SCIENTIFIC AMERICAN

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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXVIII.—No. 20. ESTABLISHED 1845. NEW YORK, MAY 20, 1893. [$3.00 A YEAR. WEEKLY.

THE BROADWAY CABLE RAILWAY, NEW YORK.

We illustrate the subway under Broadway opposite the power house at the corner of Broadway and Houston Street. In this subway, which is over 100 feet in length along Broadway and its floor 40 feet beneath the street, are placed the great inclined sheaves which direct the cables from the driving wheels in the engine room to the vertical sheaves on the overhead beam and to the arched cableways immediately under the grip slots.

The two sheaves in the foreground carry the cable running to 36th Street and return.

The inclined sheaves in the distance carry the cable to the Battery and return.

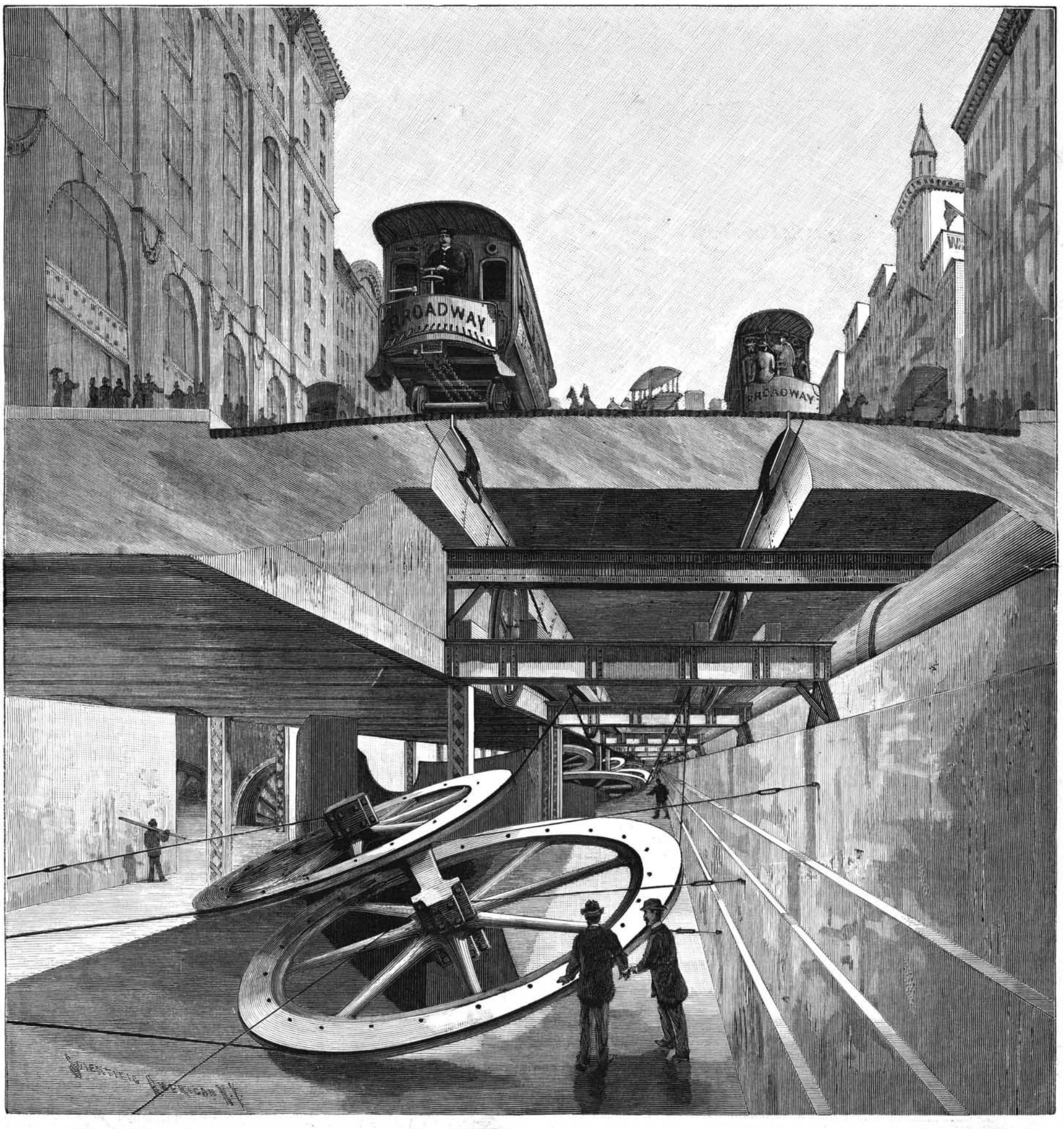
The cables between the Battery and 36th Street were started into motion on Thursday, May 11, by the seven year old daughter of John D. Crimmins, by opening the steam valve of the 2,000 horse power engine in the engine room in the basement of the great power house of the company at the Houston Street station.

