# Railways in the Congo Free State.

By Lionel Wiener.

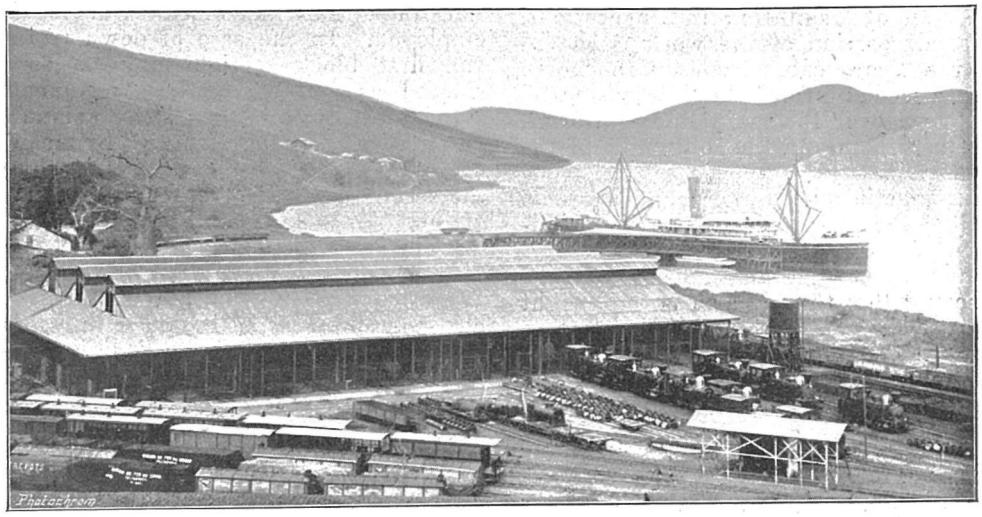
FOREMOST among penetration railways is the "Chemin de Fer du Congo," establishing a sure and fast means of communication between Europe and the interior of the central part of the dark continent.

A glance at a map of Central Africa shows that the geological formation of this part of the continent has created a formidable barrier between the coast and the interior of the continent. Its general aspect resembles that of a plate turned upside down. Rivers take their source on its summit and, wending their way through the rim on which the plate rests in its normal position, come, by a series of falls and rapids, down to the sea.

The Congo river is no exception to this rule. Most of its tributaries join it above a large expanse of water, the Stanley Pool, and thence the Livingstone cataracts (thirty-two in number) bring it three hundred metres below, after a 350 kilometre course, down to Matadi, where navigation can be resumed.

Under these circumstances, the importance of creating a practical means of communication from Matadi to the Pool is unquestionable, and the idea of digging a canal having been given up, owing to the mountainous nature of the country, a railway was decided upon.

As early as November, 1885, an English company was formed and applied to the Congo State for powers to construct and work the new line; but political stability with regard to the very existence of the new State being only a problematical uncertainty, the company claimed such advantages as the Government was unable to concede, and the idea was abandoned.



RAILWAY STATION AND STEAMER PIER AT MATADI BOMA, CONGO RAILWAY.

However, thanks to the active exertions of Captain—now Colonel—Thys, a new society was formed, and the outcome of his energy was the construction of a "toy railway," which certainly ranks amongst the greatest achievements of modern skill and engineering.

