the Empire, and was fully commended by Confucius, Confucianism has little outward ceremonial. The study and contemplation and attempted performances of the moral precepts of the ancients constitute the duties of a Confucianist. Buddhism and Taoism present a gorgeous and elaborate ritual in China. The bulk of the people are Buddhists. There are about thirty million Mahommedans, one million Roman Catholics, and fifty thousand Protestants. Most of the aboriginal hill tribes are still nature worshippers.

The army of China comprises "the Eight Banners," nominally containing about 300,000 men. The national army whose nominal strength is about 550,000, has about 200,000 available for war. Besides these forces there are mercenary troops ready in emergencies and Mongolians and other irregular cavalry. The latter are nominally 200,000 strong, but like everything else in China they largely exist on paper. They number really but 20,000 and are of no military value. The total land army on a peace footing is put at 300,000 men, and on a war footing of about 1,000,000, but the army, as a whole, has no unity or cohesion. There is no proper discipline, the drill is merely physical exercise, and many of the weapons are long since obsolete; but since April, 1895, British firms have shipped to China 71 guns of position, 123 field-guns and 297 machine-guns and a German firm has supplied China with 460,000 Mauser rifles and 3,000,000 rounds of ammunition in the same period. From this it will be seen that the Chinese are not as backward, as regards war material, as has been supposed. Supplies of ammunition for the guns have been adequate. The Chinese navy during the war with Japan disappointed those who regarded it as an effective fighting force. Some modern vessels have since been added to the fleet.

Peking is at once interesting, despicable, superlatively beautiful, disgustingly filthy, and, in short, a city of contradictions. Originally a Tartar encampment, begun by the hordes that swarmed to the eastern part of China, Peking soon became a fortified city of much strength. Here the Tartar rulers lived, surrounded by their Manchu followers—fearing the white man's usurpation far less than the numerical preponderance of the Chinese. So, in order to protect themselves from unexpected assault, they constructed a huge wall around their city—for China is a land of walls—and for a time lived in tolerable security.

Gradually, however, the Chinese, realizing to some extent their power, began a rival city adjoining the Tartar fortress. They, too, built a wall, and, as the Tartars did, whenever a workman died, his body was entombed within the wall. In this manner, it is estimated, that one million human beings found their last resting places in the walls surrounding Peking.

While the Chinese city is of much interest, both from a sociological and architectural viewpoint, yet the Tartar city is the more important, for within its precincts is the "Forbidden," or Purple City, where lives Kwang Su, the unfortunately progressive monarch of the Chinese. The Forbidden City is a city of night, for there the denizens of the palace of the Son of Heaven awaken and begin their life.

