the material before excavation, some 11,000,000 cubic yards have been blasted out and excavated, the larger part being carried to the Sound, some six miles away, and dumped on the low land or tide flats. Some of the material, however, was used in filling in property and streets of the Bronx; and a part was deposited for filling in Van Cortlandt Park. All of this work but about 10 per cent has been completed.

Both the old and the new aqueducts pass through the reservoir site on their way to the city, the former at the ground level, the latter some 100 feet below the surface. As the bottom of the reservoir lies below the old aqueduct base or foundation, it has been necessary to remove the latter structure altogether and rebuild it; this has been done. At a point about a mile to the north of the reservoir the new aqueduct is at the ground level, and it is here that it is depressed and carried in a tunnel to the deep level above mentioned, at which it is carried under the Harlem River. At about the center of the reservoir a vertical shaft, known as Shaft 21, rises from this aqueduct to the bottom of the reservoir. At the point to the north above mentioned, where the change of grade occurs in the new aqueduct, a deflecting gate chamber is being put in and a surface branch aqueduct is being built, which branch runs parallel with the old aqueduct, until the northern end of the reservoir is reached. Here the two aqueducts are continued in one compact masonry structure, known as Gatehouse No. 7, where the flow can be discharged into either the east or west basin or continued south through the masonry division wall. This division wall is built upon the solid rock and runs through the reservoir from north to south, dividing it into two approximately equal and entirely separate basins, the top of the structure being at elevation 136.5 and level with the top of the embankment, or 5 feet above the maximum high-water level in the reservoirs.

At the center of its length, and opposite the Shaft 21 leading down to the new aqueduct, a large main gatehouse (No. 5) has been built, from which a short conduit leads across to connect through this shaft with the new aqueduct below ground. To the south of the main gatehouse two conduit aqueducts are continued at bottom elevation 107, for distributing the supply, each conduit being 11 feet in diameter. The old aqueduct is carried above these at its former elevation. At a point 1,500 feet to the south of the gatehouse one distributing conduit leads into the western and the other into the eastern half of the reservoir. By this arrangement six separate systems of distribution of the water are secured. Water also can be discharged into the east reservoir from the old aqueduct at Gatehouse No. 6, or may be taken thereat. The reservoir may be filled or the water distributed directly from either the old or the new surface aqueducts, or from the subterranean aqueduct through Shaft 21, the operations being all controlled at the main gatehouses, Nos. 5, 6, and 7.

Six lines of 48-inch pipe radiate from the main central gatehouse, No. 5, two of which leave the reservoir at Van Cortlandt Avenue Gatehouse No. 2 to the northwest, two at Sedgwick Avenue Gatehouse No. 3 to the west, and two at Jerome Avenue Gatehouse No. 4 to the southeast, one of which leads to a high-service pumping station; also two 48-inch pipes will lead away south to Manhattan, from Gatehouse No. 6 at Kingsbridge Road. A gatehouse has been built at each point of exit. The main gatehouse connections are so arranged that these pipes may be supplied with water from either basin of the reservoir or directly from either the old or new aqueduct. The 48-inch pipes, with the aid of the new pumping stations, will serve the annexed district to the north of the Harlem River, and it is also proposed to carry a double line of 48-inch pipes south across the Harlem River to connect directly with the city mains on Manhattan Island. This would give an independent source of supply in case of any accident to the present aqueducts where they cross the Harlem River. It has also been arranged to take off four lines of 48-inch pipes east and west from Gatehouse No. 7, north end, connecting with the city system, should the reservoirs require cleaning, etc.

It is the determination of the Aqueduct Commission to finish the westerly half first, and put it immediately in service. The final work of concreting the bottom was begun in 1904, and 30.25 acres were laid in that year. On March 27, 1905, work was again started on a scale that would insure its completion by the following Thanksgiving, or before the frost set in. By April 27, between three and four acres had been laid, with only half the concreting plant installed. It was estimated that twelve mixers would be sufficient to complete the work in the year; but the contractors have ordered sixteen, and nine of them are at work. It is hoped to exceed the estimated output of concrete by 20 per cent, and carry the total per day up to 3,000 square yards, or seven-tenths of an acre. The task is a truly gigantic one, as 101.25 acres have to be covered with concrete 6 inches in thickness, which means that a total of 1,750,000 cubic feet must be mixed, carried to the site and carefully tamped and surfaced. It will take at least a year more to complete the easterly basin. We are indebted to Mr. J. Waldo Smith, the chief engineer of the Aqueduct Commission, and to Mr. F. S. Cook, division engineer in charge of the construction of this work, for courtesies extended during the preparation of this article.

