

sunk to a depth of 35 feet in the London clay. The foundations for the shafts are 42 feet square, and 35 feet below the ground floor level. Over 2,000 cubic yards of concrete were used in each of these foundations. The steel framework of the building, which has a total weight of 5,800 tons, is self-supporting. After erection, this frame was closed in with bricks and terracotta, the roof and most of the floors being of concrete. No attempt has been made at relief of the exterior of the building in the shape of ornamental decoration, thus giving it the appearance of a huge factory. Adjoining the main building are the offices, which occupy three floors, the lower of which forms the machine shops. This structure measures 81 feet by 25 feet. It is interesting to note here that the capacity of the whole edifice at normal load is 57,000 kilowatts. On this basis the cubic feet per kilowatt (including office building) is 139, and the square feet per kilowatt is 1.36. It will be seen from these figures that considerable economy has been resorted to in the matter of floor space.

The main building is to be divided into two distinct compartments, the near-river half holding some eighty boilers arranged in two tiers. This is regarded as quite a distinct departure so far as Europe is concerned—the erecting of boilers in tiers. The boilers are of the Babcock & Wilcox famous water-tube type. Each boiler has 5,212 square feet of heating surface and 672 square feet of superheating surface. The boilers are already in place. They are piped in groups of eight, each group supplying the steam for one electric generating set and one feed pump, there being no steam connections between the several groups, except that a supplementary header at one end of the building is connected to two groups. This header supplies the exciter engines, or compressors, house pump, etc. Every economical device for reducing labor has been resorted to. Under each boiler there is a chain-grate stoker. They have each 83 feet of surface. Coal is fed automatically direct to the furnaces, and, after being used, passes through chutes to the basement, where it is caught in self-dumping buckets and conveyed to the ash pocket.

The other portion of the building is given over to the turbines and generators, and may therefore be regarded as the most interesting department. One of our photographs depicts the present appearance of this room, from which it will be seen that although a considerable amount of work has been done, there is still much to do. Down the entire length of this room, and along one end, are three galleries given over entirely to the switchboards, from which the currents to all the sub-stations, of which there are twenty-three, are controlled. When all the generating sets have been put in place, it will be a magnificent sight to stand in the galleries and view the machinery below. In all there will be ten sets, each consisting of a Westinghouse steam turbine running at 1,000 revolutions per minute, and a four-pole, three-phase generator, which is wound for a pressure of 11,000 volts at 33½ cycles per second. This is the highest pressure yet employed for traction purposes in Great Britain. The periodicity will be thirty-three and one-third per second. It is interesting to note that the steam turbines, which are the largest ever built, are each—that is to say, nine of them, the tenth being about half the size of the others—29 feet long over all by 14 feet wide and 12 feet high. The normal rating of each generator is 5,500 kilowatts, but they will carry an overload of fifty per cent for two hours at practically the same steam consumption per kilowatt hour. There are also four 125-kilowatt, 125-volt steam-driven exciter sets, which will run at 375 revolutions per minute.

In the pits between the engine foundations are the condensers. They are designed to work on the dry vacuum principle, while all the pumps are electrically driven. They have each 15,000 square feet of cooling surface, and the circulating water will be siphoned from the River Thames through pipes 66 inches in diameter. This water and also that intended for all the other machinery will pass through specially erected filters, to prevent the possibility of the boilers getting "furred." There are no less than four miles of wires about the switchboard. All the high-tension