The machinery and cables moved in their regular course without a hitch, and with such even regularity that the balance car on the incline moved but a few inches. A car has been run over the line from 36th Street to Houston Street, and the line to the Battery will soon be under car trial.

The drivers of the present horse cars are now being schooled in the manipulation of the grips and brakes on the uptown line, and as soon as in proper drill will be placed in charge of the downtown cars. All cars will at first be run in time with the horse cars, and the time quickened as soon as the men acquire experience in their new duties.

The illustrations of the immense steel structure of the central power house of the Broadway Cable Rail-

(*Continued on page 312.*)



THE BROADWAY CABLE RAILWAY—SUBWAY UNDER STREET OPPOSITE THE HOUSTON STREET POWER HOUSE.

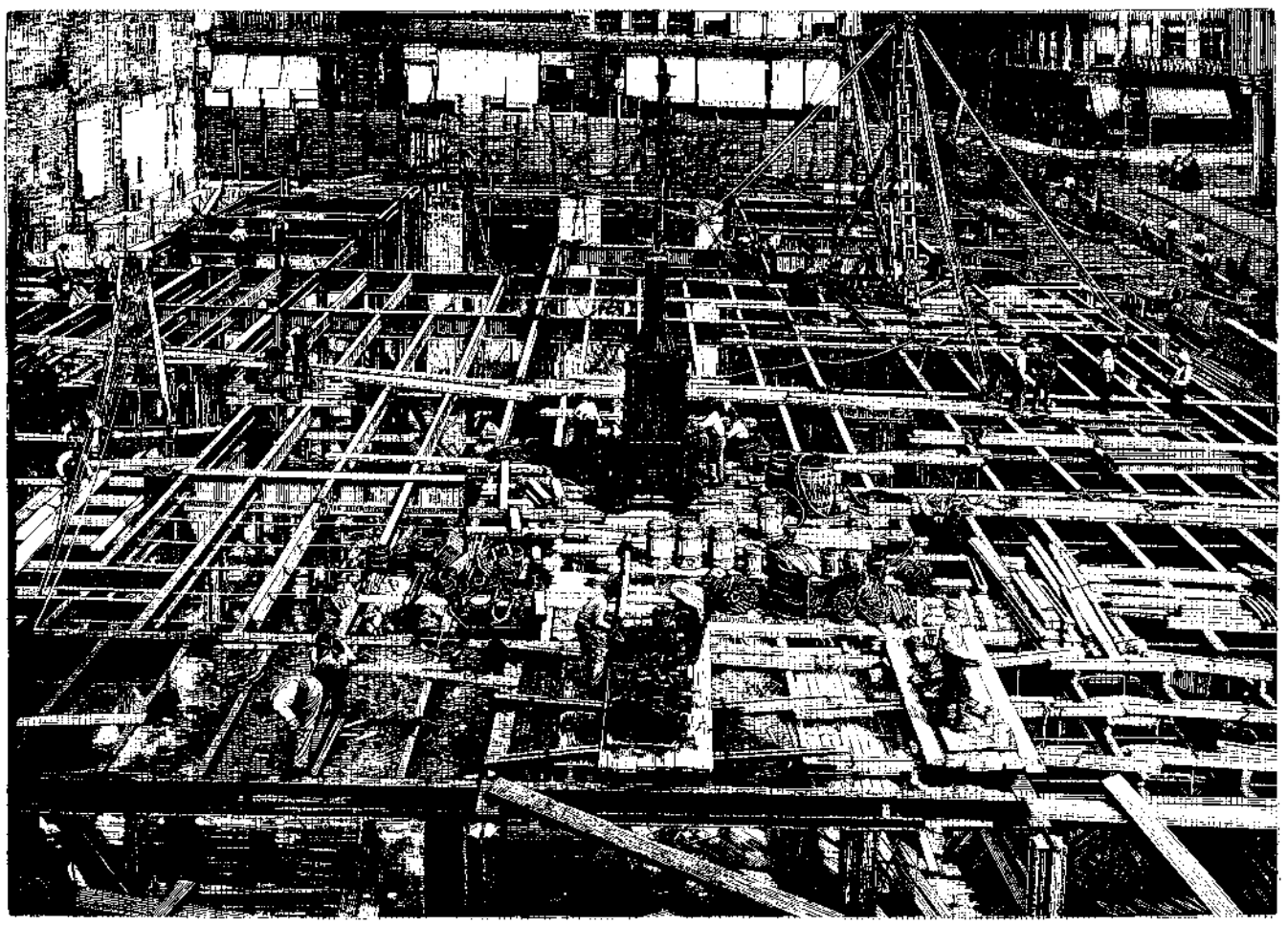
THE BROADWAY CABLE RAILWAY, NEW YORK.