THE AUXETOPHONE FOR REINFORCING GRAMOPHONE SOUNDS.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Some time ago we drew attention in the Scientific American to the ingenious invention that had been devised by the Hon. C. A. Parsons, inventor of the steam turbine, and Mr. Horace Short, by the employment of which the reproductive sounds of phonographs and similar machines could be appreciably reinforced. At that time the invention was in a purely experimental stage. In the interval, however, the inventors have been perfecting it so as to be a commercial and practical attachment to talking machines. In this direction they have now succeeded, and recently an interesting demonstration of its practicability was given in connection with a gramophone.

In this device, which is called the auxetophone, the usual diaphragm of glass or mica in the producer is replaced by a small valve, which controls the admission of compressed air to the trumpet. The air is supplied from a small pump or bellows contained in the pedestal supporting the instrument at a pressure of about two pounds to a square inch. The valve, though

THE PARSONS AUXETOPHONE.

of small size, consists of a fine comb of aluminium or magnalium, and the teeth of this comb just cover the gaps in a corresponding comb of brass, through which the air tries to escape from the compressed-air chamber connected with the supply tube.

The little magnalium valve, which is very light, is hinged on steel springs, so that when its teeth are slightly lifted from the brass comb or valve seat, the air is allowed to escape at both sides of each tooth in very large quantities up through the two combs and into the trumpet. When, however, the two combs approach closely and almost touch, the escape of air is checked and almost ceases.

It will thus be noticed that the slightest movement of the magnalium valve on its supporting springs greatly varies the admission of air into the trumpet; and being connected to the needle of the gramophone, the motion of the valve corresponds exactly to the motion imparted to it by the record, and also to the original wave of sound as recorded by the recording instrument when the record was made.

The auxetophone reproducer may therefore be called an air relay, for by its use the gramophone record has only to work a valve of special construction, which controls the power of the compressed air. It is therefore of much greater power and volume than the diaphragm reproducer hitherto used, while it has the additional feature of enforcing the harmonics, which gives increased fullness of tone.

The reason of this remarkable change in tone is somewhat complex to explain, but the velocity of motion of the valve causes, or corresponds to, acceleration of the velocity of air in the trumpet, and that acceleration in the motion of the valve corresponds to double acceleration of the air in the trumpet. When this is worked out mathematically, it is found that the air wave provided in the trumpet is the differential of the wave on the record; in other words, the harmonics are reinforced, or a richness is imparted to the sound. Another feature of the auxetophone is an ingenious little "viscous connection," as it is called, introduced between the needle and the valve, which adds to the softness of the tone, and its action may be compared to the effect of the moisture in the throat of the singer, or the effect of age and playing in mellowing and loosening the fibers in the wood of the violin.

The auxetophone is a very powerful reinforcer, and on a calm day may be heard distinctly for two or three miles, and speech may be followed in every word from two to five hundred yards at least. The device has been acquired by the Gramophone Company, of London. It is intended, as soon as a few adjustments and simplifications have been made to coincide with public requirements, to install auxetophones upon transatlantic liners for the amusement of passengers.

MOVING PLATFORM SUBWAY FOR NEW YORK CITY.

Toward the close of November last year, there appeared before the Board of Rapid Transit Railroad Commissioners of this city several leading railroad officials and engineers, with a proposal to build a moving platform subway below Thirty-fourth Street between First and Ninth Avenues in this city. The sponsors of the new scheme are men of broad experience and high technical qualifications, as will be seen when we mention that they included Mr. Stuyvesant Fish, president of the Illinois Central Railroad, Gen. Eugene Griffin, first vice-president of the General Electric Company, and Mr. Louis B. Stillwell, the electrical engineer of the Interborough Rapid Transit Company; and in the record of their testimony, given before the Rapid Transit Commission, the proposed moving platform is indorsed with a unanimity which is a guarantee that, so far as the mechanical and commercial aspects of the scheme are concerned, it is thoroughly practicable. The proposal was to build a continuous moving platform across Manhattan Island, under 34th Street, with a loop at each end, both the easterly-moving and westerly-moving sections of the platform to be contained within a single tunnel. The platform was to be built in four sections: First an auxiliary section, to be stationary during the greater part of the time, and operated only during the midnight hours, and three moving sections, traveling at the respective speeds of three, six and nine miles per hour, the fastest section to be provided with cross seats throughout its entire length. The company stated, before the Rapid Transit Commission, that the platform would have a capacity for delivering at a given point forty-eight thousand seated passengers per hour, and it was stated that an arrangement would be made with the present Subway Company for a transfer of passengers.