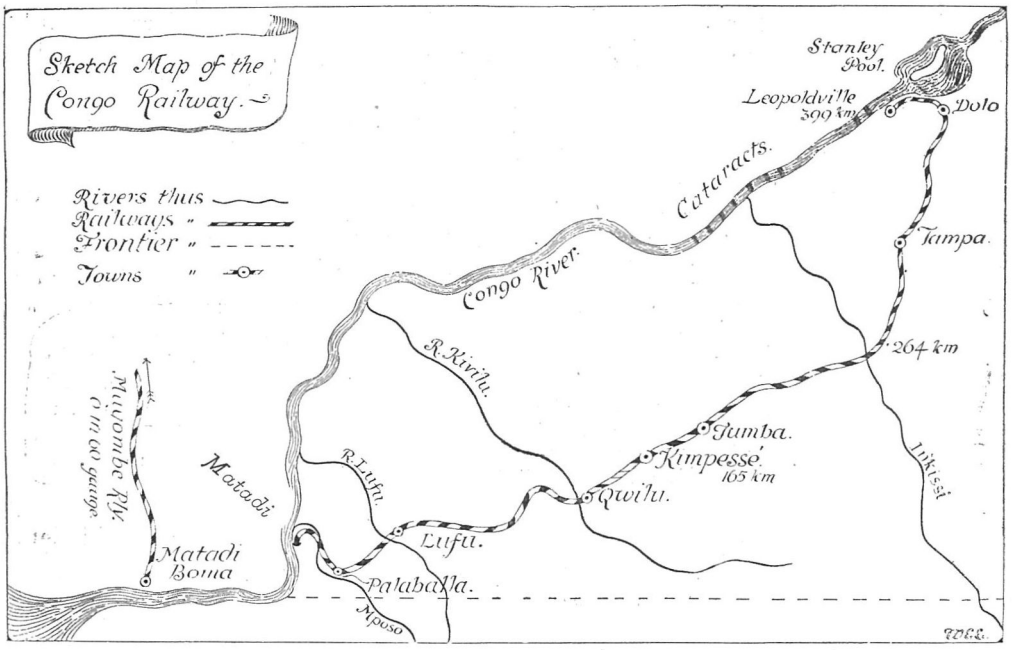
It was decided to build the line as

fast as possible, and to use it afterwards as a means of communication to bring all the necessary appliances for rendering its working easier, such as metallic bridges instead of wooden ones, etc. Since construction the improvements have principally been to the permanent way. The gradients have been lessened and brought down to 0.035 metre, or 1 in 28, and the radii of the curves increased to 60 metres.

But the first and greatest difficulty to be met and overcome was due to the country itself; it was almost totally unexplored, and its access exceedingly difficult. The pecuniary means of the company were painfully limited, and very great opposition to the Congo scheme generally, and the railway in particular, was made in Belgium. Lastly, when the country was known, it was found to be such a difficult undertaking that all the resources of modern skill and engineering were nigh to prove a complete failure. Once, for instance, it was only by sheer good luck that a practical pass through the Lukunga mountains was found.

The line, which was opened on July 1st, 1898, runs from Matadi, an important station and harbour of the lower Congo river, to Leopoldville, upon the banks of the Stanley Pool. Its general direction varies between due east and north-east near Matadi.

The most difficult portion of the line had to be dealt with at the very outset—from Matadi to the torrentuous M'Poso, one of the Congo's affluents. There was only one way the line could be carried on, and that was by suspending it, cornice fashion, above the Congo and

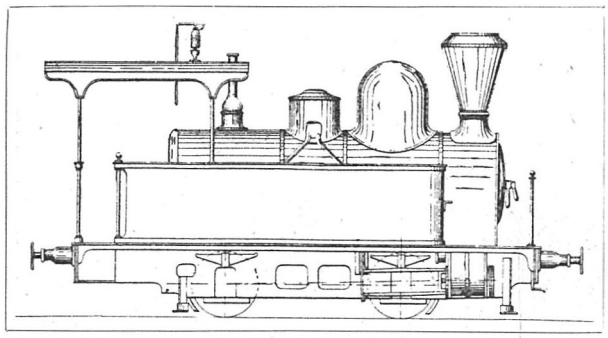



M'Poso rivers, sometimes as high as 40 or 50 metres above the water-course. Nor were the natural obstacles to end here. Hooked on to a wall of rock as the railway was, it had to cross the Palaballa range, situated on the opposite bank of the river, 240 yards higher, and that without any tunnelling. Seven kilometres of a continuous incline of 0.045 metre, or 1 in 22, and equivalent curves was the outcome of the problem.

The line having been planned without any thought being given to the works of art, these had to be constructed to

suit the plans, instead of the plans being drawn to fit them. A natural result lies in the fact that some very interesting engineering work has been displayed. For instance, a 40-metre bridge was built on an incline of 0.028, metre, or 1 in 35, and a curve of 55 yards radius.

After passing the Palaballa gorge no great difficulty was experienced until the Lukunga was reached, where a similar obstacle was met, but it was possible to avoid it by carrying the line some 16 miles to the south, and in this way, after crossing the Inkissi on a 100-metre (109 yards) bridge—by no means a slight performance, even in Europe—to run on pretty easily until the Pool was reached and all difficulties



CONGO RAILWAY FOUR-WHEEL LOCOMOTIVE, WEIGHING 20 TONS.

were at an end. The railway company had no extraneous help, but had to provide all that might be needful in any way.

The first expedition, under the orders of Captain Cambier, R.E., had to map out the region. Plans were accordingly drawn, on a scale of 1 in 1,000, comprising a zone some 200 yards wide on either side of the projected line.

Next a rough estimate of the cost was made. It was expected that—

| | £ | s. | d. |
|---|---|---|---|
| Ballasting would cost, per mile ... | 1,352 | 0 | 0 |
| Laying the line, per yard ... ... | 0 | 1 | 1 |
| Excavating— | | | |
| 1 cubic yard of clay ... ... | 0 | 0 | 10½ |
| 1 ,, ,, (silurian) rock... | 0 | 6 | 0 |
| 1 ,, ,, masonry ... | 1 | 9 | 9 |
| 1 ,, ,, gravel ... ... | 0 | 2 | 0 |

The 272 miles of line were estimated to cost £1,400,000.