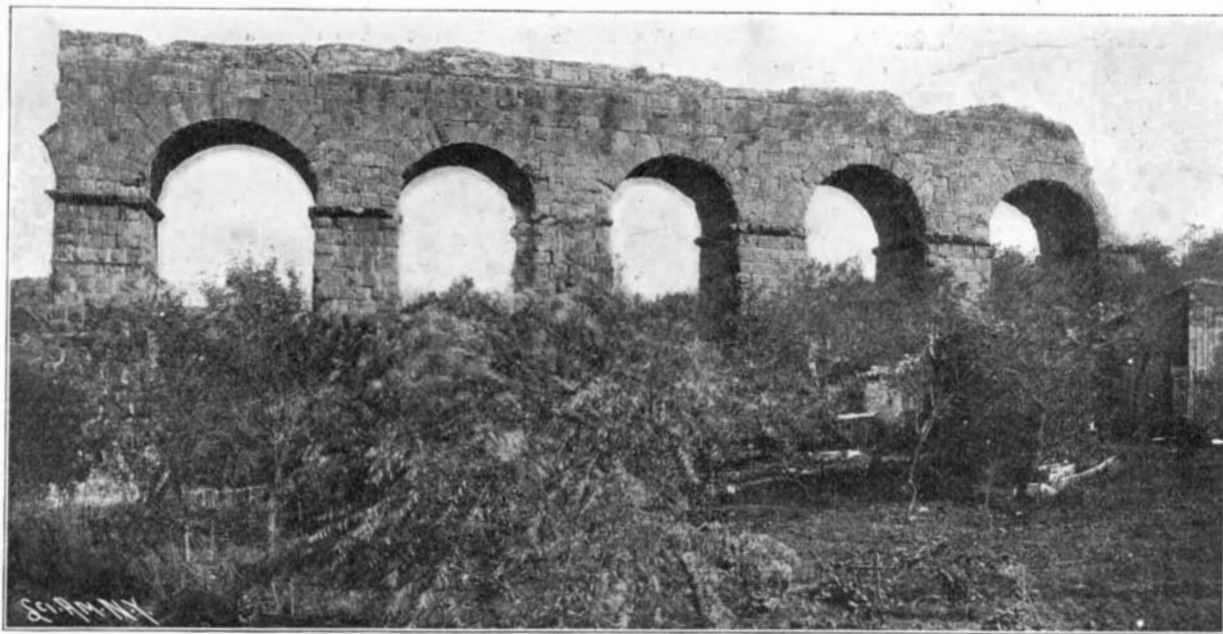
switches are motor-operated, and the feeder system is being erected in duplicate.

Before leaving the engine-room, it may be noted that the turbines are being supplied by the British Westinghouse Company, and are of the Parsons type with Westinghouse modifications. As already stated, the speed will be 1,000 revolutions per minute, while mounted on the same shaft is the three-phase generator of 5,500 kilowatts. In full working order the total horse-power available from this one station, therefore, will be slightly over 80,000 horse-power, or 120,000 horse-power at 50 per cent overload. The boiler-house portion of the station fronts Chelsea Creek, from



Triumphal Arch of Caracalla.

which barges could unload. This piece of water being the property of a railroad company, a charge of one penny (two cents) a ton is demanded. As the daily coal consumption in full working order would amount to 850 to 900 tons, a penny a ton in the course of a few years would naturally reach a respectable sum. The directors therefore decided to construct a dock of their own. This occupied a considerable time, chiefly on account of the immense amount of blasting which was found necessary. It is now completed, and barges can enter it at any state of the tide. It is spanned by two traveling cranes, each working a one-ton grab. The coal, after being weighed, is dropped through a hopper on to a belt conveyor, and carried up an incline elevator 140 feet in length to the top of the building immediately over the boilers, where the three giant coal bunkers are situated. They have a total capacity of 15,000 tons.



Ruins of the Constantine Aqueduct.

#### ROMAN REMAINS IN NORTH AFRICA.

The power station has been built by the Underground Electric Railways Company, of London, Limited, of which Mr. Charles T. Yerkes is the principal figure. It will supply the necessary power for working the Metropolitan District Railway and the three "tubes" now under construction, namely, the Baker Street and Waterloo, the Charing Cross, Euston and Hampstead, and the Great Northern, Victoria and Brompton lines. The total length of these lines is over sixty miles, the District Railway alone accounting for about forty. The work of laying the two conductor rails for the District system is now practically completed. Electric trains are expected to run over this line early in the coming

year. The Baker Street and Waterloo Railway will be ready probably about the same time, but the services of the Chelsea station for the other tube lines of the group will not be required for some time, as the construction of these is not so far advanced. The total cost of the power station has been put down at \$7,500,000.