Subsequently to the presentation of the scheme, the Metropolitan Street Railway Company, which controls all the street railways in New York city, and intends to be one of the most active bidders for the construction of further subways, argued strongly against the giving over of such an important thoroughfare as Thirty-fourth Street to a moving platform, and offered to build a subway system which would include Thirty-fourth Street as an important link therein. The matter was thoroughly argued before the Rapid Transit Commission, and that body decided at its last meeting to reserve Thirty-fourth Street for a four-track subway, not necessarily as a part of the Metropolitan scheme, but for whatever company might be the successful bidder for a subway system that included the Thirty-fourth Street subway as part of it. At the same time, it was intimated to the promoters of the moving platform subway that if they were willing to consider some other important cross-town street, such as Twenty-third Street, the Rapid Transit Commission would be ready to entertain a proposal.

In coming to this conclusion six out of seven members of the Rapid Transit Commission that were present voted against the installation of the moving platform on Thirty-fourth Street, the objections being directed, not against the moving platform as such, but against its appropriation of a thoroughfare which, because of its contiguity to the new Pennsylvania Railroad station, would form the most important crosstown link in the future complex system of subway transportation in New York. We cannot but think that, all things considered, the decision of the Commission was a wise one, and that the first level below the street surface on Thirty-fourth Street should certainly be reserved for a system of transportation identical with that under which the greater part of the future subway system will be operated. At the same time, there is unquestionably a great future for the moving platform. Its enormous capacity, which is far greater than that of a line operated by electrical cars, renders it an ideal system for operation where traffic is greatly congested, and it is to be hoped that the suggestion of the Rapid Transit Commission as to Twenty-third Street will be adopted, and a moving platform subway built below that important thoroughfare.

The engraving which we give on the front page of this issue shows clearly the general arrangement and detailed construction of the moving platform. It is a sectional perspective view, taken at one of the stations, of which there will be one to every block to the number of ten in all. The subway itself will be constructed of reinforced concrete, and between the stations it will be divided into two equal halves by a vertical partition wall provided with manholes. The whole section of the tunnel will be 30 feet wide by 14 feet in height. Eight feet of this height will be above the platform level and 6 feet below, the last-named dimension being sufficient to give headroom for operators and inspectors of the driving machinery. The moving platform proper consists of three continuous lines of steel plate covered with rubber to insure a safe footing. The plates overlap laterally at their edges. The fourth platform, shown in our drawing as adjoining the station platform, is an auxiliary which will be run at a speed of 3 miles an hour, and used only for a few hours after midnight when travel is lightest, at which time the main moving platform will be stationary. The first moving platform will run at a constant speed of 3 miles an hour; the second at 6 miles, and the third platform at 9 miles an hour. The first two platforms will be known as stepping platforms, and the third, which is considerably wider, will be provided with transverse seats. To assist passengers in moving from one platform to another, the two stepping platforms will be provided with lines of vertical posts placed at frequent intervals.

The platforms will be built in sections, each of which will be about 6 feet long, and the abutting ends of the sections will be struck to a radius which will permit of the platform curving around the terminal loops at First and Ninth Avenues. Extending longitudinally beneath each platform is a pair of I-beams, the upper flanges of which are riveted to the bottom of the platform, while the lower flanges serve to support the weight of the platform upon pairs of wheels which are carried upon transverse shafts mounted at intervals of 2 feet 9 inches, upon concrete piers, as shown in the engraving. Between each pair of longitudinal I-beams is carried a pair of horizontal guide wheels, which engage a guide rail that serves to keep the platform in proper alinement. At every 75 feet, 10-horse-power motors are mounted on the floor of the subway, and are connected by a chain drive with the transverse shafts, which carry what might be called the driving wheels of the platform. The gradation in the rate of speed of the sections of the platform is secured by varying the diameter of these driving wheels, which are 8 inches in diameter for the 3-mile, 16 inches in diameter for the 6-mile, and 24 inches in diameter for 9-mile platform. The driving wheels are covered with rubber, as are the horizontal central guide wheels, and consequently the motion of the platform will be both smooth and silent. The successive sections of the platform are coupled together by means of long links 46 inches in length, and the coupling pins are placed at the center from which the curves of the abutting ends of the platform sections are struck; consequently, the opening between the joints may be reduced to a minimum, and a smooth and continuous surface presented for walking, with no open spaces to bewilder or trip the passenger.

