

13 spans of 70 ft. each; over the Ara, 4 spans of 100 ft. and 47 of 50 ft. each; over the Kana, 30 spans of 40 ft. each; and over the Karasu, 6 spans of 100 ft. and 7 of 20 ft. each. Altogether there are 686 spans of 20 ft. and upwards, and of these 403 are between 40 ft. and 60 ft. span.

Rolling Stock: 69 engines, 248 carriages, and 1,022 wagons, was the stock on the 31st March, 1893; and is in every way similar in design to the Government stock. Orders have been sent for 48 new engines, of which 24 have arrived, besides 112 carriages, and 250 wagons. Many of these vehicles are now working, and when all are running the Nippon Railway Company should be well provided to meet all requirements. Nearly all the carriages and wagons have been built at the Shinbashi or the Kobe Government Works. A few carriages and wagons were bought from the Sanyo Railway Company.

(To be continued.)

Modern Permanent Way—X.

(Continued from page 219.)

NORTH EASTERN RAILWAY.

For the illustrations and descriptions of the permanent way of the North Eastern Railway, we are indebted to Mr. C. A. Harrison, Mr. H. Copperthwaite, and Mr. W. J. Cudworth, M.M. Inst. C. E., the engineers of the northern, southern, and central divisions respectively. As might be expected,

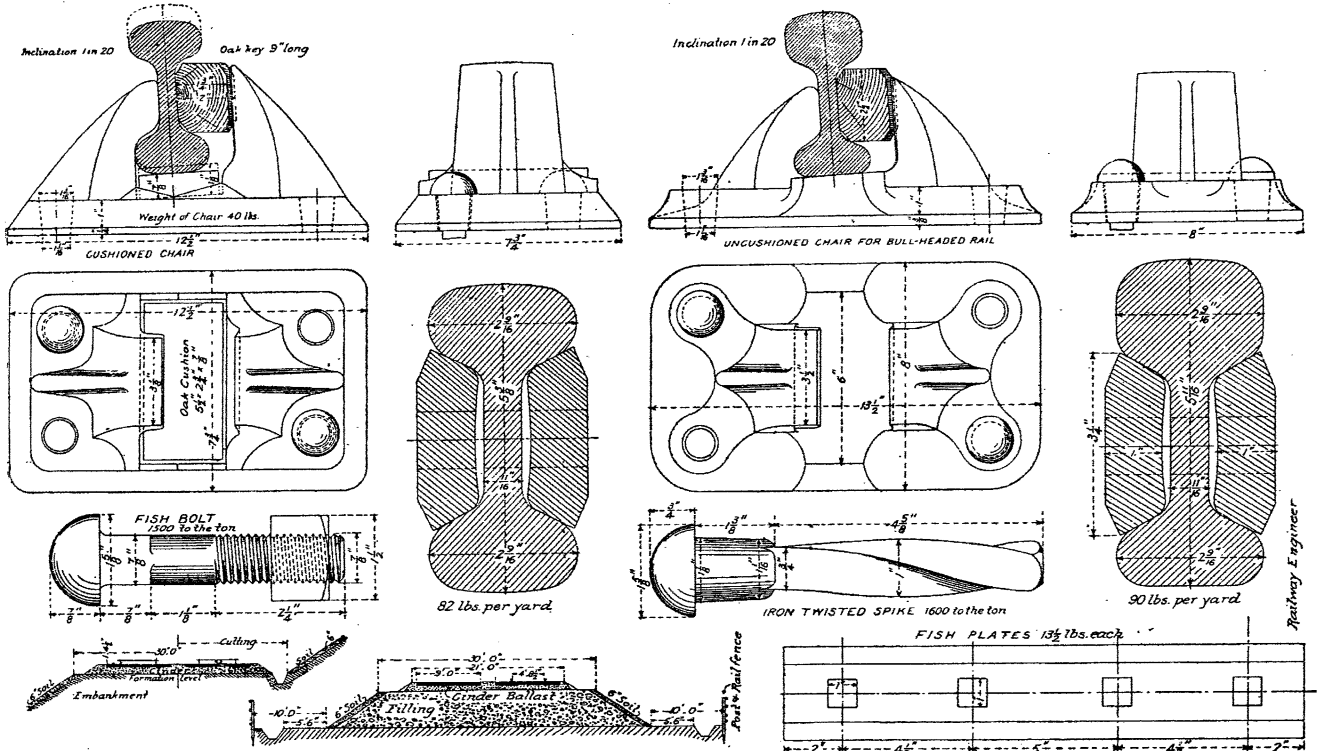
the width of the tables $2\frac{9}{16}$ " and the thickness of the web $\frac{1}{4}$ ". It will be seen from the illustration that all the corners are rounded or filled with large radii. The radius of the top corners is $\frac{1}{16}$ ". The fish bolt holes are drilled $1\frac{1}{8}$ " x 1".