#### ROMAN REMAINS IN NORTH AFRICA.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Among the Roman remains which are to be found in Northern Africa, those of Tebessa are among the most remarkable and best preserved. Tebessa is the *Thevesta* of the Romans, according to different inscriptions which have been found there. It appears for the first time in history in the geography of Ptolemy. Later on, with the title of *Colonia*, it is mentioned in the voyages of Antoninus. It is probable that it commenced to flourish in the time of Vespasian and Titus. It was founded about 71-72 A. D. and perhaps commenced as a Roman camp, at first only temporary, which then became fixed and grew in size. The camp was transformed to a city by the decree of Vespasian and was afterward raised to the rank of a Roman colony. Tebessa reached the height of its prosperity and was a flourishing city at the beginning of the third century under Septimius Severus. The principal monuments, some of which are here illustrated, must be dated from this period. The city no doubt continued to grow until the time of the Vandal invasion, when most of the Roman cities of North Africa were laid waste. Later on, it was raised from its ruins by Solomon, the successor of the general Belisarius, in 543 A. D., as we are told by an inscription found on the Arch of Caracalla. The Arab historians relate that it was taken by Abou-Yezid in 945, and it has been occupied by the Arabs down to the present time.

The ruins of the city, which are quite extensive, show the traces of these successive occupations. The fortifications which Solomon erected in the midst of the immense ruins of the Roman city are still standing, and serve to inclose the Arab town which now contains but few inhabitants. The walls are from 35 to 50 feet high and are over 6 feet thick in most parts. They are flanked by twelve towers of two stories each. Three gates now lead through the walls. One of these gates dates from the Byzantine epoch, but the most interesting is the gate which is formed by the ancient Triumphal Arch of Caracalla. This is one of the Roman ruins which escaped destruction. The arch, which is shown in one of our engravings, is one of the most important of the Roman remains in Northern Africa. Its mass forms a cube measuring about 35 feet on a side. The arch is of the form known as *quadri-arch*, and each face represents a triumphal arch with one entrance. It seems probable that it was originally placed in an isolated position, and no doubt stood in the middle of a public square. Only one side of the arch is in a good state of preservation. Mounted on the top will be observed a small edicule with four columns. No doubt this was designed to receive a statue which set off the arch and could be seen from a great distance. This structure was built in 211-213 A. D., and was dedicated to Septimius Severus, his wife and his son Caracalla.

When the city of Tebessa was abandoned by its inhabitants at the end of the fifth century, and was then sacked by the Moors and other roving bands, the monuments suffered greatly, and it is no doubt at this time that the arch was partially demolished. In later times when Solomon re-built the walls of the ancient city, he used the arch to form one corner of his construction. He closed up

the openings on two sides by rough masonry and also the upper part of the northern side and transformed it into a city gate and tower. The side which is shown here is sufficiently well preserved to give an idea of its original appearance.

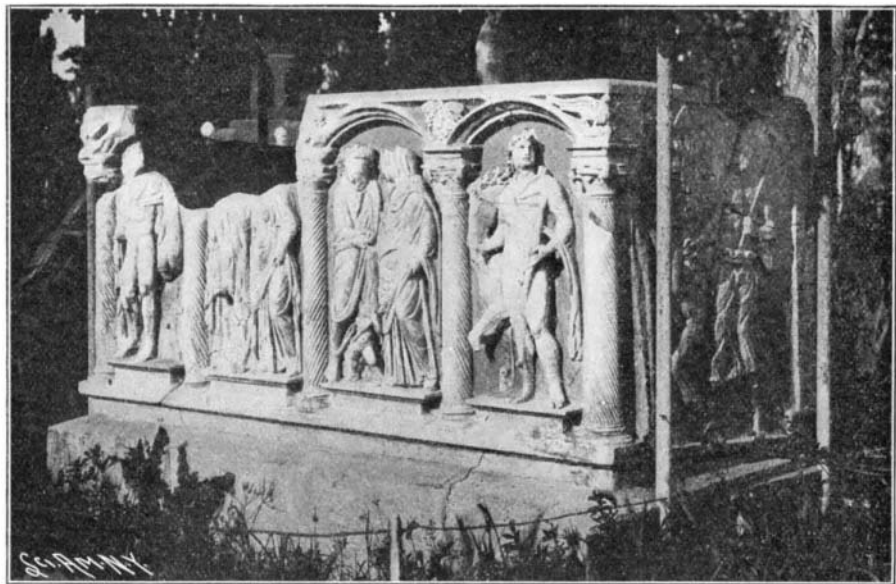
Another remarkable construction which is left from Roman times is the Temple of Minerva. As will be observed in one of the engravings, this handsome structure is in a fairly good state of preservation. The temple has undergone many vicissitudes since the fall of the Roman empire. In more recent times it served as a soap factory, a military bureau, a prison, and then a Catholic church. It is a very fine monu-