(*Continued from first page.*)

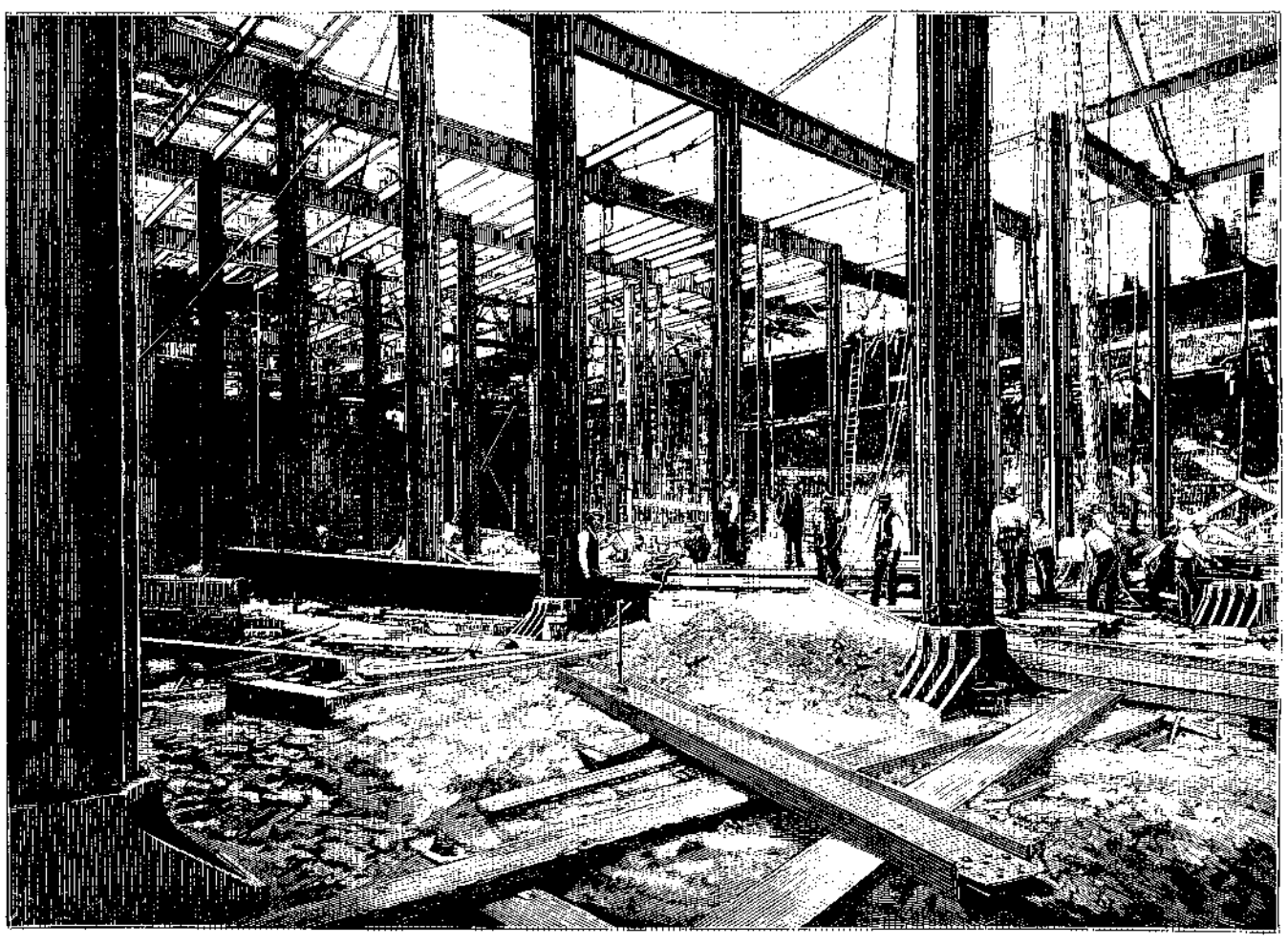
way, corner of Broadway and Houston Street, New York, shows what may be accomplished in strength, stability and freedom from vibration in a building to be devoted to business purposes in all its upper part, while machinery conveying 2,000 or more horse power is being operated in the basement. The building rests on 73 steel columns, the 28 exterior columns resting on grillages of iron I bars on concrete, while the interior columns rest on steel caissons sunk into the water-bearing strata filled with sand and concrete and capped with an iron bar grillage, so that there is no direct connection between the walls that support the machinery and the columns that support the building.