But the line was so considerably underestimated that it was necessary to increase the capital. In 1895, the Belgian State advanced a further sum of £400,000, and the following year private enterprise furnished another £600,000.

The line was entirely built by natives, under the orders of European engineers. Chinese labour was tried, but proved a failure.

The Congolese workman is intelligent and works well, except at excavating. As the earthworks required far the larger number of hands, negroes were imported in large numbers from the neighbouring colonies—Sierra Leone, Senegal, etc.—they were recruited by special recruiting agents, who received £1 per head premium. The various Governments prevented anybody being embarked against his will, and stipulated certain conditions for their welfare.

The enlistment lasted two years, after which time they returned if they chose, and at the company's expense.

As many as 7,000 men were kept at work at a time. They were formed into camps, and disciplined — like the small army they formed; whilst a special corps of military police kept order at the works. Bodily punishment was forbidden. If a negro misbehaved part of his salary was kept back for a slight offence, or the chain punishment was inflicted if it were of a more serious nature. The defaulters were chained together by a light chain—so that they could be easily looked after and to prevent their escaping—and worked at cleaning the town of Matadi or any other work tending to the general welfare.

Salaries varied from £1 to £1. 14s. a month. In the shops and engine-sheds they were as much as 2s. to 5s. a day. Most of the men let the money accumulate as they saw the Europeans do, and only asked for it when their time of service was at an end.

A new system of work was intro-

duced and has given excellent results. The work to be done was estimated and paid accordingly, independently of the time it took.

| | | | Per mile. |
|---|---|---|---|
| In 1890 | 2½ miles were laid and cost | | £15,360 |
| 1891 | 10 ,, | ,, ,, | 9,204 |
| 1892 | 15 ,, | ,, ,, | 7,640 |
| 1893 | 21 ,, | ,, ,, | 7,640 |
| 1894 | 27 ,, | ,, ,, | 6,400 |
| 1895 | 45 ,, | ,, ,, | 6,400 |

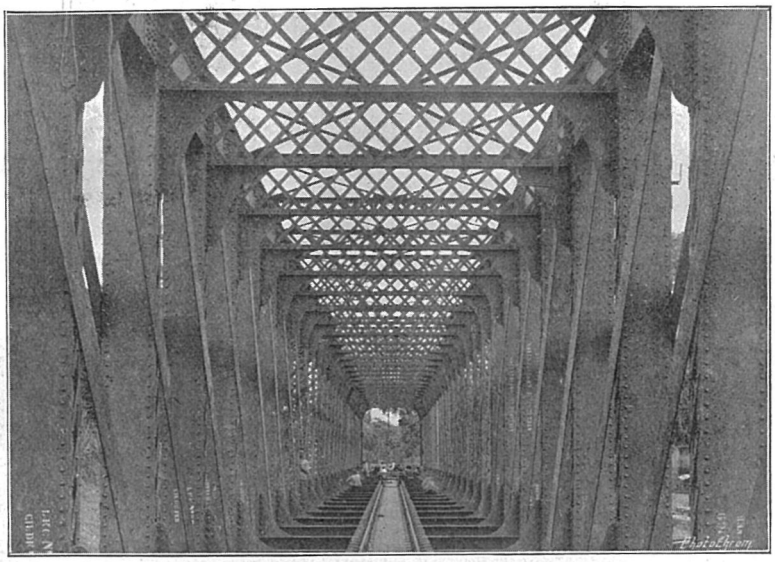
Food was dealt out as follows: One day 1 lb. of rice, ½ lb. of biscuits, and ½ lb. of dried fish; the next day the same quantity of rice, ½ lb. of beans, and ½ lb. salt meat.

A complete medical organisation was established, comprising doctors, surgeons, a sanatorium for Europeans, and a hospital for the natives.

Owing to the scarceness of roads, the line could only be started at one extremity, and the works undertaken upon a distance of 7 to 10 miles. Fast working under these conditions was almost an impossibility, yet the railway was inaugurated in July, 1898.

It is worked on the single line principle. The gauge is 30¼ inches for the line and 29¼ for the rolling stock; but there is a reason for this apparent anomaly. Some of the curves being very sharp, it is necessary for the gauge to be slightly increased and to vary according to the curve radius. But it was feared the natives would mix the various sleepers corresponding to these gauges, so the broadest, 30¼ inches, for a 31-yard radius curve was chosen, and laid on the whole line. As the trains never run very fast, the lateral stability has not been impaired.

Inclines have been limited to 0.045 metre, or 1 in 22. Such steep gradients only exist on the first section, and it is hoped to bring them down to 0.035 metre, or 1 in 28, like the other sections, when the projected tunnels through the Palaballa mountains have been constructed.



VIEW THROUGH THE BRIDGE CARRYING THE RAILWAY OVER THE RIVER INKISSI.