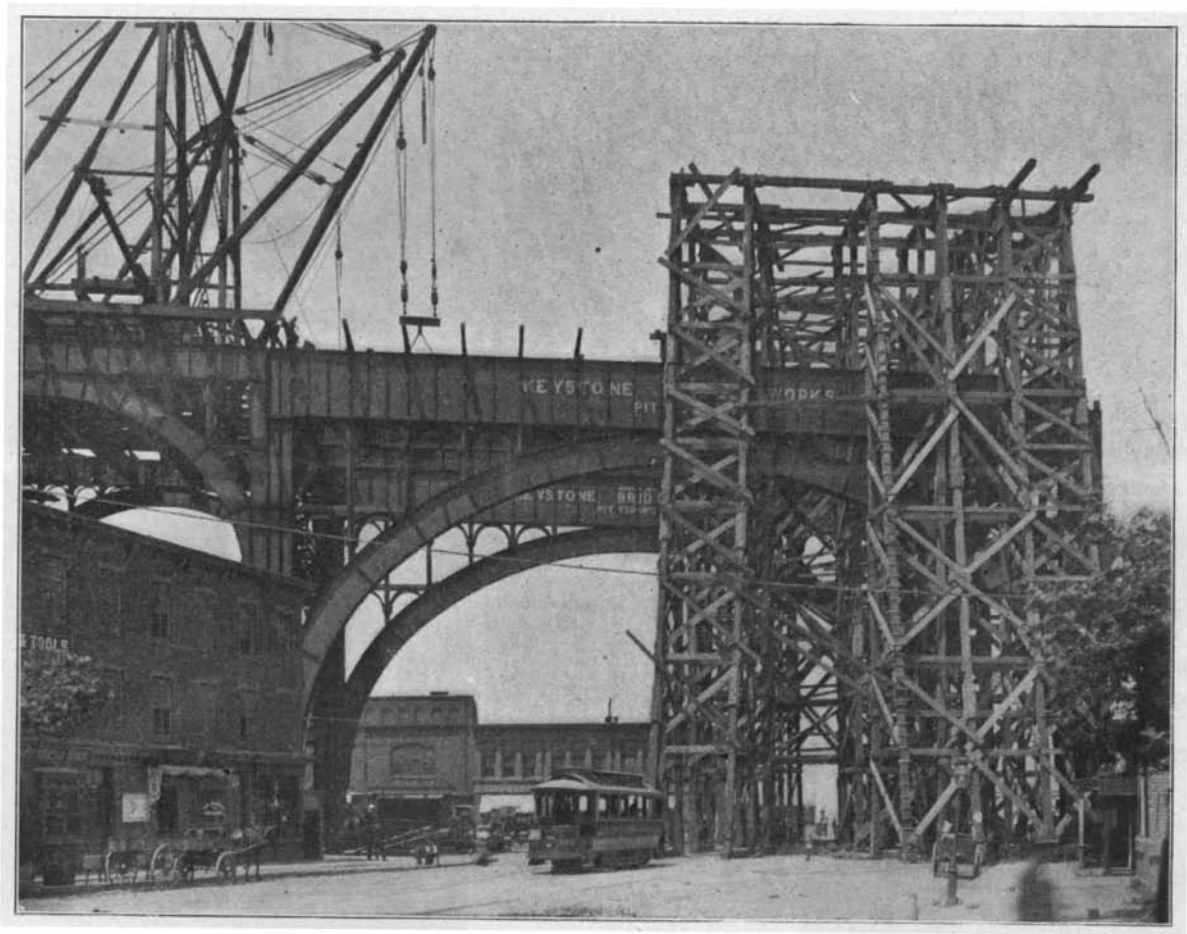
Little is known of the Forbidden City, for within the memory of man not half a dozen whites have entered it. All that is known is that it contains the palaces of the Emperor, and, what is perhaps more interesting, the famous coal hill. This immense heap of coal was accumulated for use in case the city was besieged. The hill is several hundred feet high and contains hundreds of thousands of tons of coal.

Whenever the Emperor was about to leave the Forbidden City, for some religious or State function, the legations of the foreign nations have been notified, so that no unholy eye might rest upon the puny form and sallow face of Kwang Su. The entire route to be traversed was curtained off and thousands of soldiers line the so-called streets, so that no Peeping-Tom could ply his trade. But despite all such precautions, the well-known Oriental propensity for money, exceptionally strong in the Chinese, enabled foreigners to see Kwang Su at close range. They beheld a shrinking, slight figure, dressed plainly and utterly eclipsed by the gorgeous apparel of his retinue.

The rest of Peking is very much like all Chinese cities—picturesquely confusing and terribly dirty. Streets run in the most bizarre fashion, totally oblivious of their beginning and end, aimlessly wandering from bad to worse, fringed on both sides by hovels and palaces, in confusion. Dogs and pigs meander about, jostle equally offensive beggars and unkempt children; stuffy litters, suspended on long bamboo poles and carried by coolies, make life a burden; odors, concentrated beyond the power of descriptive writing to portray, overwhelm the nostrils; the effluvia of ages of non-sanitation, drawn heavenward by the torrid sun, spreads disease; the chatter of a thousand gutteral Mongols and Chinese is intermingled with the yelping of the dogs, the squealing of the pigs, the screaming of the children, and the loud cries of the coolies—such is Peking.

Of course, there are parts in the outlying hills where the rich mandarins and merchants live, where true Oriental luxury can be found. There, magnificent palace-like dwellings dot the landscape, surrounded by idyllic gardens. The art and imagination of the Chinese architect have found full scope for his talent, and as a result these habitations are a credit, externally and internally—all save the sanitation, of which the Chinese are in blissful ignorance. Yet the wealthy Chinese has luxury, even though a coolie takes the place of an electric fan to cool his fevered brow.

Taken all in all, China and the Chinese make an interesting study from any viewpoint, but it is wrong to underestimate their brain power in such study, for they are far more advanced than is generally conceded. Let China be civilized, and the world will witness as great a metamorphosis as that which so astonished the world when Japan emerged from her chrysalis of Middle Age conservatism and provincialism.



