A Steam Sled for the North Pole.

At a recent meeting of the London Association of Foremen Engineers and Draughtsmen, Mr. Daniel Cartmel, late Chief Engineer of H.M.S. Discovery, and now of H.M.S. Cleopatra, read a paper on "Polar Exploration, with Suggestions for the Employment of Steam Power in Effecting it." The author, with the aid of several charts and diagrams, explained, in the first instance, the geographical and meteorological characteristics of the arctic regions, and then advanced to his subject proper. Mr. Cartmel, from his experiences during the expedition of Captain Nares, came to the decided conclusion that sledging by manual power was a hopeless method of attempting to reach the North Pole, and since his return has been busily engaged in devising a steam sledge for that purpose. This contrivance, as described by the inventor, consists in its general outlines of a flat-bottomed boat with two stern wheels, the midship cross section being a parallelogram. It would be constructed of steel plates lined with wood, perfectly rigid, and capable of standing the roughest usage. The boat-sledge, as it may be termed, would be highly polished so as to minimize friction, whilst the bow would be stayed and strengthened to the fullest extent, so as to resist concussions. Of course the steam power is intended to be concentrated as much as possible, whilst the steering wheels would be driven directly from the crank shaft. The proceedings closed with a vote of thanks to Mr. Cartmel, who also explained that the sledge might be warped forward with rope, and capstan, when desirable. Here is a suggestion for Captain Howgate and other members of the American Arctic Colony, now trying to reach the North Pole.

Utilizing Subterranean Heat.

The Virginia City (Nev.) *Enterprise* says: "An enterprising engineer of this city is engaged in working out a plan for heating the whole town by means of the heat generated in the subterranean regions of the mines. He says there is sufficient heat in the lower levels of the mines underneath our feet to comfortably warm every house and every room in the city, provided it can be utilized. His plan contemplates a system of pipes, through which the heat will be distributed, while at the same time it will be drawn out of the mines as it arises. Thus he will at the same time heat the town and ventilate the mines."

Pneumatic Postal Despatch, Berlin.

The proposed pneumatic despatch system in Berlin will comprise 26 kilometers of tubing and fifteen stations. The bore of the tubes will be 65 millimeters. They will be of wrought iron and will lie about a meter below the surface of the ground. The letters and cards which are to be forwarded have a prescribed size, and are enclosed in iron boxes or carriers each of which can hold twenty. From ten to fifteen carriers are packed and forwarded at a time, and behind the last is placed a box with a leather ruffle, in order to secure the best possible closure of the tube. The exhausting machines and apparatus required for the transmission are situated at four of the stations. Both compressed and rarified air, or a combination of the two, are employed in propelling the carriers. Steam engines of about 12 horse power are used in condensing or rarifying the air. Each of the four main stations has two engines, which drive a compressing and exhausting apparatus. Large reservoirs are used for the condensed and rarified air. The tension of the condensed air is about three atmospheres, and that of the rarified about 35 millimeters of mercury. The condensed air, heated to 45° C. by the compression, is cooled in the reservoirs which are surrounded with water. The velocity of the carriers averages 1,000 meters per minute, and a train is despatched every 15 minutes. Each of the two circuits, into which the system is divided, is traversed in 20 minutes, including stoppages. The entire cost of the enterprise is estimated to cost 1,250,000 marks.

THE NEW YORK ELEVATED RAILWAY.