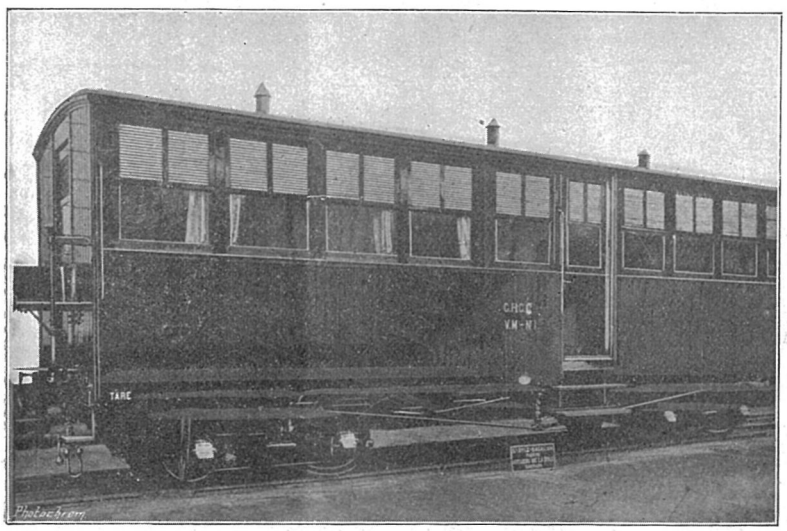
The curves radii are equivalent to these gradients, and have been calculated according to the following table:—

| Radius. Yards. | Equivalent Gradient. | Radius. Yards. | Equivalent Gradient. |
|---|---|---|---|
| 55* ... | 1 in 35 | 138 ... | 1 in 26.5 |
| 66 ... | 1 in 29.4 | 167 ... | 1 in 25 |
| 83 ... | 1 in 28 | 220 ... | 1 in 24.4 |
| 111 ... | 1 in 27 | Straight line... | 1 in 22 |

* This is the sharpest curve.

The rails weigh 43 lbs. per yard. For sharp curves a heavier rail (55 lbs. per yard) is used.

Wooden sleepers are not used though wood is so plentiful, as they do not stand the climate, nor the termites. Besides, as there are no machine tools, they come more expensive even than buying them ready made in Europe and shipping them to Africa. So metallic sleepers have been adopted. They are of the same pattern as those used on the Algerian railways, and cost at Antwerp £6. 15s. per ton; 120 tons are used for each mile of line.



FIRST-CLASS BOGIE COACH, CONGO RAILWAY.

Metallic aqueducts have been used on a large scale and have proved very satisfactory, as they stand the climate, and because of the ease and speed of their construction. They are sent out ready-made in two sizes, the smaller $19\frac{3}{4}$ inches diameter and 41 inches long, the larger $23\frac{5}{8}$ inches diameter and $32\frac{1}{2}$ inches long. These segments fit into each other, each section being of a conical shape. It has been deemed useless to cement them, as the loose earth fills the joints. Two coats of paint prevent their rusting.

Signalling, though rudimentary, is on the block system. The line is divided into sections; when a train arrives at the commencement of one of these the signalman telephones to the next section to ask if the line is free. If so, the train passes on.

However, the most interesting feature of the permanent way is certainly its bridges. Owing to the swiftness of the current of most of the rivers to be crossed, pillars have been renounced and suspension steel bridges adopted. Two only are not single spanned, and this is due to an error in the original measurements.

Such a mistake is but too frequently made, as it is only at night that ravines containing a rivulet in the daytime become the beds of sweeping torrents. This is due to the hydrographic conditions of the country. It rains regularly towards evening. Rain, or rather sheets of water, pour down and swell the rivers that rush madly on. Suddenly the deluge ceases, and the watercourses resume their beds, leaving only very vague indications as to the depth their waters can attain.

The largest bridges are 132 feet, 165 feet, two of 198 feet, one of 234 feet, two of 261 feet, and one of 333 feet respectively. The line was opened to traffic before the permanent steel bridges were placed. They were built without interfering with the working of the line. Various methods were used to attain this result. For the Quilou bridge, for instance, the line was raised on a temporary wooden structure and the bridge built beneath it. It weighs 260 tons exclusive of its

