THE ELECTRIC LIGHTING STATION OF TUNIS.*

By EMILE GUARINI.

The central electric lighting station of Tunis is well worthy of description, since it is the first example of an electric light station established by a gas company and making use of coke-gas motors for running the electric generators. The motors employed are of the Crossley type. They can be run on either coal-gas or coke-gas, and can be changed from one fuel to the other without stopping. The efficiency varies according to the gas employed. When using coal-gas, 96 electrical horse power can be obtained with 96 explosions a minute, and, with coke-gas, 77 electrical horse power per 64 explosions per minute. The power per explosion is therefore 20 per cent greater with coke-gas. The gas is delivered to the motors by two main conduits laid in a wide trench formed in front of them. The diameter of the coke-gas conduit is 16 inches, and that of the coal-gas one 10. Four of these motors, of 106 horse power each at the brake, drive four dynamos of 70 kilowatts each at 240 volts.

The Pierson gas generators, three in number and double jacketed, are supplied, for the production of coke-gas with coke derived from the works. Their maximum consumption is 2.86 pounds per kilowatt hour. The coke contains from 10 to 12 per cent of ashes and 4 per cent of water. Since the generators are supplied with coke, it was necessary to arrange them with a view to the easy removal of the slag. Each generator is capable of producing sufficient gas for developing 150 horse power. Besides the generators themselves, there are two small Hopwood boilers that have a working pressure of 85 pounds to the square inch, and are capable of furnishing sufficient steam to supply four generators. These are arranged above the generators, upon a special platform. The air and steam are led to the generator jacket and thence to the under side of the grate by a superheater consisting of two concentric tubes, the inner of which forms a radiator. It is through this inner tube that the gas produced in the generator passes, before it is led to the hydraulic main and thence to a condenser of large surface.

In addition to the parts already mentioned, the Pierson gas generator comprises a large coke pipe, two chemical purifiers of very great surface, and a gas tank having a capacity of 8,122 cubic feet.

A number of pressure gages indicate for the stokers the pressure in the generator, the condenser, the coke pipe, the purifier, and the gasometer. The approximate calorimetric value of the gas is controlled by a special Pierson calorimetric lantern. Round elbows have been avoided in the piping, which can be easily cleaned at any point by simply unscrewing a flanged cap.

The use of coke-gas motors in lieu of steam presents a triple advantage for a gas company establishing a central electric lighting plant. In the first place, it permits of regulating the stock of coke by utilizing coke-gas motors, when the stock on hand becomes too great, or coal-gas motors when it becomes insufficient. Again, in case of repairs to the gas generator, it permits of running without any supplementary expenses for illuminating gas. Finally, it permits of utilizing fuel that is ready at hand at the works, and of thus avoiding considerable expense.

It was owing to such advantages, established by the Messrs. Pierson, of Paris, that the Tunis Gas Company was led to make an installation which is giving entire satisfaction and which will probably soon be imitated elsewhere.

A GREAT CONCRETE ARCH IN GERMANY.

A REMARKABLE structure crosses the Neckar near its confluence with the River Glatt and near the town of Neckarhausen. The stream is subject to heavy floods and during such times rafts of large timber are sent down. The size of the span was determined by a reference to the highest known periods, records of which extend back to the year 1778.

Concrete was decided upon as the material of construction after a careful investigation into costs and methods. It is not even armored, and stands, probably, as the greatest exponent of purely monolithic work.

The foundations rest in beds of marl, traversed by thin layers of clay, which, on one side, have been displaced from their original positions and required, because of the danger of sliding, that the mass of masonry should be larger than was otherwise necessary.

The radius of the soffit is about 300 feet, the greatest yet used in any unarmored concrete arch, and the flatness of the structure is therefore striking. The span, from center to center of piers, is 164 feet, with a total rise of only 15 feet.

The roadway, which has a gradient of 1½ per cent on each side of the center, rising toward the crown, is supported on concrete pillars forming a subsidiary system of arches through the spandrels. This is an entirely novel conception in concrete work of this character, and accomplishes the double purpose of lightening the structure and adding to its beauty. The latter consideration is one which is almost universally observed in European structures, even of the most utilitarian character, but with us is too apt to be lost sight of.

The hinges at the crown are composed of eight pairs and those at the ends of nine pairs of shoes each. These shoes are all of the same size, 2 feet 5¾ inches by 1 foot 7¾ inches on the base, with a depth of 1 foot 3¾ inches, and bear upon steel rollers about 4 inches in diameter. A slip joint is also provided at each end of the bridge.

The foundations were begun in the autumn of 1899 and were made by means of uncovered caissons, which were pumped out at the rate of about 500 gallons per minute. The concrete, which is of gravel in the foundations, was placed in layers from 4 to 6 inches in depth. The daily quantities varied from 60 to 100 cubic yards.

The centers rest upon piles and were installed with the idea of being able to "strike" them in the easiest

way. For this purpose and to provide for any sinking of the piles during construction, the piles were capped with screwjacks, resting upon and bearing continuous tie timbers, the upper one of which was recessed to receive the screw.