The main floor in the cut shows the mass of beams on the street level, having no connection whatever with the running machinery below, save through the sand of its deep foundation.

The cable grip of the Broadway Cable Railway has all the useful features of a grip suitable for the various emergencies required in a complicated service, and mainly consists of the two vertical strips of steel on the outside—as shown in the cuts—fastened to the bottom section of the grip shoe, which is double, to take the cable on each side, and are also permanently attached to the crosshead on the truck. By this arrangement, with one movement of the operating lever, the cable is taken up on either side of the grip. The narrow vertical pieces—as shown in the cuts—are attached to wedge shaped blocks for disengaging the cable, when the grip jaws are opened, by a lever movement shown in the cut. By this means a transfer is made at the cable loops by dropping the cable on one side of the grip and taking up the next cable line on the other side. The grip crosshead has a side adjustment by a sliding movement on cross bars fastened to the truck frame running on the axles, so that the vertical adjustment of the grip is made with the track, the variable load of the car adjusting the body only by the springs. By the lateral slide of the grip on the cross bars of the truck frame, the cars are enabled to pass around the curves with the grip frame riding free from strain in the slot. The illustration of a car and grip shows the method of attaching the grip to the car truck and the cable as when the car is running. The illustration is from a photograph of car No. 98 making its first trip from 50th St. to Houston St. on the night of May 10.



BROADWAY CABLE RAILWAY—POWER HOUSE CONSTRUCTION.



BROADWAY CABLE RAILWAY—BUILDING ENGINE ROOM BELOW SIDEWALK.

Explosion of Pyroxylin.