The stations on each block are provided with two exits and two entrances, which are equipped with moving platforms arranged as escalators. There are two chopping boxes on each side, and eighteen turnstiles are provided for exit, so that there is no interference between incoming and outgoing passengers.

Meteorological Summary, New York, N. Y., April, 1905.

Atmospheric pressure: Highest, 30.40; lowest, 29.30; mean, 29.88. Temperature: Highest, 76, date, 21st; lowest, 31, date, 17th; mean, 49.8; normal, 49. Warmest mean, 54, 1871. Coldest mean, 41, 1874. Absolute maximum and minimum for this month for 35 years, 90 and 20. Average daily temperature deficiency since January 1, —1.2. Wind: Prevailing direction, NW.; total movement, 8.628 miles; maximum velocity, 56 miles per hour. Precipitation, 2.45. Average for this month for 35 years, 3.28. Deficiency, —0.83; since January 1, —2.11. Greatest, 7.02, 1874; least, 1.00, 1881. Thunderstorms, 4th, 5th, 10th, 14th, 21st. Snowfall, trace. Killing frost, 19th.

Motor vehicles are to replace the horse-drawn omnibuses in Berlin. It is intended that in the course of the next twelve months the omnibus horses shall be completely abolished in the German capital. If true, this is good news for the continental motor manufacturers.

Correspondence.

Power Below the Niagara Falls.

To the Editor of the SCIENTIFIC AMERICAN:

In your editorial of April 8 *re* the vandalism at Niagara Falls, you spoke of the danger to the beauty of the famous and delightful "Falls of the Niagara." Now, why is not some mention made of that great source of power to be obtained from that 106 feet difference of level between the foot of the falls and the town of Lewiston? Could not this power be made available by means of a dam somewhat similar to that now nearing completion at Croton?

It seems to me that modern engineering practice should be able to overcome the difficulties there, and make Lewiston and the neighborhood the greatest power district in the world, and give to mankind unlimited quantities of that clean and ever-increasingly useful source of power, light, and heat.

Walkerville, Ont., April 24, 1905. M. PRICE.

[It would be quite possible to develop the energy of that portion of the Niagara River lying between the falls and the lake; not by building a dam, but by a shaft and tunnel. It would, however, be a very costly undertaking.—ED.]

Dangers in the Use of Soap.

To the Editor of the SCIENTIFIC AMERICAN:

In the SCIENTIFIC AMERICAN of March 4 there was an article by Mr. G. F. Shaver, telling of the awful effects following the use of the soap in public toilet rooms. I beg leave to tell the other side of the story. While in the employ of the State Board of Health of New Hampshire, I performed a large number of experiments to determine the relations of the use of various soaps to the transmission of disease. I made careful bacteriological study of seventy-five cakes of soap, obtained from as many sources, including hotels, machine shops, railroad stations, a sewage disposal plant, various kitchens, two abattoirs, and a number of specimens from a public bath, and was unable to find living germs on any of them. Another set of experiments was conducted, to find how long germs would live on soap. A cake of soap was put in a sterile dish, and inoculated with living germs from strong cultures and placed in the incubator. This was repeated with many varieties of soap and twelve of the most virulent varieties of germs. In no case did the germs live more than four hours, and that only once. The germs were all dead in less than a half hour, with but three exceptions. Bacteriological examinations were made of twenty new cakes of soap, and no bacteria were found on any of them, although on one cake of "antiseptic soap" we found a pure culture of a non-injurious mold, and we were able to grow this variety of mold on other cakes of the same soap, but not on the ordinary soaps, such as most commonly used. We found that the soaps selling for five and ten cents per cake would kill the germs planted on them in slightly less time than the higher-priced soaps; this probably being due to much greater alkalinity.

These experiments were not done for any soap company, but were in connection with an extensive study of sterilization for operations in places other than hospitals. We concluded that soap in the farmhouse of ordinary cleanliness is safe to use for any purpose of cleaning. A. P. MERRILL, M.D.

519 North Street, Pittsfield, Mass., April 30, 1905.

A Hint to Inventors.