The concreting of the arch-ring was carried on in equal proportions on each side of the transverse axis in order that the pressures on the false work might increase equally. The surfaces and ornamentation were carried on with the main body of the work in forms of planed wood, which was oiled on the inner side. These portions of the work were variously colored by imitating sandstones of different colors in the cement with which the concrete was mixed. The arch proper contains 350 cubic yards, and this was placed in nine days. Following this, the pillars, subsidiary arches, roadway and ornamentation were carried on.

The striking of the centers took place about two months after the commencement of the arch-ring.

The cost of the whole work, including studies and plans, amounted to about \$17,600, and the quantities and mixtures were as shown in the accompanying table:

	Cubic yards.	Composition parts.			Gravel or broken stone.
		Cement.	Sand.		
Foundations.....	1,140	1	3	6	Gravel
Arch.....	350	1	2.5	5	Broken stone
Roadway.....	95	1	2.5	5	Broken stone
Pillars.....	215	1	3	6	Broken stone
Crown.....	34	1	4	6	Broken stone
Artificial stone.....	80	1	2	4	Broken stone

SARSEN STONES.

ACCORDING to a paper read by Mr. Horace Woollaston Mouckton at the British Association, the blocks of sandstone or quartzite, known as Sarsen stones, are found in many parts of the South of England. They occur at or near the surface of the ground as well as in or at the bottom of the gravels. They are usually believed to be derived from the Bagshot or Reading beds, but there does not seem to be definite evidence of the discovery of a Sarsen stone *in situ* in these or in any other formation.

Sarsens are very abundant in the neighborhood of Bagshot. They have been observed by the author first and most frequently at the bottom of or close to the bottom of beds of gravel; secondly, and rather less often, at or near the surface of the ground where there is no gravel; and, thirdly, but only seldom, in gravel, some height above the bottom of the gravel. The author has never seen a Sarsen stone *in situ*, for though he has seen many partially uncovered stones, they have in every case shown signs of wear by either water or weather. At the same time, he has noticed that the corners are frequently angular, and many of the stones have been very slightly worn and certainly not rolled by water currents or streams. The country around Bagshot is formed of the Bagshot beds, largely of Upper Bagshot beds, which are shown by their fossils to be of Lower Barton age, and the author suggests that soon after their deposition this part of England rose somewhat above sea-level, and remained as a wide, fairly level, and low-lying flat covered with marsh and vegetation for a very long period. The Sarsen stones are, he believes, indurated portions of this old land surface. If this is correct it accounts for all the above-mentioned facts and also for the presence of numerous rootlet tubes in the stones, and for the absence of marine shells or of casts thereof. If after a long period of repose an elevation of the land took place, the streams would rapidly cut channels in the sandy soil and leave the indurated fragments of the old surface scattered about at various levels, and many of these would become buried in the beds of gravel, thus accounting for the presence of the Sarsen stones in the gravels. It was suggested long ago by Mr. Huddleston that the concretionary action which formed the Sarsens was due to the decomposition of vegetable matter, and a somewhat similar opinion has been expressed by the Rev. Dr. Irving.

THE CATFISH AND ITS HABITS.

GEORGE M. BOWERS, the Fish Commissioner, declares in a recent report that the catfish has not been given the attention it deserves, especially when the amount of space devoted to the black bass or the wily pike is taken into account. These Mr. Bowers was inclined to regard as the most intellectual fish until he acquired a closer acquaintance with the catfish through some investigations made by Prof. Kendall of his staff.

The catfish abhors running water. It likes to find a pond with a muddy bottom on which it can repose after having satisfied its ravenous appetite. Prof. Kendall says the appetite of an ordinary catfish is a wonder. It eats incessantly day and night, prowling along the bottom of the pond or river with its barbels widely spread, searching the mud beneath and the water above for its prey. It is not fastidious. Anything from an angleworm to a piece of tomato can be bolted with the greatest relish. In the search of food it displays great strategic ability. Prof. Kendall has watched catfish carefully select a spot where the mud is the same color as their dark skin, bury their yellow stomachs in the mud with only barbels and dusky forehead exposed, and then wait for hours for the unwary prey. When it comes along out darts the catfish, and that is the end of his victim. This fact alone, the Fish Commission experts declare, is enough to show that the cat is a very intellectual fish.

But there are other reasons for boasting of his brain power. The experts say that the species is easily tamed, and can be trained like pigs. When it is recalled that there are several troops of educated pigs going about the country this is no small compliment. The catfish knows the law of self-preservation as well as any other of the finny tribe. If the water becomes warm in summer, he survives because he knows how to make the best of a bad situation. Should the air supply in the water fail the catfish, instead of turning up on his back, will set about taking care of himself. He will come to the surface, leisurely renew the air in his swim-bladder, and even, frog-like or turtle-like, swallow air in bulk, trusting to stomach respiration.