One end was lifted from the traveling derricks and the other from the timber falsework.

LIFTING THE 130-FOOT GIRDERS INTO POSITION.

RIVERSIDE DRIVE VIADUCT, NEW YORK.

The handsome viaduct which is now being constructed across Manhattan Valley is being built for the purpose of connecting Riverside Drive with the important system of driveways which encircles the northern end of Manhattan Island. When it is completed the citizens of New York will be provided with a continuous high-level boulevard, reaching from Seventy-second Street and the Hudson River to the western end of Dykeman Street, on the Harlem River, a distance of 7¼ miles. As the latter thoroughfare is practically the northern terminus of the Harlem River Speedway, which is some three miles in length, the completion of the Riverside Drive viaduct will afford a continuous drive of ten miles along the picturesque banks of the Hudson and Harlem Rivers.

Manhattan Valley has a width of about a third of a mile and is intersected by six different streets, one of which constitutes the main approach to the Fort Lee ferry and is traversed by horse and electric trolley lines, the latter fact alone rendering the valley unsuitable for the construction of a public driveway at the level of the streets. On the north the valley rises abruptly to Washington Heights, a ridge or tableland which extends northward between the Hudson and Harlem Rivers to the extreme limits of Manhattan Island. Around its western and northern bluffs winds a most picturesque driveway known as the Boulevard Lafayette. This boulevard and the Riverside Drive to the southward afford magnificent views of the Hudson River, which is here flanked by the lofty cliffs of the Palisades on the west and she richly wooded heights of Manhattan, Spuyten Duyvil and Yonkers to the east.

The viaduct, which has been designed with a view to its harmonizing with the features of the surrounding country, is a steel structure whose total length, including the masonry approaches at either end, is 2,074 feet. The southern approach is located just below Claremont, a villa rich in historic interest, which is situated in the loop which at present forms the northern terminus of Riverside Drive. Immediately to the south of Claremont rises the massive pile of the Grant Memorial Tomb. This entrance to the drive will be carried on a masonry approach 262 feet long. The steel structure, 1,564 feet in length, consists of a series of steel arches of 65 feet span carried on steel latticed piers. The roadway, 60 feet in width, is constructed at an elevation of about 75 feet above the ground level. Ten-foot sidewalks, supported on brackets, are provided on each side of the roadway, and at regular intervals balconies are built out from the sidewalks to afford places of rest and observation. The southern entrance is widened out and bounded with a semicircular wall, in the center of which stone staircases lead down to the lower level of the valley. The masonry of the approach is finished in coursed ashlar limestone, while the pedestals, copings, capstones, etc., are of granite, hammer-faced. The 65-foot arches of the viaduct, which are 3 feet in depth, are of latticed plate-girder construction and are rectangular in section. The steel columns are oblong in section, measure about 3 by 5 feet, and are also of latticed plate-girder construction. The floor is carried on floor beams 5 feet in depth, of which there are six to each span, and upon these are thirteen rows of 12 inch longitudinal I-beam floor joists. Above the joists is a solid floor of riveted ⅜-inch buckle-plates. The plating of the roadway and sidewalks will be covered with a paving composition of coal-tar residuum and broken stone, and upon this will be laid the asphalt surface.

From a structural point of view the most interesting feature is the large semicircular arch of 130 feet span by which the viaduct is carried over Manhattan Street. In its relative proportions this span is exactly similar to the smaller 65-foot spans of the viaduct. It will be noticed that the plating of the columns is carried up in every case between the spandrels of the arches to the level of the under side of the longitudinal plate girders which carry the floor system. These plate girders are designed to carry the whole of the dead load of the floor system, and they have been so nicely calculated that when the bridge is completed their under side will just touch the crown of the arches. Most of the live load that comes upon the bridge, consequently, will be transmitted directly to the arches and carried by them to the columns.