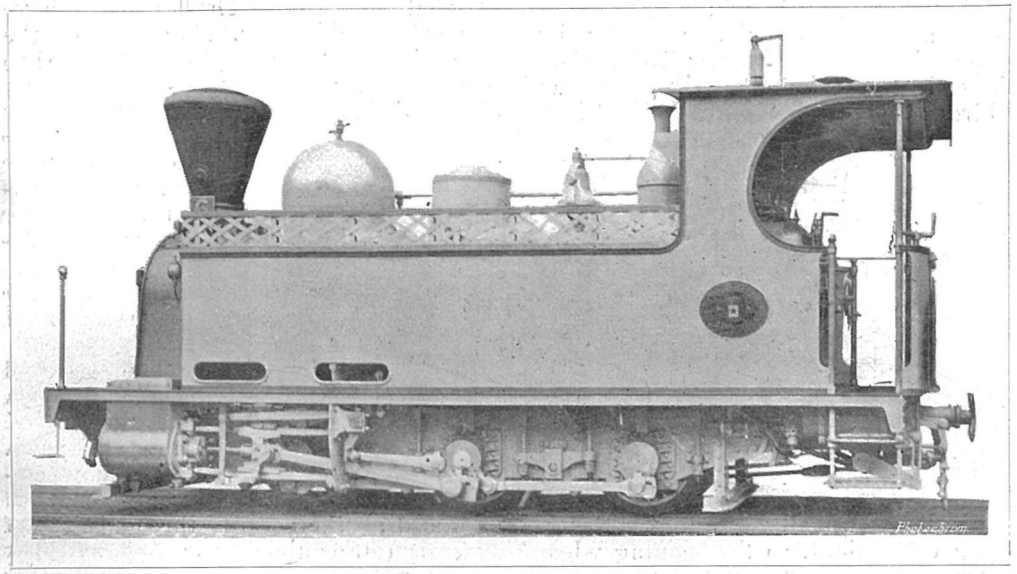
supports (these contribute another 17 tons). The whole structure is cast steel. Its length is 261 feet, its width 18 feet 6 inches.

Quite a different method was used for the Inkissi 333-foot bridge (illustrated on page 65). The line was slightly deviated, and the bridge put together on the bank, as it was feared the wooden pillars might be carried away by a sudden flood, as had once happened. A 100-ton crane then lifted the whole structure sufficiently to place cylinders under it, and so enable it to be rolled forward to its definite position, when a second upheaval enabled the cylinders to be withdrawn.

All the smaller bridges are built on the bank, finished there and placed in position on their foundations between the passage of two trains.

However, a more difficult problem to solve was how to build the curved bridge I have already mentioned. If it had been suppressed a huge viaduct would have been necessary, and this was a much too costly affair altogether. So it was built as straight as any well brought up bridge should be, with this difference, that on its concave side half the longitudinal supports were slanted inwardly. All the supports rested on the lower portion of a vertical frame similar to what would have been used for a broader bridge. As for the 1 in 26.5 gradient, it was managed by giving the supports a trapezoidal section.

Considering the temperature, it was thought probable that these large metallic structures would play havoc with the rails when they expanded or contracted. So a gap was left between the rails, but a steel piece was screwed on to the side 8-10 inch broad, 1 3-5 inch higher than the line, and 2 2-5 inches long, with a 1 in 14.3 grade at either end. This system is interesting but useless, owing, probably, to the very slight variations of the temperature.



SIX-WHEELS-COUPLED LOCOMOTIVE, WEIGHING 26 TONS, CONGO RAILWAY.

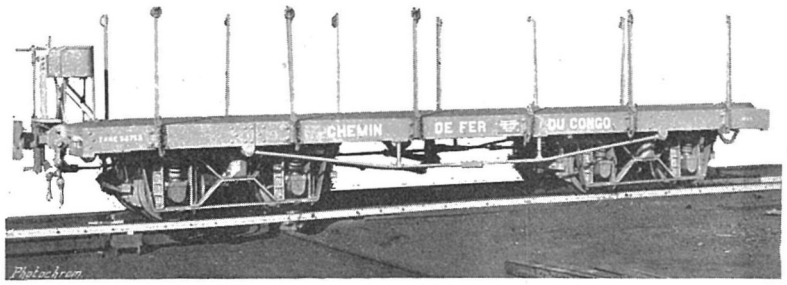
Quartzite has been used as ballast. But for the last section a thin white sand was found and no other ballast needed, as curiously enough the profile has remained unimpaired. This is due to the daily evening rains, and to the soil retaining sufficient moisture.

Water stations have been established every 15 miles. A few steam pumps are used to raise the water, but windmills will probably replace them. As

water may be scarce three cistern wagons have been provided. But one wagon in each four-wagon train would be too great a proportion, so the cisterns serve as frames and carry goods above—rather a neat dodge for increasing the carrying capacity of goods trains.

The company's rolling stock consists of 56 locomotives, 15 carriages, and 690 wagons. The locomotives are of four types, and considering the requirements they have to meet, climbing steep gradients and rounding sharp curves, they have proved very satisfactory.

The first class (goods locomotive) has eight wheels. six of which are coupled, and a trailing axle. Its principal dimensions are as follows: Total wheelbase, 13 feet 11½ inches; the second and third pairs of wheels are both drivers.




10-TON OPEN GOODS TRUCK. CONGO RAILWAY.