The pyroxylin used in pharmacy and the arts, dinitrocellulose, is usually regarded as non-explosive, but C. O. Weber shows how, under certain conditions, it may become dangerous. After preparing some in the usual manner, he added a small quantity of ammonia to the water used for washing, so as to effect complete removal of the acids more rapidly. A copper oven heated to 70° C., used for drying about one ounce of the pyroxylin thus treated, was after three hours' drying torn to pieces by the force of an explosion, the fragments of copper being hurled all over the room. Since pure dinitrocellulose requires a temperature of 194° to 198° for ignition, while hexanitrocellulose only ignites at 160°–170°, it appeared that the explosion must be due to the use of ammonia in the washing process. A little nitrate of ammonia was probably formed and dried upon the nitrocellulose in a state of fine subdivision, and any trace of acid would then suffice to cause the salt to act as a fuse. The use of ammonia in this connection is accordingly to be avoided.—*Jour. Soc. Chem.*

Liquefaction of Osmium.

While certain noted chemists have been striving to compass the liquefaction and solidification of gases hitherto regarded as permanent, others have been working as persistently in the opposite direction by seeking to liquefy the more refractory metals. The metals of the platinum group have presented most difficulty in this respect; but in a recent number of the *Comptes Rendus*, MM. Joly and Vezes explain the means by which they have been enabled to obtain, in the liquid form, osmium, the most refractory element of the group, and the last to yield to experimental skill. Metallic osmium, which occurs as small grayish blue crystals, was heated in the electric furnace of Ducretet and Lejeune, in a carbon crucible, and in an atmosphere of carbon dioxide. At the highest temperature of the electric arc the metal was fused without appreciable loss by volatilization. After fusion it was exceedingly hard, and capable of cutting glass, or scratching quartz, but not affecting the topaz, while it appeared to remain unaffected by the oxygen of the air. It is remarkably like ruthenium in many of its properties, but differs from it in aspect, having a blue metallic luster, while ruthenium is whiter than platinum, and resembles burnished silver.

The Census Returns of Sugar and Rice.

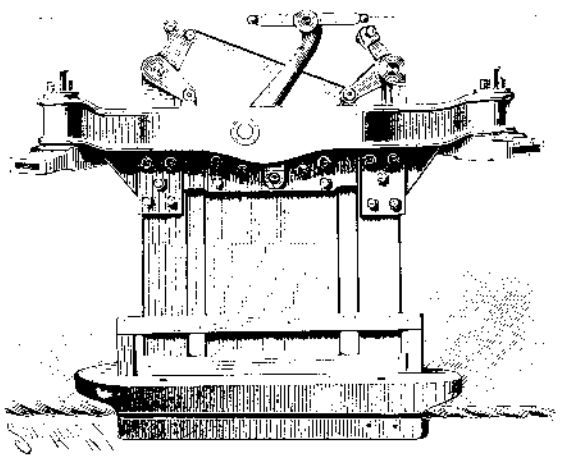
The superintendent of census has issued the statistics of sugar and rice production in the United States, compiled under the supervision of Special Agent Hyde. The total production of cane sugar in the year ending May 31, 1890, was 302,731,895 pounds valued at $12,829,824 on the plantation. The total production of merchantable cane molasses was 25,398,954 gallons, valued at $8,076,575. The total production of rice was 130,019,123 pounds, valued at $3,951,119; 96·5 per cent of the sugar and 58·6 per cent of the rice were produced in the State of Louisiana.

The *Louisiana Planter* says: While the figures seem to be quite exact, they are somewhat misleading in this, that they really only cover the crops of the year 1889, which will long be remembered in Louisiana as a year of unprecedented drought, resulting in an immense falling off in the sugar crop. The Louisiana sugar crop of 1890 was nearly twice as large as that of 1889.

IN A. D. 105 Trajan built a magnificent stone bridge across the Danube 4,770 feet long.

Two New Great Steamers.