ment in the Corinthian style, with graceful columns and well-executed reliefs. The edifice measures 35 feet wide by 45 feet long, including the *pronaos* or portico, which is surrounded by six columns, but is not topped by a fronton as in the usual case. It is thought that the latter was originally replaced by a series of statues. The pavement of the temple lies at a height of 26 feet above the original ground level, and is upheld by a three-arched vaulting. A staircase of twenty steps leads up to the portico.

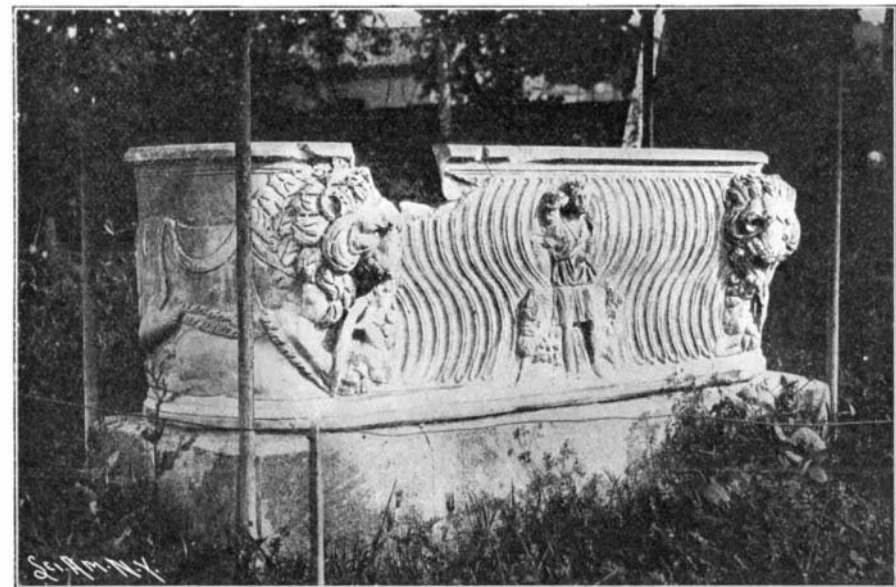
Many Roman remains are found at Constantine, which was fortunate in escaping the fate of Tebessa, and is now one of the large cities of the region. Surrounded as it is on three sides by the deep gorge of the Rummel, it is a remarkable example of a natural fortress, and must have been the scene of great fighting in the course of history, as we are told that it was besieged and taken as many as eighty times. In the history of Numidia it was known as *Cirta*, and was the refuge of the unfortunate Jugurtha. When taken by the Romans, it was made the capital of Numidia, and its original name of *Cirta* was retained. After many battles it was partially destroyed, but the Emperor Constantine rebuilt it and gave it his name, which it has since retained. In later times it fell under the domination of the Arabs, then under the Turks, who held it down to the present day. Its siege and conquest by the French troops forms an exciting page in the history of this region. But as this is somewhat outside of our present limits, it may only be mentioned that the Duc de Nemours besieged it in

its characteristics, the mosaic is thought to belong to the early Christian religion, but this is a matter of question. At any rate the inscription might give some color to this supposition, as it reads: *JVSTVS SIBI LEX EST*, "The just man is his own law." The exterior border of the mosaic measures about 10 feet each way, and the execution is so harmonious that at a little distance it might be taken for a painting.

Tipaza is an ancient seaport which still bears the traces of its Roman origin. At present nothing remains of its former prosperity, and it is only a small village lying not far from Algiers. The ancient walls, which were flanked with towers, had a perimeter of 6,500 feet and the sea defended the town on the northern side. Among the principal remains may be mentioned a basilica, which is a rectangle 200 by 100 feet. The seven naves of the edifice were upheld by square pillars. Two sarcophagi of white marble which are now in the garden of M. Tremaux are here illustrated.



The Sarcophagus Discovered at Tipaza.



A Sarcophagus at Tipaza.