Should the pond go entirely dry, the catfish will seek out some comfortable crack in the mud and lie dormant for days or weeks until the pond fills up again. He is a great lover of home, and when once comfortably settled in a pond will move only on extraordinary inducements. When the spring freshets come the catfish does not permit himself to be washed out of home, as most other fishes do, for he buries himself in the mud, and if the flood dislodges him it only does so by carrying away the bottom of the pond. After such a catastrophe he hunts up a new abode, even gives up his all-commanding habit of eating until he is situated again to his liking.

The catfish takes exceptionally good care of his family. Both the male and the female watch over the little ones, and Prof. Kendall was agreeably surprised to find that the predaceous feeding habits of the old fish do not go so far as to permit it to eat its own young as do bass and other more highly esteemed fish. Mr. Kendall in watching a pair of old catfish raise their young discovered that when he threw pieces of beef liver into the pond for the young the old fish would seize it and apparently swallow it, together with the dozens of little catfish, which were eating at and hanging on to the meat. They invariably ejected the young fish from their mouths quite uninjured, the parent fish seeming to be able to discriminate its proper food.

The Fish Commission is of the opinion that the catfish is much underrated also by those who gage its commercial value. They say that it is one of the very best pan fishes. Its meat is white, crisp, and juicy, and of excellent flavor. The experts consider the flesh of the channel catfish superior to that of the black bass, the wall eye, the yellow perch, or any other percid fishes. Among fresh water fish they say it is inferior only to the white fish and the trout. The other varieties of catfish are not so good for table purposes, but their flesh is nutritious and of a fair flavor.

Prof. Kendall calls this the poor man's fish, and predicts that when the public comes to know the merits of the catfish better there will be a great deal of money made by raising them in artificial ponds.—Evening Post.

RECENT AERONAUTICAL PROGRESS, AND REDUCTIONS TO BE DRAWN THEREFROM, REGARDING THE FUTURE OF AERIAL NAVIGATION.*

By MAJOR B. F. S. BADEN-POWELL.

IT is with feelings of the greatest satisfaction that I am now able for the first time to address the society in the capacity of its president, and I must seize this opportunity of expressing to you my heartfelt thanks for the very great honor which you have conferred upon me by electing me to this position. I can not but feel that my labors in the past, though varied and dipping into almost every branch of aeronautics, have not been so extensive or so prominent as to warrant my selection for this important post, but nevertheless I sincerely hope that, with freer opportunities, I may, in the immediate future, be able to accomplish much more in the work we have before us.

My absence from England during the last three years, on active service in South Africa, has prevented my fulfilling many important duties for the society during a period of unusual activity and importance, but on the other hand, the time I have spent on the "trackless veldt," and in the monotony of camp life, has not, I hope, been wasted, as ample opportunity has been afforded for careful meditation and consideration of the whole subject which it is the object of this society to study. I therefore propose not so much to give a technical lecture on the various experiments of recent years—you have had better opportunities than I of studying these—as to endeavor to make clear our present position.

During these three years many great events have taken place in the aeronautical world. Count Zeppelin's monster airship, built on sound scientific principles, of enormous size and quite different in design to anything made before, has been completed, and has made successful ascents, although, I much regret to have to add, it has not succeeded in traveling through the air at a sufficient speed to warrant its being considered a practical success.

Then we come to M. Santos-Dumont's many more or less successful trips in his navigable balloons, which, if not demonstrating any new principles have shown what perseverance and attention to detail can achieve. Though we have learned some useful practical lessons, and have been given data of great value for future experimenting, unfortunately the actual results attained carry us so little beyond what was accomplished twenty years before by MM. Renard and Krebs, that one begins to think whether we have not nearly reached the end of the tether as regards the propulsion of balloons.

The unfortunate calamities to M. Severo's, and, more recently, to M. de Bradsky's balloons, as well as the absolute failure of M. Roze and others, only tend to confirm this growing opinion. The latest accounts of M. Lebaudy's balloon seem to make out that it has accomplished more, but we must await the results of more prolonged trials before we can come to any decision. Mr. Stanley Spencer's trip over London in a navigable balloon, though it proved nothing as regards the dirigibility or inherent speed of the machine, attracted some interest in the matter.

Besides these we have heard of various experiments with flying machines proper. Herr Kress is said to have risen off the surface of the water, but owing to some mismanagement the machine turned downward and fell in the water again. In Australia, Mr. Hargrave has constructed a large machine. In America, Mr. Wilbur Wright and his brother have been making wonderful progress with gliding machines, and Prof. Langley has been hard at work constructing a large new machine. He informed me the other day that in a very short time we might expect to hear something of this—something big. It might, he added, be

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*Presidential address before the Aeronautical Society of Great Britain.

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THE ELECTRIC LIGHT PLANT OF THE CITY OF TUNIS.

THE PIERSON GAS GENERATOR OF THE TUNIS ELECTRIC LIGHT STATION.