This large wheelbase would not have been convenient, so the leading wheels were allowed 2 centimetres (8-10 inch) side play; whereas the trailing wheels have radial boxes. Total heating surface, 675 square feet, of which the tubes contribute 626.5 square feet and the firebox 48.5 square feet. Working pressure, 170 lbs.; grate area, 12.12. Number of tubes, 118; length between tube plates, 138 inches; outside diameter, 1 8-10 inch. The tubes and firebox are copper, the barrel steel. Outside cylinders, 12⅝ inches diameter; 15¾-inch stroke, Walschaert gear. Wheels: trailing, 25½ inches; others, 35⅛ inches. Tractive force, 13,500 lbs.; practical tractive force, 7,500 lbs. Weight empty, 53,900 lbs., in working order 69,300 lbs., distributed equally on the three first pairs of wheels, and 15½ tons on the last. Height of centre line of boiler, 30 6-8 inches. Length of engine, 12 feet 11½ inches; width, 8 feet 2½ inches; height, 10 feet 8 inches; water capacity, 814 gallons; fuel capacity, 1,550 lbs.

Hand brakes only have been applied to all the rolling stock, as sufficient for short trains (never more than four wagons. Besides, if a continuous brake were adopted, and got out of order in an inconvenient place, as it would do for choice, the accident would have too nasty an appearance.

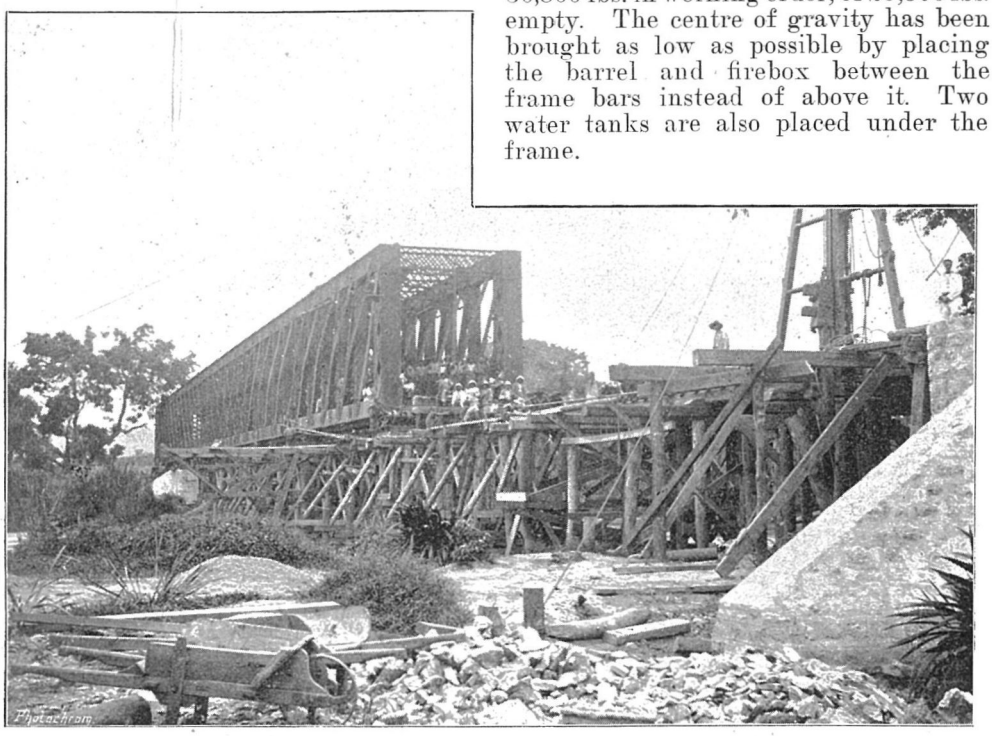
The steam reversing gear is of the Lechatellier type. These engines have American chimneys, or rather of the American type, as they were destined to burn wood or coal indifferently. Coal only is used (briquettes), but the chimney design has been kept so as not to mar the general appearance. This class draws three 10-ton goods wagons up the grades of 1 in 22.

The second class, also goods, is similar in most respects. But the wheelbase has been reduced; there are three pairs of wheels (all coupled) the first and last with 1½ inch side play. The tubes are steel instead of copper. These engines draw four wagons at a maximum speed of 13 miles an hour. This type is illustrated on page 63.

Chief dimensions: Heating surface in firebox, 44.1 square feet; tubes, 1,030 square feet; total, 1,074.1 square feet. Grate area, 12.26 square feet; tubes (steel), 130; length between tube plates, 7 feet 10¼ inches; inside diameter, 1 8-10 inch. Working pressure, 199 lbs. per square inch. Cylinders: Diameter, 12⅝ inches; stroke, 13 6-8. Wheels: 2 feet 8½ inches; tractive force, 18,680 lbs.; practical tractive force, 11,209 lbs. Weight in working order, 58,500 lbs., and empty, 48,400 lbs. equally distributed. Total wheelbase, 11 feet 9 2-8

inches. Length, 21 feet 3½ inches; width, 8 feet 0 2-8 inch; height, 10 feet 10 inches; height of centre line of boiler, 5 feet 9⅜ inches; water capacity, 528 gallons; fuel capacity, ½ ton.