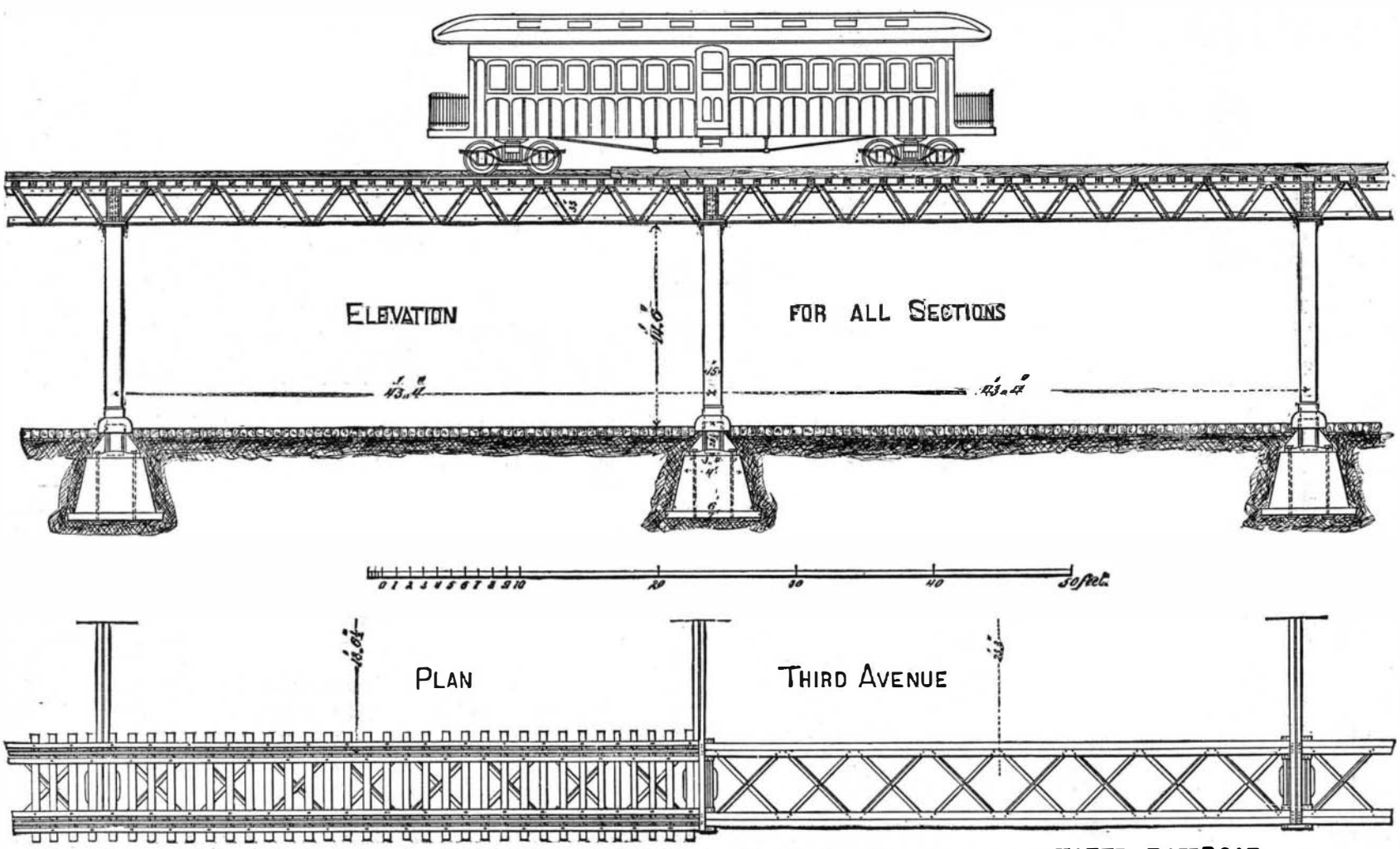
Along Sixth, Ninth, and Third avenues, Pearl street, West Broadway, and other great thoroughfares of this city, large gangs of men are at work, digging foundations and erecting the structures which form the roadway of the different elevated railroads. Within a very few months trains will be running over these new aerial routes, and the long vexed problem of rapid transit, which has been discussed in this metropolis for nearly a quarter of a century, will at length be solved. Whether this solution will have been accomplished in the best possible manner and in conformity with the rights and convenience, both of the traveling public and of the public whose property is affected by the proximity of the necessary structures, is open to question. We have reviewed in these columns all the schemes having a like result in view, and have advised in favor of the underground plan, pointing out its entire feasibility, and directing attention to its successful operation in London, in this city, and elsewhere. In rather anomalous manner, however, the Legislature has authorized the Gilbert and New York Elevated railways to carry their tracks above the same routes, the franchises of which had previously been bestowed upon the street car corporations. Our lawmakers have set aside the old law maxim that right in real property is supposed to extend upward to the heavens; and the highest court of judicature in this State has affirmed the legality of the privileges accorded to the elevated companies, and of the means whereby the latter propose to carry out their projects.

It remains, therefore, but to examine into the practical features of the now adopted plans. Their disadvantages affect, first the horse car companies, whose tracks are virtually inclosed in a tunnel; second, the property owners along the route, before whose second floor windows trains constantly thunder, and whose buildings along the line are depreciated in value without any means of reimbursement or compensation being open to them; and, lastly, the general public, through the obstruction produced by such large structures in important thoroughfares. Their advantages enure to whoever travels upon them, for certainly no more pleasant mode of locomotion can be suggested than to be rapidly whisked along in roomy, well warmed or ventilated vehicles, high above the dust and noise of the crowded streets.

In this article—which is the first of a series on the means of rapid transit in New York, to appear from time to time in these columns—we present a detailed description of the New York Elevated Railway, a portion of which is now in operation over a length of about 5 miles, extending from the southern extremity of the city at the Battery to 61st street, on the north, near Central Park. A perspective view of this road is given in Fig. 1; and in the annexed drawings, for which we are indebted to the *Railroad Gazette*, the details of construction, as the same differs at various portions of the route, are shown. Except over about one third of its length this road is now single track.