In the case of the main 130-foot span, the two longitudinal plate girders were necessarily of massive proportions, as can be seen from the small engraving showing one of them in place upon the cars on which it was transported. They are 130 feet long, 10 feet deep and 3 feet wide, and each weighs 62½ tons. Necessarily the work of raising these masses of metal to their place on the columns was a difficult piece of work, which was aggravated by the fact that only a limited number of hours was granted by the street railway company for the necessary interruption of traffic during their erection. The accompanying illustrations show the method by which the spans were lifted into position. A series of trestles, built up of 12 by 12 timbers, was erected at the northern end of the arch, and a pair of powerful erecting derricks was built upon the floor of the viaduct at the southern end of the span. Four hoisting engines were engaged in lifting each span, and at a given signal the huge mass was lifted the necessary 75 feet into the air and moved easily into place on its abutments. What rendered this operation particularly difficult was the fact that the exigencies of

erection demanded that one of these 130-ton spans and four of the longitudinal, intermediate girders should be suspended in the air at one time, and held there long enough to allow a certain amount of bolting and riveting to be accomplished. The total amount of girder work thus suspended at one time was 220 tons.

The designer of the structure, Francis Stuart Williamson, M. Am. Soc. C.E., of this city, is to be congratulated on the appearance of the viaduct, which, judging from that portion of it which is now completed, promises to be an attractive feature in one of the most picturesque localities on Manhattan Island.

Engineering Notes.

The public buildings of the United States have cost, since the foundation of the government, exclusive of the buildings in Washington and those employed by the Army and Navy, $154,775,384. Of this the sites have cost $22,755,167, and there remains $23,843,574 to be expended on these buildings before they are completed.

Two types of moving stairways for the Manhattan Elevated stations in New York city are to be put on trial shortly. One is a ramp consisting of an endless rubber band running over drums. In the other type regular steps will take the place of the nearly smooth incline, so that a passenger always stands on a level surface.

A special car for invalids is being built for the Saxon State Railroads for the transportation of those who can afford the expense of a whole car. It consists of three apartments, with a corridor on one side. One is for the sick person, and one of the others for the physicians, and the third for attendants. Cooking apparatus and refrigerators are provided. It may be hired for use on any railroad in Europe provided it is not needed at home.

The question of the scarcity of fuel in Russia has long occupied the attention of Russian scientists. Coal is found only in small quantities, while wood is by no means sufficiently abundant to warrant extensive consumption. It is proposed to surmount the difficulty by turning the enormous quantities of peat to account. In many districts the turf comprises almost the staple fuel. Its calorific power is said to be double that of wood. The turf is compressed into small briquettes and sent to the market. It is estimated that the cost of manufacturing the turf for commercial purposes is about six dollars per ton, which compares very favorably with the price of coal.

A new fire-proof substance was recently tested in England at the station of the British Fire Prevention Committee. The material, which is known as "gypsine" is manufactured of plastic hydraulic lime, mixed with coke or sand, and asbestos. It is compressed into bricks. In the experiment to prove its fire-resisting qualities, a partition 10 feet in length by 7 feet 9 inches in width was constructed with these bricks, which were laid in hydraulic mortar with joints ¼ inch thick. The side of the partition exposed to the fire in the test hut was coated with a thin layer of fire clay. The fire was maintained for an hour, during which time the temperature rose to 2050° Fahr. Notwithstanding, this tremendous heat the material successfully resisted the flames. At no period of the test did the temperature of the exterior surface of the partition attain a height sufficient to ignite a match.

It is a well-known fact that in all carbide works a vast amount of material is manufactured that is of such inferior quality that it cannot be employed in connection with acetylene, and so far has been regarded as waste. Now, however, a French engineer, M. Hubou, has invented a process by which he can convert this unsalable material into a commercial article in the form of acetylene black. When acetylene is decomposed the carbon is liberated in an absolutely pure and finely-divided state. It is immeasurably superior to lampblack, and would prove a valuable substitute for that substance in the manufacture of lithographic ink were it not for the fact that it is so exceedingly expensive that it would not pay for its manufacture. M. Hubou, by his new process, however, is able to convert the carbide residue into the black at a very small cost, so that it can compete in price with the ordinary lampblack. His process is simplicity itself. The acetylene is forced into an explosive vessel, filled with hydrogen, until a pressure of about 75 pounds is attained. The substance is then exploded by firing a coil of platinum wire, that has been previously inserted into the vessel, to a white heat. Owing to the presence of the hydrogen in the receptacle the heat generated by the acetylene in the process of decomposition is reduced, so that the highest pressure recorded during the explosion is no more than 370 pounds per square inch. One cubic foot of acetylene yields 1 oz. of black, while also a cubic foot of pure hydrogen is produced. There is no reason why the latter article should not also be turned to commercial account. It could be easily stored in cylinders and could be employed for æronautical and other purposes.

Science Notes.