To the Editor of the SCIENTIFIC AMERICAN:

It frequently happens that even some of our most prolific inventors are at a loss for something to invent, and a hint now and then, if acted upon, will "help them out." Successful inventors usually cast about for something for which there is an urgent demand, and which would come into general use. Just now there is a demand for a reliable signal to prevent railway collisions, i. e., a certain *class* of collisions. The causes of collisions are so various in their character, that they may properly be classified. But this proposition has nothing to do with collisions between stations, but more particularly with such as occur in yards, or on sidings at small stations, or at any place on the line where there is but one siding.

It frequently happens that the siding is too short to accommodate a train and keep the main line clear. This class of collisions is far more frequent than formerly. The roads have increased the length of trains, while the length of the sidings remains the same, and the trains, being heavier than usual, frequently get stalled before they can clear the main line, even if the side tracks were long enough. It not infrequently happens that the side track is so short or the train so long that the train on the siding covers the main line at both ends. This state of things will bring disaster to trains running in either direction and the one on the siding, as has been reported on several occasions.

Within the last few years the most disastrous collisions have resulted from the inability of too long and too heavily laden trains to clear the main line in time to prevent disaster. Sending a flag by day or a lantern by night to warn the incoming trains are wholly unreliable precautions. In dark, foggy weather, or at night, semaphores, flags, or lanterns cannot be seen in time to prevent accident, and the only reliable signal is something in the nature of an explosive. It often happens that the train crew are asleep, and pass all visual signals unheeded, and the only sure preventive of disaster in such cases is a system of ordinary track torpedoes operated by small wire cables, operated by trainmen or some responsible person, a part of whose duty will be to superintend the operating and keeping in repair of the signal appliances. This is not intended to act automatically. The idea is to stretch a small wire cable along the track on the ties or telegraph poles or on short posts, reaching far enough from the station to give an incoming train warning in time to stop before reaching the place of danger. At the far end of the wire or cable would be placed a number of torpedoes in a box or housing, this to be connected by the cable to a suitable contrivance to act as a wire stretcher, located at some convenient point at the station. When desired to place the signal, the person in charge would turn a hand-wheel, or move a lever, or operate whatever mechanism may be in use to pull the wire, which would place the torpedoes on the rail. The wire or cable would be stretched taut on friction rollers, so that only a movement of the wire for a few inches would be required to place the explosives on the rail. A small cable made of about three small wires would be preferable to a single wire, on account of greater pliability. There are various appliances for stretching wires, some of which would operate this signal apparatus admirably.

There are other details that would be necessary to make such a contrivance perfect, but they will readily become apparent to anyone who essays to complete a signal after the above outline.

Within the last few years more lives and a greater amount of property have been destroyed for want of proper or reliable signals to prevent this class of collisions than from all other causes combined; and the explosive system, if properly constructed and kept in order, is more reliable than any other kind of signal yet devised. WILLIAM S. HUNTINGTON.

The Current Supplement.

The current SUPPLEMENT, No. 1532, opens with an account of the recent explorations in Peru, carried out under the auspices of the University of California. As the result of these investigations, it will be easier to give correct chronological position to each Peruvian culture which may be discovered. Excellent illustrations accompany the article. The famous French chemist, M. Berthelot, writes on "Receptacles of Quartz and Their Uses in Chemistry." Prof. William J. S. Lockyer concludes his highly instructive paper on "Our Sun and Weather." A great many although not all deep-sea fishes possess luminous organs, which vary remarkably in details in the different species, yet show a general resemblance to one another and to the analogous organs of cuttlefishes. These luminous organs are described in an interesting paper by Prof. Brauer. Dr. Alexander Roberts gives a simple explanation of variable stars. The new section of electric railroad which has been built up Mount Vesuvius is fully described and illustrated by the English correspondent of the SCIENTIFIC AMERICAN. The well-known naval architect, George W. Dickie, discourses eloquently on "The Man and the Ship." Perhaps in no country in the world are workingmen so protected by the state and cared for as in Germany. Insurance is more or less compulsory. The system which has been worked out by the government is disclosed in an instructive article. Thomas Holgate reviews recent gas and oil engine generators. The usual Electrical Notes, Engineering Notes, and Science Notes will be found in their accustomed places.

Discovery of a Tenth Satellite of Saturn.

Prof. W. C. Pickering, of the Harvard University Observatory, has discovered a tenth satellite of Saturn. The stages of the discovery from the first suspicion of its presence to the confirmatory evidence extended over some years.

The discovery of the ninth satellite was also made at the Harvard Observatory by Bond in 1848. The new satellite has a period of revolution of twenty-one days, or a little less than that of Hyperion, a near-by satellite, which revolves around Saturn in twenty-one days and six hours.