The work in progress involves the completion of the second track between the Battery and 61st street; a double track extension along Ninth avenue from 61st street to 81st street, west side; double track road from Whitehall street through Front and Pearl streets, the Bowery and Third avenue to 59th street, including branches to the ferries, western terminus of the East River Bridge and the Grand Central Depot, east side, comprising altogether about three miles of single and six miles of double track.

From the map given herewith (see page 20) this route can be followed in heavy black lines. The route of the Gilbert railway is marked in dotted lines. We shall devote a separate article to the Gilbert system, which differs in many respects from that under consideration. The New York Elevated Railway has a structure based on the "one-legged plan," the essential feature of which is that the weight of roadway as far as possible is carried immediately over the posts which support the structure. The Gilbert Company, on the contrary, in nearly all cases, supports its roadway between the posts on transverse. It will be seen, however, from the drawings, that the elevated road adopts this latter mode, over its Whitehall street route. As the drawings are all marked with the names of the streets, the reader can easily trace for himself the various modifications of structure which have been adopted to suit varying localities. Front and Pearl streets from Whitehall street to Franklin Square being narrow, with but little room in the roadway, the latter is either spanned or a single track is carried by each line of columns over the curbs. The latter plan is preferred.



ELEVATION AND PLAN OF PROPOSED STRUCTURE FOR THE NEW YORK ELEVATED RAILROAD.

From Franklin square to the intersection of the Bowery with Third avenue, alone the New and Old Bowery, owing to the number of surface railroad tracks and other circumstances, the columns must be on the line of the curbs.

On Third avenue the upper stories of the buildings are occupied very generally as dwellings, and it was thought desirable to remove the tracks as far from the houses as possible, and as the roadways are 50 feet wide, with a double line of surface horse railroad tracks in the middle, a line of columns is to be placed upon each side of the horse railroad tracks, and connected at the top by light elliptic arch girders. The track superstructure will be 17 feet or over above the grade of the surface railroads, and the columns in the roadway 15 inches square, and in nearly all cases 15x18 inches when on the curb. The general average length of the spans will be 43 feet 4 inches. the girders made of open lattice work, and 33 inches deep, and to be proportioned so that no part of them will be subjected to a greater strain of tension and compression than 8,000 lbs. per square inch, or a greater shearing strain than 6,000 lbs., and the maximum deflection of the girders when loaded not to exceed one fifteen-hundredth of its span. The columns will consist of two 15 inch rolled channel beams united by lateral bracing, consisting of $3\frac{1}{2}$x$\frac{5}{8}$ inch bars riveted to the flanges of the beams. Where the track is carried over the columns, the tops of the channel beams are curved outward from the center each way far

enough to support the longitudinal girders. When the track is carried on girders between the columns, the channel beams of the post are carried up straight. The lower ends of the beams will be set into sockets of cast iron bed plates weighing about 2,200 lbs. each. The bed plates will be 3 feet 4 inches square at the base and secured to masonry foundations by four anchor bolts 2 inches in diameter. The foundations will generally be about seven feet deep and seven feet square at the bottom; and are to consist of flag stones and hard burned bricks laid in hydraulic cement mortar.

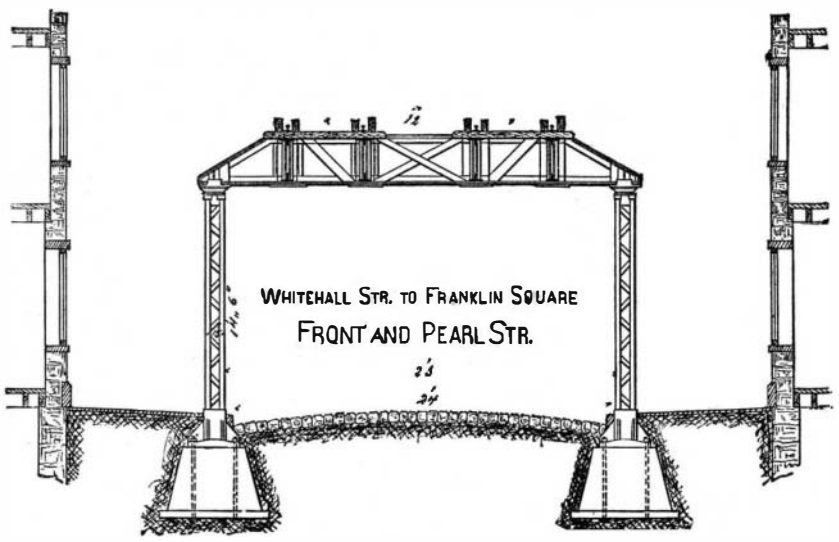
The top chord of the longitudinal girders will be composed of two $6\times6\times\frac{9}{16}$ inch angle bars, and the lower chords of two $5\times5\times\frac{9}{16}$ inch angle bars, riveted together so that each will form a T, the two riveted by double angle braces, $5\times3\times\frac{7}{16}$ inch at the ends of the beams and $4\times3\times\frac{7}{16}$ inch in the center, placed back to back on the outside of and embracing the Ts by being properly riveted together.