In Paris a journal is published for theater physicians. Nearly every special branch of medical service now has its own particular organ.

The Monthly Weather Review denies the authenticity of a paragraph, which is going the rounds of the press that the Weather Bureau is utilizing piano wire kite strings in developing a new method of wireless telegraphy.

Gutta percha in Sumatra and Borneo is being exhausted owing to the reckless and primitive way in which the trees are treated. The Philippine Islands will prove an excellent place for profitably growing gutta percha.

Of the 46,988 deaths which occurred in Paris in 1899, as many as 12,314 are attributed to tuberculosis, or more than one-fourth. A more striking result is obtained by observing the figures for the different ages; thus for 100 deaths the figures for the ages from 1 to 20 years attributes 37·2 to tuberculosis; from 20 to 40 years, 60·2; from 40 to 60 years, 30·5; 60 years and over, 3·3. It will thus be seen that from the age of 20 to 40, tuberculosis counts for three-fifths of the total mortality.

The Board of School Superintendents for the Boroughs of Manhattan and Bronx have recommended the abolition of the vertical system of penmanship. The objection against the system is that it makes slow penmen. The advantage of the vertical penmanship is said to be that the attitude in which a pupil produces the vertical writing is far more healthful than for slanting writing. Roundness and legibility of vertical writing, as well as the usual angle in its execution, are asserted to be much more favorable to the eyes. If abandoned later for a more rapid style it is thought to be best to teach the child vertical writing as a foundation for his future chirography.

In a communication recently made to the Agricultural Society of France, M. Vassiliére gave an account of a new process of preserving wine from the action of microbes which attack it when in the cask. When the wine is placed in a cask which has been left empty for some time, it is subject to deterioration owing to the action of the different microbes, these being propagated when the wine is in contact with the air. The expedient generally in use consists in burning sulphur in the empty cask to purify it. The experimenter proposes to remedy the difficulty by covering the wire with a layer of carbonic acid gas, which, being more dense, drives out the air and takes its place. The carbonic acid is liquefied in tubes of chrome steel provided with a reservoir in which it takes the gaseous form before passing into the cask; the reservoir is provided with a rubber tube which descends into the cask and also with a pressure gauge by whose indications the supply of gas is regulated. By this method very good results have been attained and at a small cost.

The English government is conducting an interesting and unique experiment in connection with the foreign trade of Great Britain. For some time leading manufacturers have complained and suffered a good deal of inconvenience from their inability to obtain any information exclusively for their own benefit, regarding commerce in foreign countries. For instance, when an English firm received a contract from a foreign source they experienced considerable difficulty in endeavoring to ascertain the financial status of their client, unless they dispatched their own agent, which they were not in a position to do. Now the government has appointed commercial agents in Russia, Switzerland, the United States, and Central America, for the sole purpose of answering inquiries and forwarding any information that may be desired by English firms. By this means, English manufacturers will be able to obtain private, confidential, and exhaustive information regarding any particular process, bona fide character, or otherwise, of contracts; in short, exactly the same information as if they had dispatched their own representative to the country to conduct the investigations. The government intends to try the experiment for two years. If it proves successful, it will doubtless be continued and extended. Of course a small charge is made for all information supplied, varying according to the character, and time expended in the investigation, but taken on the whole the charges are so moderate that no complaint as to their exorbitance can be made. For instance, the charge levied upon an ordinary inquiry is $1.25; for inquiries as to trades, $5.25; for extended inquiries involving long reports and information of an exceptional character, up to $25. If the agent has to undertake a railway journey, the cost of same must be defrayed, together with $5 a day for his expenses; $2.50 for a broken day, and $5 per night for subsistence. British firms requiring any such information, can obtain, if necessary, an estimate of the cost of obtaining same, by application to the Embassy or Legation of the country in which they desire the investigations to be conducted. The agents will also forward complete and detailed reports upon commerce, industries, and so forth, to the home government, at various intervals.

Electrical Notes.

In Egypt the telephone operators are all men, and they are required to be expert linguists, speaking English, French, Italian, modern Greek, and Arabic.

A Portugal paper gives details of an invention for facilitating fox and badger hunting. It consists of a small electric lamp fixed to the collar of the dog, which is to enter a burrow. The effect of this light is to frighten the animal and cause him to come out of his burrow.

