; 20 cotton ropes 2 inches diameter are the transmitting medium for each of the four sets.

The large driven wheels are on separate shafts, each in pairs with friction clutches; each shaft connecting with one of the four cable drums, which are run in pairs and interlocked with gearing, so that any required repairs may be made to any one or two of the rope driving systems without stopping the cables in either direction.

The cable drums are 14 feet in diameter, with five grooves in each, to fit the 1⅛ inch cables, which are wound over and over the driving drums to obtain the necessary friction for driving the cables. One of the latest improvements in cable driving is introduced on these cable drums, consisting of an independent grooved friction ring for each wind of the cable, which allows the strain from unequal wear in the grooves to become equalized by a movement of the rings among themselves, instead of the drawing of the cable in the grooves of a solid driving wheel, which causes friction and wear. A system of traveling cranes is arranged overhead, covering all of the machinery in the room, giving the best and most modern facilities for erecting or removing the heavy parts of this ponderous machinery.

In the upper corner is illustrated the tunnel from the engine room into and under 51st Street to Seventh Avenue, blasted out of solid rock, lined and arched with brick, the engine room being located on the corner of 51st Street and Sixth Avenue.

Through this tunnel, which is nearly 1,000 feet long, the two outgoing and incoming cables for both the uptown and downtown sections are carried, turning a right angle on four large grooved sheaves placed under the street, two of which are shown in the cut.

The tunnel is lighted by electricity. At the opposite upper corner, first page, we illustrate a part of the power house at the corner of Sixth Avenue and 50th Street, used for the cable tension apparatus, which consists of large grooved wheels mounted on car trucks running on rails. The cables, coming from the driving wheels of this power room, pass over the tension wheels and back into the tunnel. The trucks are attached to a cable running over pulleys in the iron towers and fastened to weights adjusted to a proper tension for the running of the cables and for taking up the stretch and accommodating variations in length by changes of temperature.

After the roadbed for the Broadway cable railway was completed, it became necessary to run the cable into the interior of the slotted tube. This was done by means of a platform car weighted with iron. Projecting from beneath the car into the slotted tube of the roadbed was a strong colter, to the lower end of which the cable was attached at the power station. At 3 A. M., when the street was clear of traffic, the car was started, drawn by thirty-six splendid horses, and in the course of two hours a section of the cable was unreeled and run into the tube. Each cable section was run in the same way.

The illustration on this page shows the platform car and teams at work on Broadway, drawing the cable into the tube, as stated.