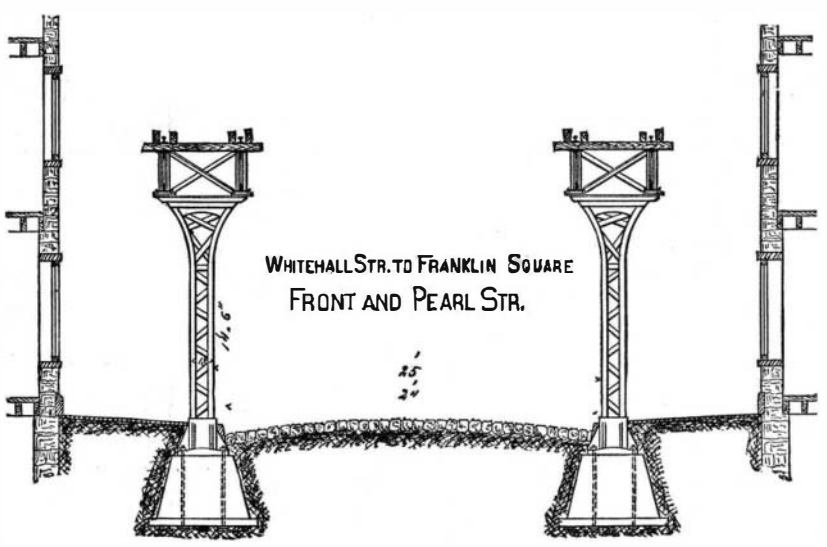
The track will be of 4 ft. 8½ in. gauge, the superstructure consisting of Bessemer steel rails, weighing fifty pounds to a yard and laid on yellow pine cross ties 7 ft. long by 6 in. by 5 in., to be placed ten inches apart in the clear. On each side of each rail longitudinal guard timbers are to be placed. the inner ones are to be 5 x 8 in. and the outer ones 5 x 10, the ends to be securely spliced together, and each guard will be bolted to every alternate tie, and each tie bolted by two bolts to the guards. The cross ties will be secured to the longitudinal girders by lag screws with washers at the bottom, the latter projecting under the top flanges of the girders, clamping the ties to them.

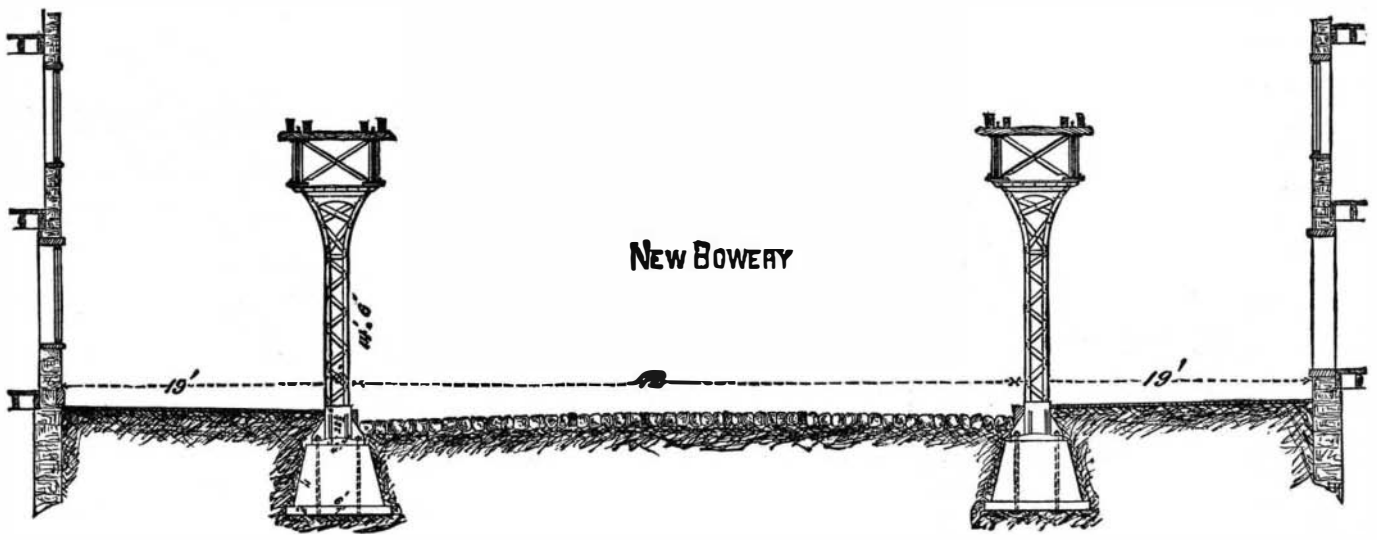
The rolling stock at present used on the Greenwich street road consists of light four-wheeled engines, of the form shown in the perspective view, Fig. 1. These weigh from 12,000 to 14,485 lbs. with a full supply of coal and water. The driving wheels are 33 in. in diameter, placed five feet apart. It is proposed to increase the weight of the engines to 16,000 lbs.