In Germany considerable attention is being devoted at present to the application of electricity in agriculture. One of the most recent movements in this direction is the formation of a syndicate in the district of Ochsenfurt, Bavaria, for the establishment of an electric system for use in agricultural work. The current will be furnished by a central station, which will use hydraulic and steam power; the distribution of current will be made at high potential, 5,000 volts, to the territory where it is to be used. In each farm will be located a sub-station, provided with a distributing switchboard, and the current will be utilized to operate threshing machines, root-cutters, crushers, etc. The electric motors are of simple construction and sufficiently solid to stand wear and tear, and are operated without difficulty. The current will be also utilized for the lighting of the villages in the neighborhood.

A new theory of atmospheric electricity has been established independently by Messrs. Elster and Geitel, on one hand, and by J. J. Thomson and Wilson on the other. This theory is based on the properties of ionized gas. The solar light, and especially the ultra-violet rays, produce in the atmosphere the phenomenon known as ionization, giving rise to an equal number of ions charged positively and ions charged negatively. As these are in equal number in dry air, their charges do not develop an electric potential of an appreciable value; but when the air has been cooled below the dew-point, it appears that the negative ions serve as nuclei for the condensation of the humidity into drops, and these, in falling, take with them the negative ions, soon leaving an excess of positive ions in the air. This causes a rise in electric potential due to the presence of these ions, and hence the electrical phenomena which accompany rain. A number of laboratory experiments have been made which seem to bear out this theory.

Two new telephone stations have been erected at Vienna, which replace the old installation, this having proved insufficient to meet the demands. The two central stations make connection at present with 12,000 subscribers in the city and suburbs, and have a maximum capacity of 30,000 subscribers. The surface occupied by the two new buildings is about 14,000 square yards each; they have four stories and cellar, the latter being reserved for the machines and for the general distributing boards into which the subscribers' lines enter. The ground floor is occupied by various offices and public telephone cabinets, and the first floor contains the sets of accumulators which furnish the current for the system. On the upper floor are several large halls, well lighted and ventilated, which contain the intermediate switchboards and the connecting boards of the station. In one of the stations there are 48 of the latter, corresponding to 144 operators; in the second station there are 36 boards and 108 operators. The construction of the buildings, ground included, has cost about $400,000, and an equal sum has been expended for the telephone lines and apparatus.

The city of Alexandria is provided with a system of electric railways, which has been in successful operation for some time past. The central station is located near the canal of Mahmoudieh, which is fed from the Nile. The various buildings cover an area of 15,000 square yards. The dynamo room is provided with three sets of dynamos, besides a switchboard and the necessary connections for the feed circuits. The first set of dynamos includes two railway generators of the Walker type, having a capacity of 350 kilowatts each; they are direct-connected to compound engines of Belgian make. The second set consists of two 100 kilowatt generators of the same type, with tandem compound engines, and the third group is a dynamo of 150 kilowatts, with a 200 horse power engine. The boiler room contains five boilers, of which one is used as a reserve. The switchboard is of black marble, divided into seven panels, six of these being used for the different feeder connections; the seventh is arranged for a battery of 225 accumulators, whose charge assists the dynamos at times of heavy traffic. The batteries are of the Sellon-Volckmar type, having a capacity of 1,500 ampere hours. The system of electric roads in Alexandria has a total length of 18 miles, not including 12 miles of road which is now operated by steam, but will soon be changed to the electric system. At present the road employs 50 motor cars and 40 trailers, each of the motor cars having two motors of 35 horse power. A foundry and machine shop have been constructed at the central station to make repairs and different pieces of apparatus.