We learn from *Engineering* that the White Star Company are negotiating with Messrs. Harland & Wolff, Belfast, to construct for the line two steamers, which are to have a speed in excess of anything now afloat, including the two new Cunarders. It is not yet possible to give details; but it is said the vessels will



CABLE GRIP MECHANISM.

each be something like 60 feet longer than the Cunard vessels. They are to be propelled by three screws. We are informed the stern framing is already under order, so that it is intended to proceed at once with the construction of the vessels. The stern frame is of novel design. The run of the keel has a curved rise in front of the rudder post, as in the case of some torpedo boats, and as it is of heavy section with suitable points for bearings, the intention is evidently to run a propeller in the space left by the curve on the keel plate or bottom part of the stern frame. The massive character of this frame will be appreciated when we state that it weighs about 20 tons. There are brackets for the two side screws, and these weigh 8 tons each. As to the power to be generated by the engines, it is understood to be about 40,000 indicated horse power.

Turkish Great Guns.

In 1478 Mohammed II., in forming the siege of Scutari, in Albania, employed fourteen heavy bombards, the lightest of which threw a stone shot of 370 pounds weight, two sent shots of 500 pounds, two of 750 pounds, two of 850 pounds, one of 1,200 pounds, five of 1,500, and one of the enormous weight of 1,640 pounds, enormous even in these days, for the only guns whose shot exceed the heaviest of these are our 80-ton guns, throwing a 1,700-pound projectile, our 100-ton, throwing one of 2,000 pounds, and the 110-ton, throwing an 1,800-pound shot with a high velocity. The stone shot of Mohammed's guns varied between twenty and thirty-two inches in diameter, about the same height as a dining table; 2,534 of them were fired on this occasion, weighing, according to a calculation of General Lefroy's, about 1,000 tons, and were cut out of the solid rock on the spot. Assuming twenty-four inches as the average diameter of the shot fired at this siege, the total area of the surface dressed was nearly 32,000 square feet. At this siege the weight of the powder fired is estimated by General Lefroy to have been 250 tons. At the siege of Rhodes, in 1480, Mohammed caused sixteen basilisks, or double cannon, to be cast on the spot, throwing balls two to three feet in diameter. — *Chambers's Journal.*

The Mining District of Guanajuato, Mexico.

To many people a Mexican silver mine is close kin to a Spanish castle, but the fact remains that the most productive silver mines of the world are in Mexico; not the most productive at present, but in the gross amount of the metal won in the past.

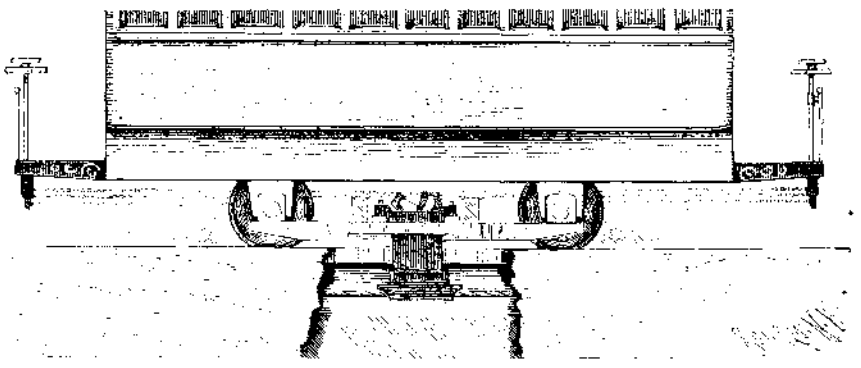
The mining district of Guanajuato has been an active producer of silver since 1548, and the known amount of metal obtained with the crude and wasteful methods in use approximates $650,000,000. Some of the greatest shafts ever put down are in the vicinity of the city of Guanajuato, one of them being 40 feet in diameter and over 1,400 feet deep. The new shaft of the Bolanitos mine is 20 feet in diameter and 600 feet deep. This mine is said to have produced over $3,000,000 in the six years preceding 1890.

The entire district is permeated with veins of quartz in metamorphic clay slate, nearly all the chief silver-bearing minerals being present. Only the first class ores are worked commercially, those whose assay value falls below $30 per ton not being available for the Washoe or the patio process. The excessive cost of transportation and of fuel militates against the working of any ores of this grade. Packing on mules to the haciendas costs $3.50 per ton, and treatment of the ores $11.50: these two items added to the $12 for mining, hoisting, pumping, sorting, etc., leave but a small margin on a $30 ore.