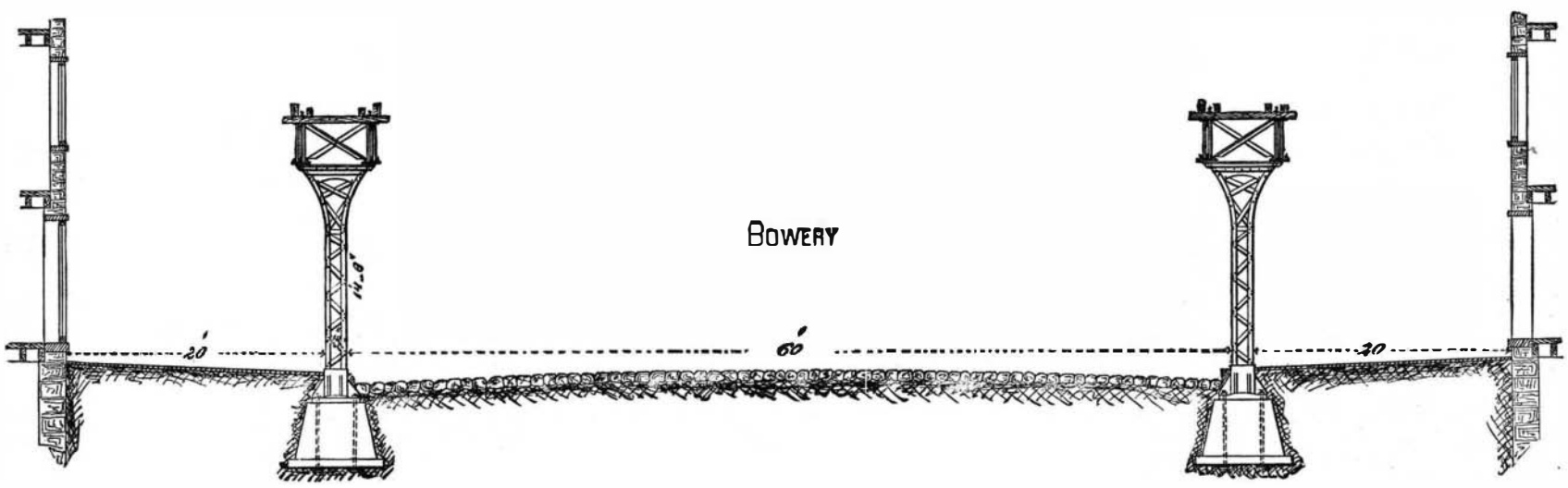
The last passenger cars purchased weigh, when empty, about 16,000 lbs., and are 41 ft. 6 in. long over the platforms; the bodies are 35 ft. 6 in. long by 7 ft. wide, and seat 48 passengers. It is thought that the cars can be made lighter.

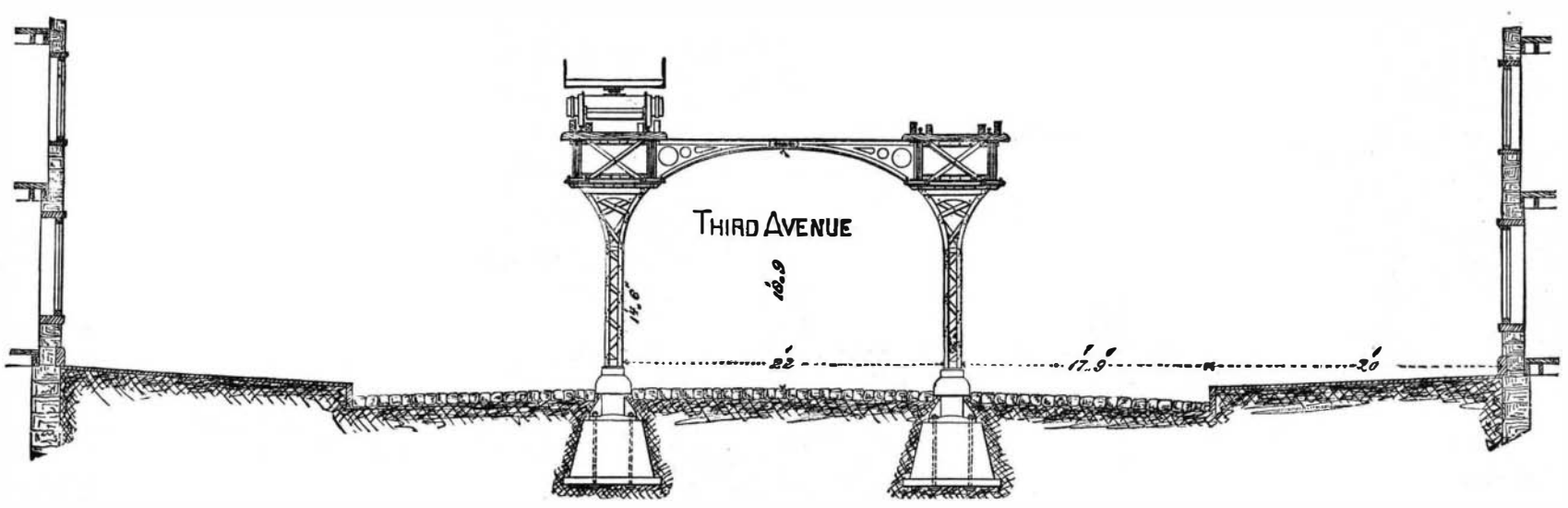
At first sight the impression produced by the appearance of the one-legged structure, as it has derisively been called, is that it is lacking in lateral stability. This, however, is not the case, as the structure is subjected to very little lateral strain, the chief difficulty being to give sufficient longitudinal stability to resist the action of the momentum of the train when the brakes are applied. This difficulty arises from the necessity of allowing space between the ends of the girders for their expansion and contraction, and therefore such strains cannot be transmitted through them to more than two, or probably three, columns. To provide for this,