SCIENTIFIC AMERICAN

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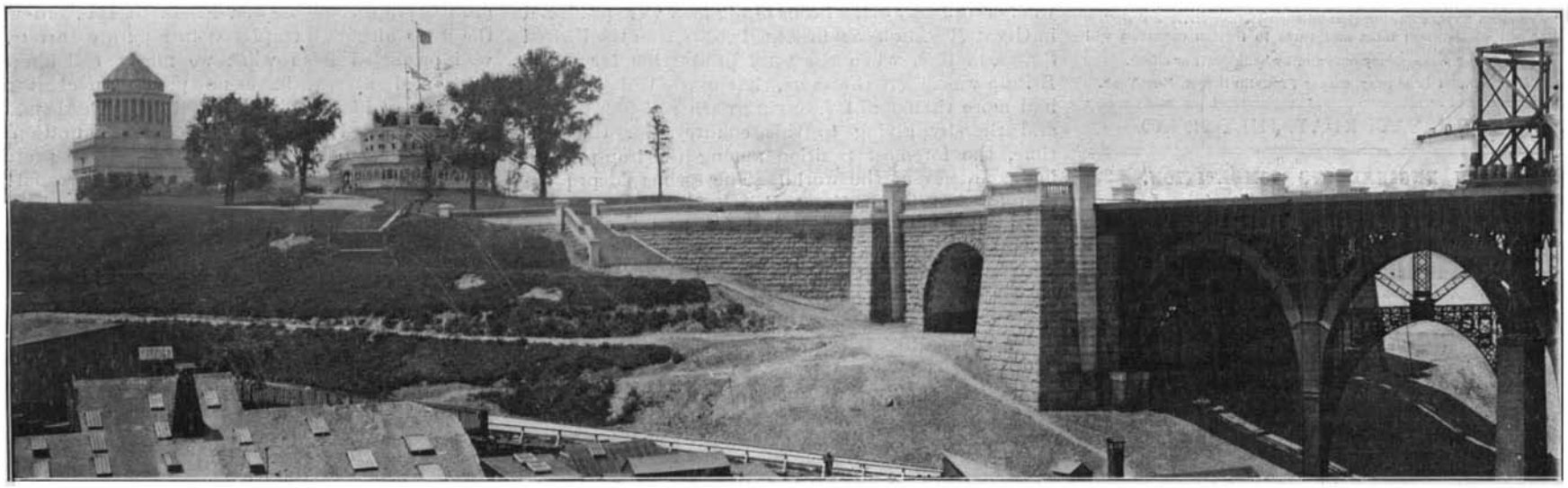

