

THE EDISON ELECTRIC LIGHT STATION IN BROOKLYN.

WE illustrate in this issue the central station of the Edison Illuminating Company recently completed in Brooklyn, N.Y. Fig. 1 is a view of the Pearl Street front of the building, Fig. 2 is a plan of the engine and boiler room, and Fig. 3 is a vertical section of the station. The station is designed for an ultimate capacity of 36,000 lights of 16 candle-power each. At present only about one-third of the plant is installed, that being sufficient to supply the immediate demands. The rest will be added as required.

The building, which is fire-proof throughout, is seventy-four by a hundred feet, three stories high, and is located practically in the centre of the district to be supplied. Besides the generating plant, supply rooms, store rooms, etc., the building has ample room for offices, thus enabling the company to centre all departments of its business under one roof.

Under the sidewalk are located large reserve coal vaults, the coal for immediate use being in a storage room on the second floor, over the boiler room. On the first floor are the engine and boiler rooms; the dynamos and electrical apparatus generally are on the second floor, and the third is taken up by store and supply rooms and by a suit of handsomely fitted offices. Under the engine room is a solid bed of concrete four feet thick, laid entirely apart from and independent of the wall foundations. Upon this rest the foundations for the twelve engines. In this manner all jar from the engines is absorbed or neutralized, none of it being transmitted to walls or floors.

The engines are high-speed compound Ball engines, of three hundred horse-power each, the high-pressure and low-pressure cylinders being respectively thirteen and twenty-five inches in diameter and sixteen-inch stroke of piston. These are said to be the heaviest and largest engines of their class ever built. The general arrangement of engines and boilers is shown in the plan, Fig. 2.

Steam is supplied by eight Babcock & Wilcox sectional boilers of the largest type, arranged in two groups or batteries of four each. Each boiler has about 2,800 square feet of heating surface—between six and seven square feet for each horse-power developed. The boiler room has all necessary arrangements for the convenient working of the plant. The ash-pits under the boilers, into which the ashes are raked from the furnaces, discharge into a car running on a track in the basement, which is then hoisted on an elevator, thus avoiding all shoveling and handling. The coal is elevated to the store-room, whence it is fed down to the boilers through chutes, on each of which is a special coal-scale, so that every day's supply is known, and the economy of the plant is constantly recorded. Water meters, in a similar way, record the quantity of water used. Two main steam pipes extend from the boilers to the engines, each engine and boiler being connected to both pipes, so that any boiler or engine may be disconnected without interfering with the operation of the others.

The front half of the second story is devoted to the electrical plant. The space is arranged for twenty-four Edison dynamos, each engine being belted directly to two dynamos. The dynamos run at a speed of 650 revolutions per minute, and each has a normal capacity of fifteen hundred sixteen-candle power lights. In both engine room and dynamo room overhead travelling cranes are arranged, for the convenient handling of heavy pieces of machinery.

Through the centre of the dynamo room runs what is called the "electrical gallery," to which are brought all the cables from the dynamos. In the centre of this gallery, within easy reaching distance of one person, are arranged all dynamo switches, dynamo field-boxes, ampère meters, etc., so that one man in this gallery has all the electrical apparatus under his immediate control.

From this gallery seventeen feeders run to different parts of the district to be supplied with lights. The three-wire system being used, each feeder consists of three cables, a positive, a negative, and a neutral. By the arrangement of apparatus in the gallery, the man in charge can see at a glance the total load on the dynamos, and through what feeders and in what part of the district this load is being distributed. The underground system or

net-work of wires throughout the district is all united by large mains; and the regulation of current is such that at no time is there a difference of potential of more than one volt throughout the district.

The underground system, as at present laid out, is arranged for a total of twenty thousand lights, and may be readily extended as the demand warrants. It covers an extreme distance of a mile from the station in one direction, and about three-quarters of a mile in the other, in an excellent business and residential district, from an electric lighting point of view.

The Edison system of underground tubing, which has proved so successful, has been introduced here, with many improvements and additions. The maximum drop under full load is one per cent on the mains, and there are only four sizes of tubes used in the mains, ranging respectively from 100,000 to 250,000 circular mils. Mains, as here introduced, are in larger-sized tubes than have heretofore been used, allowing more insulation compound to be introduced into the tube. All three wires in the mains are of the same size.