A double headed steel rail, weighing 82 lbs. to the yard, and laid in 24' to 30' lengths, is also used to some extent on this Railway, but is renewed with bull-heads.

The laying of the sleepers varies somewhat on the different divisions. On the northern division the joint sleepers are spaced 2' 4", centre to centre, and there are 9 intermediate sleepers equally spaced in each 30' rail-length; $\frac{3}{8}$ " is allowed between the ends of the rails. On the central division, the joint sleepers are spaced 2' 1", centre to centre, and the intermediate sleepers at 2' 9 $\frac{1}{2}$ ", $\frac{3}{8}$ " is allowed between the ends of the rails. On the southern division, the joint sleepers are spaced 2' 3 $\frac{3}{4}$ ", centre to centre, and there are 9 intermediate sleepers, which are laid at distances apart, which increase towards the centre of each rail length as follows: 2' 4", 2' 8", 2' 10", 3', and 3' 0 $\frac{1}{2}$ ", and decreasing towards the other end of the rail length: 0' 3" is allowed between the end of the rails.

The Fish Plates are steel, and weigh 27 lbs. per pair; they are 1" thick, 3 $\frac{1}{4}$ " deep and 18" long. The positions of the fish-bolt holes are shewn on the drawings; those on the inside plates, 1" sq., and those on the outside plates, $\frac{1}{8}$ " diameter.

The Fish-bolts are iron (on the central division of steel), $\frac{7}{8}$ " in



Standard Permanent Way—North Eastern Railway,

there is but little difference in the permanent way in the three divisions, but the few points of detail which are different are duly noted below.

The Rails are steel and are laid in 30 ft. lengths. The joints are opposite to each other, and the inward cant is 1 in 20. The standard weight of the bull head section adopted in 1889 is 90 lbs. to the yard. The height of the section is $5\frac{1}{8}$ "

diameter, with square necks and cup heads, $1\frac{5}{8}$ " x $\frac{7}{8}$ "; the nuts are $1\frac{1}{2}$ " sq. x 1" thick. The nut and bolt weigh about 1,500 to the ton.

The Chairs weigh 40 lbs. each, the base $13\frac{1}{2}$ " x 8", and gives a net bearing area on the sleeper, of 108 sq. inches. The rail seat is 6" long. The drawing is fully dimensioned. Another pattern of chair is also illustrated, and in this a recess is cast to

to take an oak cushion $5\frac{1}{2}'' \times 2\frac{3}{4}'' \times \frac{7}{8}''$ under the rail, and when the bull-headed section is used with the cushion-chair the cushion is made $1\frac{1}{8}''$ thick.

Fastenings—Four holes are cast in each chair, but only two fastenings are used, and these are iron spikes of the pattern illustrated, and which is peculiar to the North Eastern Ry. The part of the spike which enters the sleeper is $\frac{3}{4}''$ square in section and twisted. The neck is tapered to fit the holes cast in the chairs. The holes bored in the sleepers are $\frac{3}{4}''$, $\frac{5}{8}''$, and $\frac{1}{2}''$, in the three divisions respectively diameter. Should a fastening work loose the holes in the other corners of the chairs are still available for securing the chair.

The Sleepers are of the usual size, $10'' \times 5'' \times 9'$ long, and are cut from Scotch or Baltic fir. They are creosoted and laid with the heart side upwards.

The Keys are of oak, $2\frac{3}{8}'' \times 2'' \times 9''$ on the northern, $2'' \times 2'' \times 8\frac{1}{2}''$ on the central, and $3'' \times 2'' \times 6\frac{1}{2}''$ on the southern divisions, respectively. In the two first the key bears only on the web of the rail, and is of unusual length. The keys are driven on the outside of the rails.