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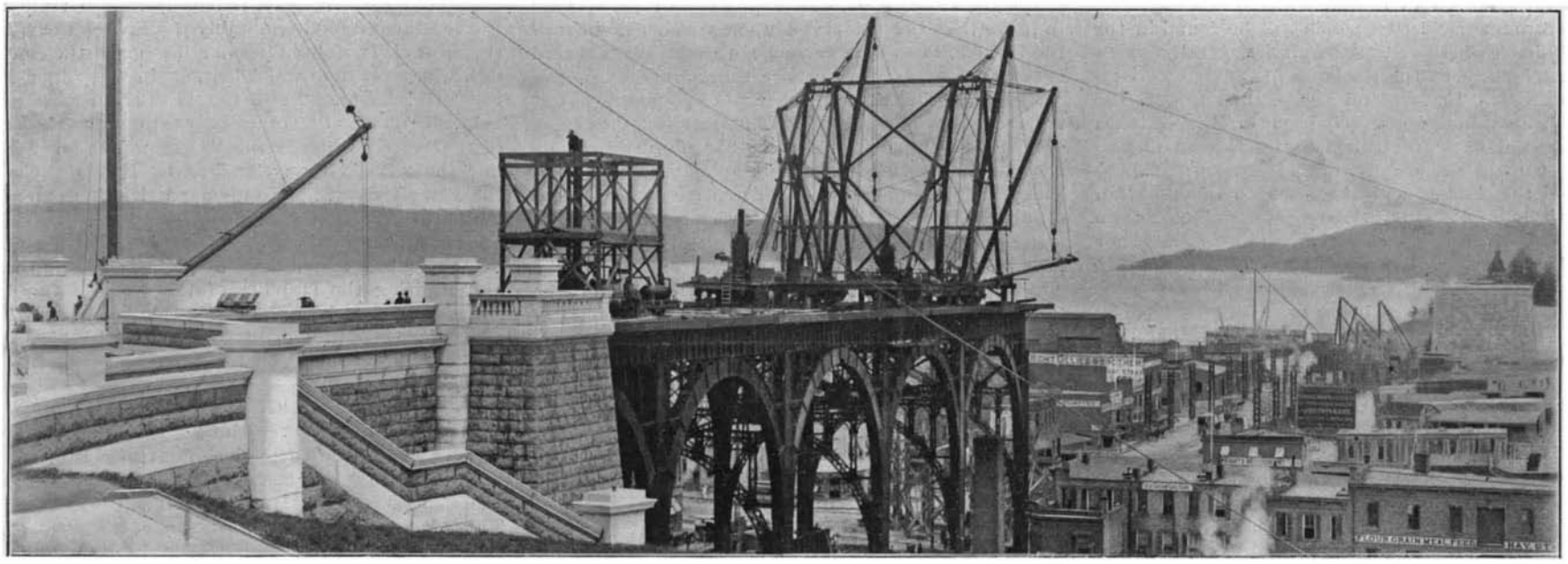
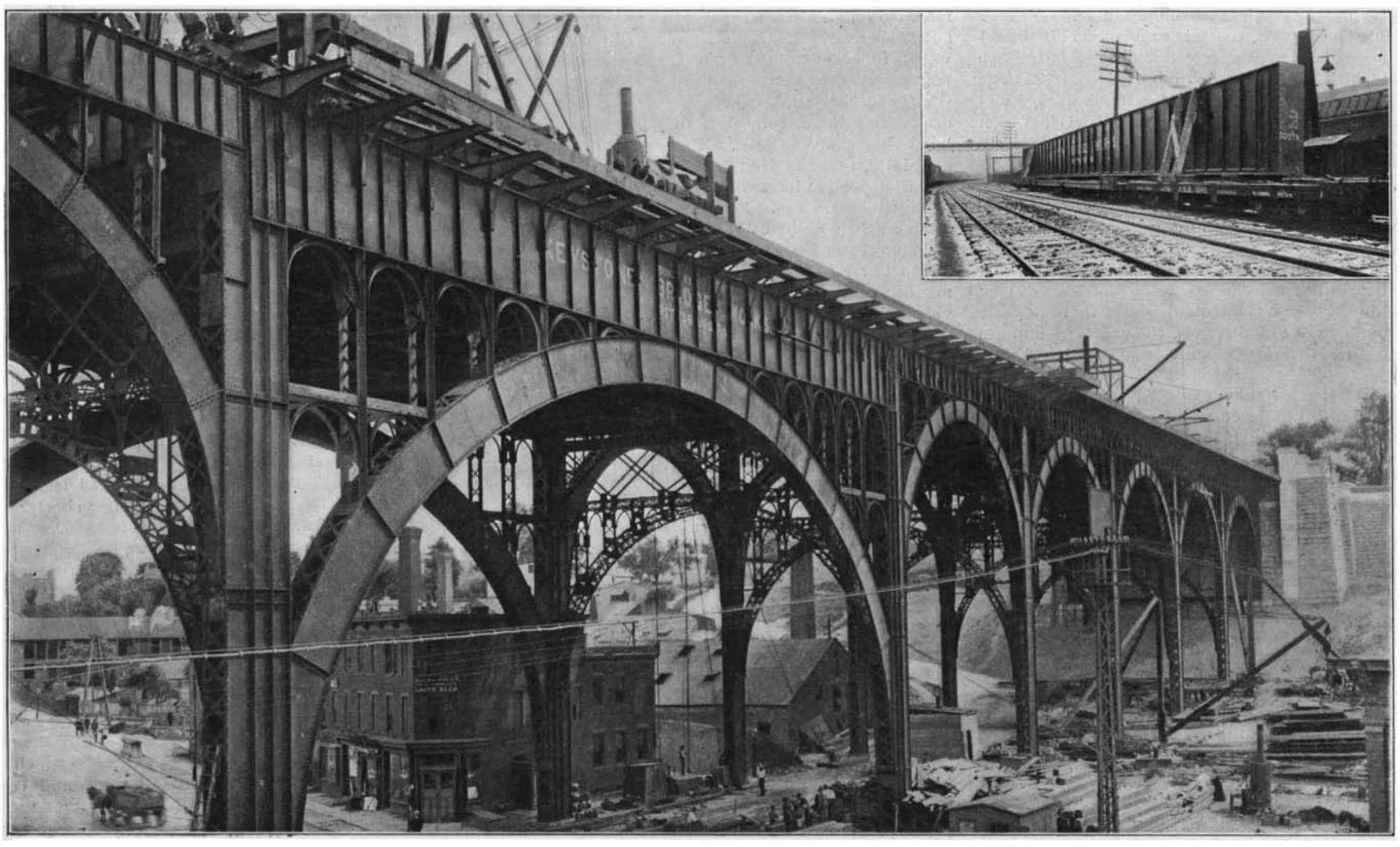


Looking North up the Hudson River.



The 130-Foot Arch Across Manhattan Street.

Transporting the big girders on four flat cars.

RIVERSIDE DRIVE VIADUCT, NEW YORK.—[See page 38.]