The Edison system of distribution is too well-known to need any extended description. Service connections can be taken off at the coupling boxes every twenty feet. At all street crossings are placed main junction boxes with busses, into which all mains at each street-crossing are brought, thereby uniting and tying the mains together at every corner, to obtain uniform distribution and pressure, and to allow more readily of a proper inspection of the system. At these boxes each main is protected by an ampère safety catch of proper size, except the neutrals, which are coupled with solid copper catches. Into certain of these junction boxes the feeders running direct from the station are connected to the system of mains. In case any feeder is disconnected, for any cause, it will not in any way affect the system, as the main which it is directly feeding will be supplied from the other feeders. In case of any accident or short circuit on the main, it does not throw off the service from any customer, as the mains are fed out to the point of trouble from both directions. Five of the feeders, instead of running to only one point of distribution, run to a certain point, and from there to two or three other points. This is to obtain better control and distribution over the system. This underground system, after completion and being thoroughly tested and started in operation, showed an insulation resistance on the whole system of over 700,000 ohms, said to be the best result in that direction ever achieved in an underground system.

THE BASIN OF THE KONGO.

A GREAT deal of interesting information concerning the Kongo, gathered from trustworthy sources, is given in the December number of the *Scottish Geographical Magazine*. The estuary of the river, between Banana Point and Shark Point is eight miles across, and soundings have indicated depths of sixty fathoms. The current at the mouth is very rapid, certainly not less than three knots an hour, or a little over five feet per second. Taking the vertical section at the mouth to be a triangle, the base of which measures eight miles and the altitude sixty fathoms, it will be found that about 1,060,000 tons of water are poured into the sea per second. The effect of this huge volume is perceptible as far as six degrees of latitude northwards from the mouth of the river, or to a distance of 360 nautical miles, so that a vessel making for Banana feels this formidable resistance after crossing the Equator, and its speed is diminished. Sailing-vessels have often to wait for weeks for a spring-tide, or a strong wind springs up, and enables them to enter the river.

Another phenomenon is the current caused by the water at the edge of the stream losing its onward velocity, and being forced back towards the land, where it spreads itself out along the coast. The ports along this coast, such as Kabinda, Loango, etc., are only roadsteads with but little shelter. Vessels have to be loaded and unloaded by lighters towed by small tugs. The lighters are sometimes overturned, when their cargo, if it be palm-oil, for instance, floats, and the owners know where it will be found on the shore. For example, any article that falls into the sea off Landana,

two miles out to sea, will arrive at the shore near Sette Cama. This current is not felt beyond Cape Lopez, for its effect is neutralized by the rivers Gabun and Ogowé.

When a vessel coming from the north arrives at about thirty miles from the mouth of the river, it crosses a clearly marked line on the surface of the water. On the side of this line towards the Atlantic the water is of the greenish, milky color which announces the proximity of land; on the other, it has the characteristic color of the river, a brownish yellow. The ship has now entered the waters of the river, though the land is scarcely yet visible. The pilot-signals, buoys, and landmarks set up by the Government, render it a very easy task to take a ship into the port of Banana. After skirting the bank at the point, she enters at once into a magnificent bay, where a whole fleet could ride at anchor. This port far surpasses all others along the coast, and it is astonishing that no one thought of occupying a spot so favorably situated at the mouth of one of the mightiest rivers of the globe until some slave-traders in the present century took up their quarters at Banana Point. Cases of illness are rare, and invalids speedily recover in this healthy spot. The heat is rendered supportable by the sea-breeze, which blows from ten o'clock in the morning.

The basin of the Kongo and its affluents has an area of about 386,000 square miles, more than thirty-three times the area of Belgium, and nearly as large as Holland, Belgium, France, Switzerland, Italy, and Ireland united. The navigable waters of the basin measure together about 7,140 miles in length. The length of both banks of the navigable waterways, 14,280 miles, is about that of the coast-line of Europe from North Cape to Constantinople. In addition to this, the Lower Kongo extends for about 120 miles from the mouth to Matadi, where the region of cataracts commences, and consists of two portions differing considerably in character. From Matadi to the Ile des Princes, or thereabouts, wild scenery, steep mountains, and torrents falling headlong into the river show that the volcanic forces which formed the region of the cataracts extended their energy over this district also. Below this island the river expands at once to double, and a little lower down to three times, its former breadth, and at last measures about twelve miles across instead of two miles and a half. It is studded with numerous islands, larger streams flow into it, its banks and the hills beside it are rounded, and the whole country has a tame appearance. Between Boma and Ponta da Lenha the islands are only banks of sand covered with grasses and sickly-looking shrubs, but below that point they bear a luxuriant vegetation.

A further diversity in the vegetation and soil is caused by the tides. The salt water ascends the river as far as Malella, so that, while the islands above are covered with oil-palms, baobabs, and wild cotton, on those towards the mouth of the river the effect of the tide may be seen in the increase of bamboos and the diminishing number of palms, etc. The latter islands are submerged at exceptionally high tides, whereas those above Malella have a fairly dense population. As soon also as the fresh water is entered, alligators and hippopotami are met with.