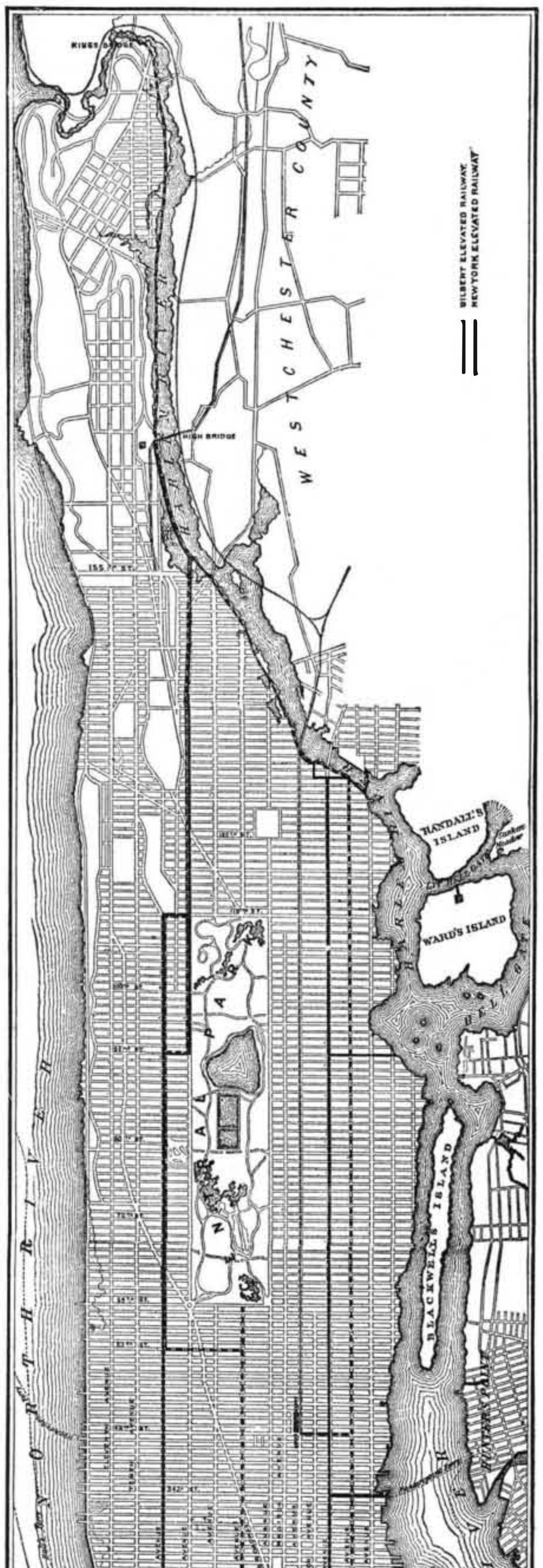


TRANSVERSE SECTIONS OF PROPOSED STRUCTURE FOR THE NEW YORK ELEVATED RAILROAD.

the longitudinal guard timbers, which are not subject to expansion by changes of temperature, are securely bolted through the cross ties and to the flanges of the top chord of the girders. In this way the longitudinal strains are distributed over an indefinite length of the structure.

MINERAL WOOL.