Next come the express engines with two pairs of wheels only. They draw passenger and goods trains from Matadi to the Pool in twenty hours or at the rate of 15 miles an hour. (See illustration on page 60.)



ERECTING BRIDGE TO CARRY THE CONGO RAILWAY ACROSS THE INKISSI RIVER.

Leading dimensions: Heating surface in firebox, 35.62 square feet; in tubes, 320.58 square feet; total, 356.2 square feet. Grate area, 10.41 square feet; tubes, 210 square feet; length between tube-plates, 6 feet 2¾ inches; outside diameter, 1 8-10 inch; steam pressure, 199 lbs. per square inch; cylinders, 11 inches diameter and 13 6-8 inches stroke; wheels, 2 feet 6⅞ inches; tractive force, 10,835 lbs.; practical, 7,040 lbs.; weight, empty, 35,200 lbs.; in working order, 42,350 lbs. Wheel-base, 6 feet 7 inches. Length of engine, 20 feet 4 inches; width, 7 feet 4¾ inches; height, 10 feet 8½ inches. Water capacity, 396 gallons; fuel, ½ ton; height of centre line of barrel, 5 feet 9⅜ inches.

The last class was used during the construction of the line, and was built with a view to fast running even on a badly laid line. It has a 5 foot 10¾ inch wheelbase, and weighs 30,800 lbs. in working order, or 25,300 lbs. empty. The centre of gravity has been brought as low as possible by placing the barrel and firebox between the frame bars instead of above it. Two water tanks are also placed under the frame.

These engines have both hand and steam brakes. Height of centre line of boiler, 57⅛ inches; wheels, 32¾ inches; total length of engine, 19 feet 1 2-8 inch; height, 9 feet 2 inches; height of buffers above the rail, 27⅝ inches, as for all the rolling stock.

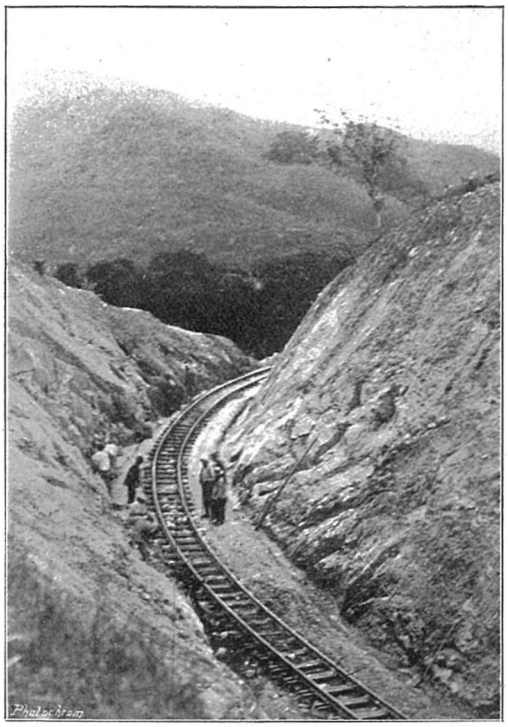
There are four kinds of goods wagons, all of which are of 10 tons capacity, and run on bogies. The frames are 25 feet long, and 5 feet 10⅜ inches wide; bogie wheelbase, 3 feet 8 inches; distance of bogies, 14 feet 5 inches; length of wagon

over buffers, 26 feet 3 inches. The open wagons weigh about 6 tons. They have brake blocks on all the wheels of one side. The wheels are $23\frac{5}{8}$ inches diameter and made of ferro nickel.