1837 with 10,000 men, and after a hard struggle succeeded in penetrating into the city. The Turks had taken refuge in the citadel and then tried to escape by means of long ropes which they let down into the gorge. But under the weight of so many bodies, the ropes broke and they all fell down into the abyss and perished. A large number of inscriptions, statues, and other remains have been found at Constantine, and excavations are continually bringing fresh specimens to light. Built into the walls of the Turkish citadel or Kasbah are to be seen upward of twenty Roman inscriptions. The most ancient of these dates from the reign of Alexander Severus. In the way of architecture, one of the most remarkable of the remains is the Roman Aqueduct which lies in the plain at a short distance from the city. This construction goes back to the Emperor Justinian. Five of the arches are still standing. The highest of these is no less than 65 feet above ground.

A fine piece of mosaic was discovered in 1860 by Cherbonneau. It dates from the later empire. In the center is an inscription whose characters leave no doubt as to the epoch. To the right and left of the frame which contains the inscription are two doves. The background is ornamented with flowers. By

costing one of his predecessors the Chancellorship. It was Brougham who in the autumn of 1834 "carried about the Great Seal" to his lasting damage, grave scandal being caused by a report, generally credited at the period, that two good-humoredly mischievous girls had hidden it so effectually at a country house

**The Great Seal of England.**

Something of romance as well as of almost sanctity has always been associated with the Great Seal of England, and many a striking story has been told concerning it. The provision recently, therefore, of the first Great Seal of King Edward VII. is an event of more than merely historic interest; and the Lord Chancellor may assuredly be depended upon to obey both to the letter and in the spirit that statute of Henry VIII. which forbade the "carrying about the Great Seal," inattention to which was largely responsible for

that it could not for a time be found. William IV. was greatly shocked at this, and yet he was the monarch who, in the presence of Brougham himself, had joked over the Great Seal, for, when that Chancellor had intimated that his immediate predecessor, Lyndhurst, claimed half of the old Seal, because he had been Chancellor at the King's accession, the sovereign exclaimed: "Well, then, I will judge between you like Solomon; now do you cry 'heads' or 'tails'?" and Brougham took the bottom part. This, of course, was not so bad as when James II. flung the Great Seal into the Thames at Lambeth on his flight from London, with the desire to embarrass his triumphant son-in-law, William of Orange; and even this was not so deep a degradation for the Seal as when it was stolen from the house of Lord Chancellor Thurlow and never recovered, though some sort of dignity was attempted to be attached to the theft by the Tory suggestion that it was done by the wicked Whigs for the purposes of party warfare.—Westminster Gazette.

**Unsinkable Life-Saving Raft.**

An ingenious unsinkable life-saving raft for passenger steamships has been invented by Robert Chambers, of Dumbarton, Scotland, the inventor of the semi-collapsible lifeboat. This raft is built of wood and measures 20 feet long, 6 feet broad by 22 inches deep in center and 14 inches at the edge, tapering at both ends in the whaleboat form. The raft consists of three longitudinal bulkheads, dividing the raft into four longitudinal compartments thwartship. The bulkheads divide into thirty-two air-tight compartments. Sea anchor and hawser are also provided, to prevent the raft from drifting to leeward in a heavy sea. Owing to the small space necessary for the stowage of the raft, several can be safely and easily stowed on top of each other on the vessel's deck. In the event of collision, fire, stranding, or other causes of shipwreck, whereby life is endangered, the raft can be cut adrift at a moment's notice and thrown over the ship's side into the water. It is self-adjusting, and has rowlocks and pulling and steering oars secured in sockets in bottom and top alike. Each raft will carry between forty and fifty people, and the life lines round the edge will support as many as can hang on till rescued. The raft has been severely tested by the Board of Trade, and has been duly passed.

The Bureau of Construction of the Navy Department has asked for bids on twelve sectional wooden wireless telegraph poles for the proposed stations at Key West, San Juan, Panama, and Colon. The poles will be 212 feet high—the tallest ever used in wireless operations in this country—and three will be installed at each of the stations named. It is expected that when equipped with the latest and most efficient wireless receiving apparatus a large field of action for each of the stations will be assured.



The Ruins of the Temple of Minerva.  
ROMAN REMAINS IN NORTH AFRICA.