The new satellite has an estimated diameter of 200 miles. It is just beyond even telescopic vision and only the sensitive photographic plate can catch it. The motion of the satellite is direct—against the hands of the watch viewed from the north—in a plane considerably inclined from the plane of the rings.

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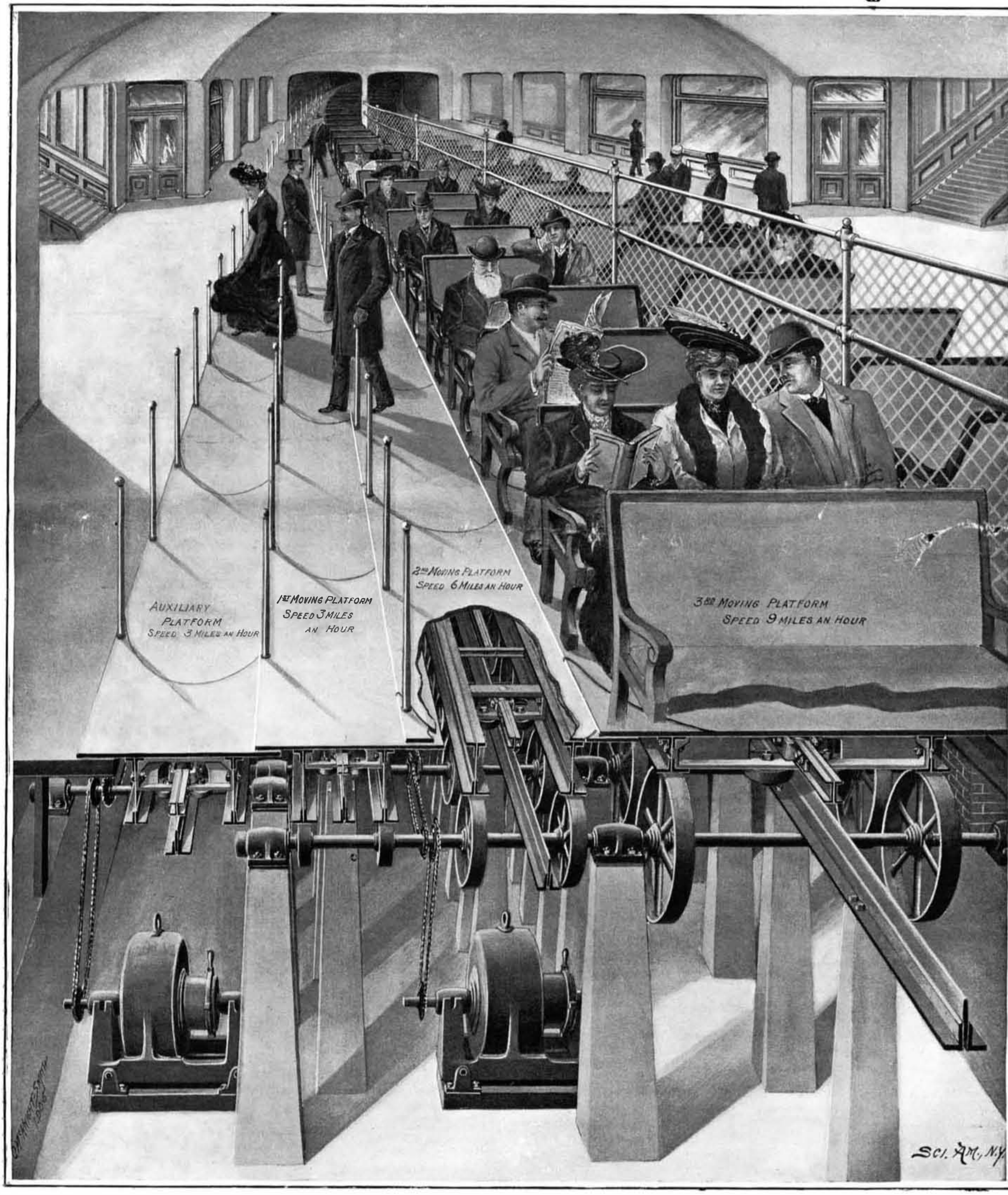

Speed of Seat Platform, Nine Miles per Hour. Capacity, 48,000 Seated Passengers per Hour.

MOVING PLATFORM SUBWAY FOR NEW YORK CITY.—[See page 382.]