The Ballast used is mainly broken blast furnace slag or "cinder." It is kept level with the top of the sleepers. The standard depth of the ballast is 18". Standard cross sections of the line are shewn on the illustration.

(To be continued.)

Railways in Turkey.

OF the various railways projected, only two out of four have been undertaken. The railway from Damascus to Homs, Hamah, Aleppo, and Beredjik, the concession for which was granted to a French company, is still hanging fire, as the question of the kilometric guarantee cannot be satisfactorily determined, the Ottoman Government refusing to accede to the company's proposals. But the later report says:

The Damascus-Homs Biredjik Railway, which forms part of the strategical system approved by the Ottoman Government, will be constructed with a normal gauge, and the State has granted an annual kilometric guarantee of 12,500 fr. secured by the tithes of the Sandjaks through which the line pass.

The Acre Haïffa-Damascus Ry. project has also, apparently, completely fallen through, as no serious work has been undertaken for some time past, and the concession lapses in the autumn of this year. It is much to be regretted that an undertaking which had every prospect of success should have been allowed, from whatsoever cause, to come to such a termination.

The Beyrout-Damascus Railway is nearly completed for traffic, and will be opened in the middle of July, though some time must elapse before the line is in perfect order. This line will join the Hauran Railway, running round the western side of the town: 34 kiloms. of it have been constructed on the cog-wheel system, and there are 4 tunnels, one of which (at Dahr-al-Baidar) is 350 metres long. The train will attain a speed of 16 kiloms. per hour, and it is expected that this rate of progress will be exceeded when the permanent way has thoroughly settled down.

The promoters of the railway are confident that there will be a great increase of traffic between the termini of the line, and in this connection it may be of interest to note that in 1894 the goods conveyed by road from Damascus to Beyrout,

and *vice versa*, amounted to 27,000 tons, the number of passengers being 14,834; figures which will probably be largely increased when the advantages of speed and ample accommodation are placed within the reach of the public by a reasonable scale of charges.

The Hauran Railway, which is amalgamated with the Beyrout Railway, has been open for traffic since the middle of July last, and has done more business than was thought possible. It is true the working is managed with the greatest economy, but it was not supposed that an excess of receipts over expenditure could be realised for some considerable time to come. As a matter of fact, however, on the first 10 months a net profit of £4,000 was realised, but this does not include the expenses of the staff nor those of the maintenance of the line, which is still in the hands of the contractors. It is estimated that the total working expenses will not exceed £80 per kilom., or about £8,000 per annum, only one train being run per diem each way, and that even on the present returns of traffic, which may reasonably be expected to increase, there will be a small net profit. This statement is, of course, far from favourable when the question of interest on capital comes to be considered, but it is at least more hopeful than most people expected, or than anyone, who took into consideration the fact that the line runs through a very sparsely populated country without any important terminus and with no products but cereals, could have conceived. The rolling stock is inconsiderable, and consists of 8 engines, 20 passenger coaches, and 73 vans and trucks. The ordinary daily train does the distance of 101 kiloms. to Mezerile in 4 hours.

The Tripoli-Sidon Steam Tramway, which is to run along the coast, and for which a concession was granted two years ago to a native of the Lebanon, has not yet been begun; but the necessary capital has been raised in France, and a French firm has contracted for the construction of the line. It is proposed to begin by carrying the tramway as far as Gebail, which lies about 40 kiloms. north of Beyrout on the way to Tripoli, and the remainder of the work is to be completed gradually as the demands of local traffic may dictate. The first section of the line will take about a year to make, and an arrangement is in contemplation for the company sharing the terminus already constructed for the Beyrout-Damascus Railway.

The terminus has the disadvantage of being situated at a distance of nearly $1\frac{1}{2}$ miles from the port, and there is an urgent necessity for a connecting line being constructed between these two points; but the estimated outlay (£48,000) which would be entailed by the engineering problems involved, has hitherto prevented the execution of this most important adjunct to the harbour and railway.—*Consular Reports, dated Damascus, 6th June, and Beyrout, 23rd July, 1895.*

The Design and Construction of Railway Carriages and Wagons.—XLIII.

(Continued from page 305).

BODIES—continued.

One of the most successful appliances for dispensing with the strap or "glass string" on the drop-light of a carriage door is that introduced by Messrs. Greenwood & Co. It is illustrated by figs. 515-9.