A small portion of the waste product of a blast furnace may be successfully utilized by converting it, while in the molten state, into the materal known as mineral wool. The cheapness of the slag and the simplicity of the process render the manufacture of mineral wool capable of being carried on in all iron districts, and it is the object of this article to give such an explanation of its properties and characteristics as may be of general interest.



MAP SHOWING LOCATION OF RAPID TRANSIT RAILROAD IN NEW YORK.

The New York Elevated Railroad is represented by black lines; the Gilbert Elevated Railroad by dotted lines.

The process is confined to the treatment of substances containing a high percentage of silica. Regarding slag as a silicate of lime and magnesia and alumina, we can readily see that, as the silica acts as the acid, its presence in a low or high degree gives wide range for difference in the resulting slags; and according to the predominance of either base or acid, they are classed as basic, acid or neutral. A great variety of mineral wools is thus afforded, but experience has shown that a neutral slag produces finer fibers than one containing a large amount of silica, and therefore it is more pliable and easier of application. Slags containing manganese make a greenish wool, while pink or reddish wool appears to accompany hard grades of iron. Under other circumstances the wool will be white, being purest white when the percentage of base is large and assuming a gray and smoky color as the silica increases.

The diagram shows a section of the mineral wool house and apparatus at the Clove Furnace, Greenwood Iron Works, Orange County, N. Y. At this furnace, as at the majority of American furnaces, there is not sufficient room about the stack to erect a chamber in which to blow the mineral wool, and even if there was ample space it would be economy to allow the slag first to run into box-cars and afterward tap these, because the cinder, when it comes directly from the furnace, flows too fast to be controlled and properly utilized. As a result of this difficulty the wool-house stands about 100 feet from the furnace. When a car is run full of fluid cinder it is taken in front of the wool-house, the chilled slag knocked out of the tap-hole, and a small stream only allowed to fall to the runner, over which it travels and again falls 3½ inches, where it is met by the jet of steam.

The sudden impact of steam or air under pressure against thinly flowing slag immediately scatters the stream, forming a spray of small globules or shot, which, on becoming detached from the larger mass, stick, as it were, and thus give a beginning to the vitreous thread.

The aperture of the nozzle which forms the jet of steam plays a most important part in separating the stream of slag into small shot at the outset, for it is obvious that the smaller they are at the first the greater the possibility of their being absorbed in the fiber, which is pulled out in their flight. The blowing part of the process has been so far improved that the shot are much less than a sixteenth of an inch in diameter, and there is no need of separating them from the wool, as they do not impair its effect.

The wool house is 30 feet long by 14 wide; the gable of the roof is 21 feet above the floor, and a sheet iron extension 10 feet long reaches to the slag car. The frame of the building is covered on the interior with thin sheet iron. The front of the house is provided with a window which serves as an outlet for the currents created by the jet of steam, and these currents carry a portion of the lightest wool up on the top floor. The mineral wool taken from the first floor is entirely free from shot, and is called No. 3; the other two grades are deposited on the lower floor, and are separated also by currents of air.

As this conversion of vitreous substances into a filamentous or fibrous material is a mechanical one, we find the wool to be of the same composition as the slag, so that, if the composition of a slag be previously ascertained, the character of the resulting wool may, in a measure, be determined.

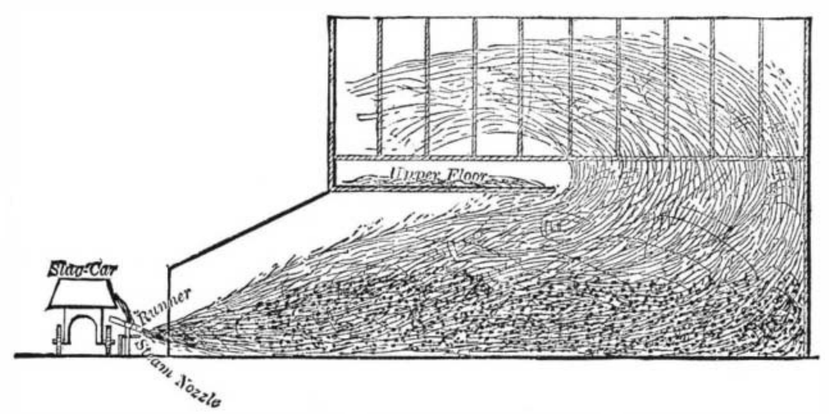
The density of bodies, generally speaking, determines the rapidity with which heat is transmitted through them, and accordingly we find the metals to be best conductors, and stone-earthenware and plaster not so good, while porous or air-confining substances constitute the so-called non-conductors. The gases are very poor conductors, and probably air is the worst conductor known, that is, it is the substance which, when at rest, impedes the passage of heat most. But heat is conveyed through air by the movement of its particles, which is obviously not the case in more dense media; therefore, we should infer that, if the circulation of the air were some suitable absorbent, the passage of heat would be retarded. This brings us to a clear conception at last of what a non-conductor ought to be, and it might not be out of place here to recall to mind the fact that birds are clothed with feathers and beasts with hair as a protection against cold, and that these coverings are poor conductors, simply because they hold in suspension an enormous amount of air. In order to ascertain how much air is confined in mineral wool, we will consult figures a little. A cubic foot of slag weighs 192 lbs., while a cubic foot of No. 1 mineral wool weighs but 28 lbs.; No. 2, 16 lbs. and No. 3, 8 lbs.; thus showing as a result of the conversion a decrease in weight, which is equivalent to an increase in air-space of 85 per cent., 90 per cent., 95 per cent., for the three grades respectively. The immense expansion is better illustrated, perhaps, by saying that one cubic foot of slag will make 24 cubic feet of No. 3 mineral wool, which would cover 192 square feet two inches thick.