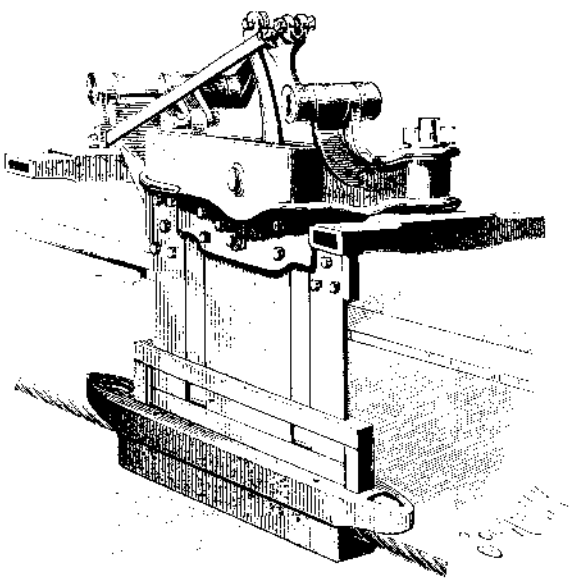
The unwatering of the lower levels of the mines has attracted considerable attention of recent years, and two companies are now engaged in an undertaking of this kind. The first of these on the ground was an English company, and work has been prosecuted on the San Calletano tunnel for several years. The second is the Victoria Tunnel Company, an American concern, which proposes to drain La Luz group of mines by a tunnel 7,000 feet in length. This group lies about 12 miles west of north of Guanajuato, and comprises 14 mines, viz., San Barnabe, La Luz, San Jose, Santa Clara, Refugio, San Vicente, La Trinidad, Los Locos, Jesus Maria, Villarino, El Santo Nino, La Purisima, San Pedro and San Nicholas. Up to the end of 1889 the group had been credited with a production of $312,860,000 since 1548.

The main difficulty in the way of the successful treatment of the ores seems to be the excessive cost of fuel. Wood costs $10 and coal $22 per ton, so that the operations, even if the mines can be made dry enough for working, would be restricted to the better class of ores.

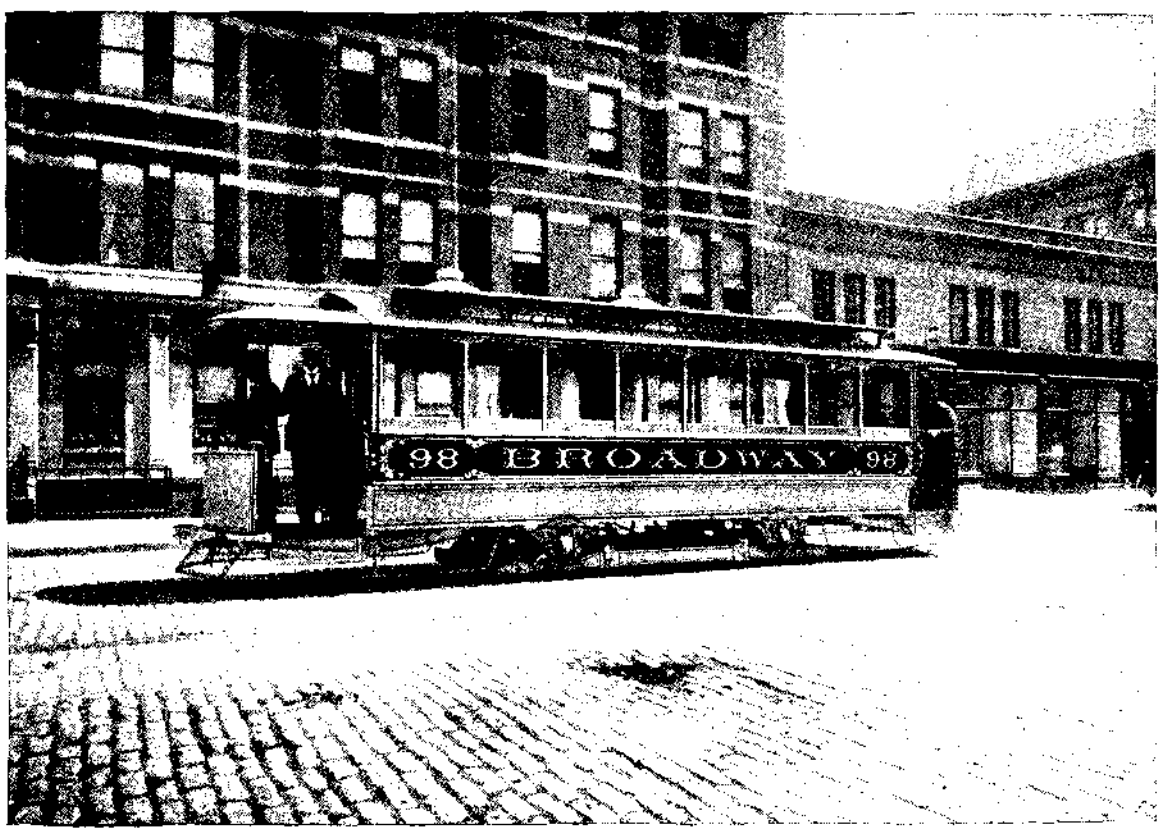
It is in respect of such undertakings that the importation of Southern coal and coke into Mexico deserves to be carefully investigated. Coal for domestic consumption will cut but a small figure in Mexico for many years to come, and it is to metallurgical and often industrial enterprises that one must look for a market. —*Eng. and Min. Jour.*