The navigation of the Lower Kongo is rendered difficult and dangerous by the rapid changes that take place in the depths of the channels. Some twenty years ago steamers always followed the northern bank between Ponta da Lenha and Boma, for the Fetish Rock passage was practicable only for crafts drawing less than six feet, whereas now this passage has a depth of about 190 feet, while opposite Kanga a boat drawing eleven feet of water would certainly touch ground. Several other similar cases might be quoted. Again, when the tidal waves are urged forwards with more than usual violence by the wind, which generally blows from the sea from ten o'clock in the morning, the struggle of these waves with the waters of the river is so fierce that it is felt as far as Binda, ninety-three miles from the mouth. At such times boats are obliged to keep close to the banks, or they would be swamped immediately. Ocean steamers ascend as far as Boma, and small steamers belonging to the Kongo State ply along the river up to Matadi. From the soundings taken by Captain Boyé, however, which show that the channel is nowhere less than sixty feet deep, it is considered that large steamers may safely ascend to Matadi at a speed of nine to ten knots. The large quantities of water which are poured into the river during the rainy season cause great

changes of level. The water rises gradually through June, July, and August, and attains a maximum height between the 13th and 25th of September, after which it decreases up to the middle of February, and attains a second but lower maximum at the end of April.

North of the river, between Banana and Ponta da Lenha, lies an arid plain. The soil is a compact clay interspersed with lagoons, which are flooded at high tide, and are covered with impenetrable vegetation, chiefly papyrus. At a distance of from three to twelve miles from the river the country entirely changes its aspect: here hills, 300 feet high, are separated by broad valleys, and the soil is light, and no doubt very fertile. Fifty to fifty-five miles from the river, Mayumba — i.e., the land of forests — is entered, which supplies the greater part of the merchandise shipped from the ports of the Lower Kongo, and of the coast between that river and the Gabun.

Four tribes inhabit this country; the Mussorongos, who dwell on both banks of the river and the islands between Ponta da Lenha and Banana, the N'Zaadi along the river to the east of the Mussorongos, the Kacongos to the north of these tribes, and, beyond the Kacongos again, the Mayumbas. The natives have a gentle disposition, and their barbarities are due entirely to the old-established rites of fetichism. They attack a village on slight provocation, but disturbances among the inhabitants of the same village are very rare. Drunkenness, except perhaps at the great feasts, is not a common vice. They are by no means impervious to new ideas, and, if the Government can put down the tribal wars, they will probably make great progress in civilization.

Between Matahdi and Stanley Pool merchandise has at present to be carried overland at great expense. A railway has therefore been projected to connect the upper and lower parts of the river, and thus provide a cheaper and more commodious means of transport from the interior. The distance, as the crow flies, is 174 miles, but the railway, in order to take advantage of the formation of the ground, and avoid all great engineering difficulties, will be extended to a length of 264 miles. The cost is estimated at £1,000,000 sterling.

A new edition of three sheets of M. Lannoy de Bissy's map of Africa, which embrace the greater part of the Kongo territory, has been published. Several important changes may be observed in this edition, particularly near the cataract region. The French Rouvier Mission has furnished more complete and exact information than has hitherto been attainable regarding the course of the Kuilu and the country north of Manyanga; and the Belgian Cambier Mission has supplied details concerning the country on the south bank, between Matadi and Leopoldville. The survey for the railway has also determined the position of many points more exactly. The position of Mboko Songo has been removed about 20' towards the north, and therefore the sources of the Chilungo, in the neighborhood of this place, have undergone a similar displacement, whereby the basin of the Kongo, and consequently the territory of the Kongo State, have been enlarged. The middle course of this river has also undergone changes in direction, and its affluents, the Luisa and Luali on its right bank, and the Lukula, on its left, are represented as the important streams they really are. The tributaries also which enter the Kongo in the region of the cataracts are put down from their sources to their confluences.

Between Stanley Pool and Kwamouth the river runs swiftly between mountains often six hundred to one thousand feet high, and covered with forests. Only at Msuata is this barrier broken. Here the land rises from the shore in terraces, and is inhabited. As far as Chumbiri the river widens very gradually, but above it expands considerably, and is generally very broad all the way to Stanley Falls: it is often fifteen, and sometimes as much as twenty-one, miles across. Between Bolobo and Lukokela a marshy tract occurs, a slight blemish on this beautiful river.

All along the banks of the Upper Kongo are frequent villages, and even towns. Bolobo, for instance, has a population of 30,000 souls, public squares, and regularly built streets. Considering the enormous length of waterways, and the fertility of the soil, the new railway, by which all the exports must reach the Lower Kongo, should prove a success.