A substance, to be a superior non-conductor for application on heated surfaces, should combine great air-confining capacity with indestructibility, which means that it should contain nothing organic. To further substantiate these statements, which might otherwise appear hypothetical, a few experiments have been made after the method used by Count Rumford in 1792, when he ascertained the relative degrees in which furs, feathers and other organic materials used for clothing conduct heat.

The ball and stem of a thermometer were covered with a inch thickness of the substance to be tried, by placing it within a larger bulb of glass and then filling the surrounding interval between the two with the substance; and after heating this apparatus to a given degree in boiling water, it was surrounded by ice, and the comparative times required to cool the thermometer a certain number of degrees was noted. The figures following the names of the substances mark the number of records required respectively for cooling down the thermometer through 60 degrees Fahrenheit: Asbestos, 390; cotton, 438; felt, 463; mineral wool, 770. Of course cotton has no bearing on the subject under discussion, except that it is used for domestic purposes as a poor conductor of heat, but asbestos and felt are used extensively to protect heated surfaces.

It is a characteristic of organic substances that they gradually become impaired by heat, are liable to burn; and there is no reason to suppose that felt has lost this unfortunate property. There is a disparity in the weights of these substances which favors the felt. The space filled being the same in all cases, the relative weights were noted as follows Felt, 310 grains; mineral wool, 757 grains; asbestos, 2483.

For the coating of steam boilers, cylinders, steam domes, pipes, etc., mineral wool is especially valuable. It is economic, durable, and very easy of application. It can be applied underneath wooden lagging or sheet iron. These can be kept at a uniform distance from the boiler by runners or studs, and the mineral wool stuffed under as the lagging is put on. The strips forming the lagging should be tongued and grooved and seasoned to prevent their warping afterward. The wool must not be stamped in so as to crush it, but must simply be loosely pressed, so as to thoroughly fill the open spaces. For the up-take in marine boilers, which are often carelessly covered with combustible materials, and cause frequent alarms of fire, mineral wool is particularly adapted, because it cannot possibly burn. Thin sheet iron makes a very neat and lasting jacket, and is readily bent over the boilers before the wool is stuffed in.



PLANT FOR THE MANUFACTURE OF MINERAL WOOL.

In consequence of the looseness of mineral wool, its application to pipes requires some device for holding it on. Where a pipe runs underground or in the open air, a common box answers every purpose, and for inside work canvas makes a suitable jacket, if it is properly kept in place by collars or studs. Vulcanized fiber is a material admirably adapted for a covering, because it is pliable and yet of sufficient stiffness to keep in shape while packing. It has a brown color, and is generally varnished so as to withstand the weather, it should be put on in sections of about a foot at a time, and secured by small brass clasps placed at intervals of 3 or 4 inches.

Mineral wool should be applied between 2 and 3 inches thick. The No. 1 quality is used for lining large ice houses, brewers' vaults, etc., and is put in with best results 4 inches thick, at a cost of 12½ cents per square foot. A square foot of No. 2, two inches thick, costs 10 cents, and one of No. 3 costs 20 cents. This material is receiving wide introduction in England under the name of slag wool, and it has also been in very general use in Germany, where it is called silicate cotton. The process for the manufacture of mineral wool and its manipulation are protected by five United States patents, the rights for the use of which in the different States or parts of them must be secured from Mr. A. D. Elbers, 26½ Broadway, N. Y. Mr. Elbers is the sole agent for the sale of mineral wool in this country.—*Iron Age.*

SAND FOUNDATIONS.—A block of stores is now building in Hartford, Conn., for which the foundations are laid in this way: Trenches are dug down to the hard pan, and are then filled with water. Beach sand is then sifted in until the trenches are filled with the soaked and compacted sand, which is covered by a thick layer of concrete, which in turn is to receive the stone work of the foundation walls.

A NEW soap has been patented in Germany which is composed of common soap with the addition of phosphate of soda. It is said to have especially good cleansing qualities, and to be adapted for use in salt as well as fresh water.