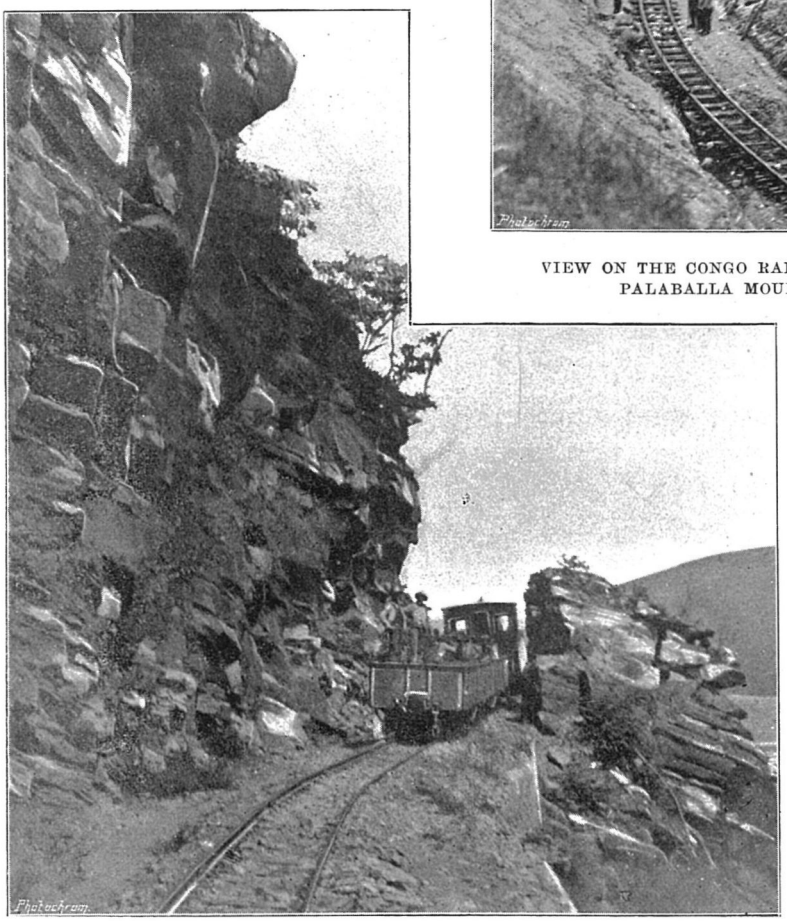
The passenger carriages have a platform at one end, a central compartment seating twelve passengers, and a *coupé* for invalids. They are 19 feet long and have no side pannelling, but thick leather curtains to protect the passengers from the sun or the rain, both of which can be very inconvenient at times.

There are three passenger trains a week in each direction; from Matadi on Mondays, Wednesdays, and Fridays; from the Pool on Tuesdays, Thursdays, and Saturdays. Passengers sleep half-way at Tumba, both on the up and down journey, which takes two days. As soon as possible the carriages will be fitted with night equipment, and the trains will run through from Matadi to the Stanley Pool.

Fares are very high if compared to those of European railways, but are cheaper than those of



VIEW ON THE CONGO RAILWAY. IN THE PALABALLA MOUNTAINS.



CUTTING NEAR THE CONGO RIVER.

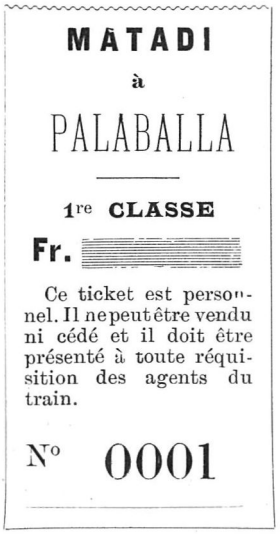
the road caravans, before the line was built. In first-class they vary from £2 to £20 for the entire distance. In second-class (negroes only) from £1 to £4.

Goods pay 8s. per 20 lbs. on the up journey. Fares are lower on the down journey, so as to encourage exportation. The fares for salt, boots, and a few other articles are 50 per cent. cheaper. Wood pays 3½d. per ton mile, tobacco 9d., india-rubber 1s. 4d., but ivory, under the pretext that it is a valuable article and will bear taxation, 3s.

working the line from £120,000 to £160,000.

For twenty-five years no competing line will be granted. Even if France built one in the French Congo, its neighbouring colony, it would be a longer route.

Besides these clauses, the company was granted all the necessary land for the railway, station works, and Matadi harbour (its property) free; also a strip 220 yards wide on either side of the line, and so much land for each mile of rail-




FACSIMILE OF FIRST TICKET PRINTED FOR THE CONGO RAILWAY.


FACSIMILE OF FIRST TICKET PRINTED ON CARDBOARD FOR THE CONGO RAILWAY.

The "Chemin de Fer du Congo" is a limited society with an original capital of £12,000,000, half of which sum was subscribed by the Belgian Government. The line was granted for a period of 99 years, but the Congo State may buy it up any time after January 1st, 1909, and Belgium between 1904 and 1st January, 1909. A 3 per cent. dividend is guaranteed, quite a needless formality, as the £20 shares have been as high as £600.

The yearly receipts vary from £360,000 to £440,000; the cost of

way constructed. This land the company might choose in any part of the Congo Free State. From these various sources it is owner, as a land holder, of an area equal to about one-fifth of Belgium.

The traffic has considerably increased year by year, and the single line is already being doubled, which seems to promise a brilliant future.

My thanks for the illustrations are due to Colonel Thys, R.E., to Mr. Goffin, General Manager of the Chemin de Fer du Congo, and to Mr. Alexandre, the Brussels photographer.