BROADWAY CABLE RAILWAY—GRIP CONNECTION WITH CABLE.



CABLE GRIP MECHANISM.



CABLE CAR—BROADWAY CABLE RAILWAY, NEW YORK.

Remarkable Dust Explosion.

Early on the morning of March 21, in the city of Litchfield, Ill., one of the most remarkable dust explosions on record occurred in the "Planet" or Kehlor flour mills. Before the explosion a fire broke out in one of the elevators, and the watchman was unable to send an alarm before the fire had reached the mills. Here it was beyond control. The fire companies, on reaching the scene, got their apparatus connected. By this time the flames had reached the part of the mill where there presumably was an accumulation of dust, and the explosion occurred. The great mill, said to have been the largest flour mill in the world, was blown to pieces as if by dynamite. Bricks, timbers, and pieces of machinery flew in all directions. The spectators of the fire were thrown to the ground by the shock, and people a mile distant were prostrated. Towns sixty miles away telegraphed that they had experienced the effects of the explosion. At Decatur, fifty miles away, the atmospheric concussion was felt. In the town no house escaped injury. Those near the scene had every window blown out. Some houses two miles distant were entirely destroyed. The town bore the appearance of having been swept by a cyclone. The incoming trains brought crowds of spectators.

When Sir Humphry Davy invented the safety lamp which bears his name it was supposed that mine explosions were due to inflammable gas, generally or mostly marsh gas, CH_4. But recently it has been found that coal dust plays a most important role in mine explosions, and the miner's "fire damp" may be interpreted as including coal dust as well as marsh gas. The recent development of steam milling has brought dust explosions more into prominence. In mill explosions there is absolutely no gas. The flour dust is so fine that, mingled with and suspended in air, it produces an explosive mixture. The loss of the mills, which had a capacity of two thousand barrels of flour per day, represents about one million of dollars.

Separation of Flames.

As a supplement to the subject of flames, Professor Clowes recently performed before the Society of Chemical Industry, Nottingham, the experiment devised by Professor Arthur Smithells, of the Yorkshire College, Leeds, of separating the inner from the outer portion of the Bunsen flame, each burning independently of the other. Professor Clowes stated that the experiment he had shown would modify some of the theories of combustion. He would, however, enter into no details, as Professor Smithells would probably give one of the popular lectures at the forthcoming meeting of the British Association in Nottingham.

THE great aqueduct which supplied Carthage with water was seventy miles long.