PERMANENT WAY.

—:o:—

ON Plates CXCI. we give drawings of the chairs, joints, and rails of some railway companies other than those illustrated in our last.

On the former occasion we gave some description of the Permanent Way of the London and North-Western Railway, and having been unable then to include any illustrations, we do so now, at Figs 1 to 1*i*. Fig. 1 is a section taken through the chair, rail, and key at *A B* of the plan Fig. 1*b*. Fig. 1*a* is a section through the chair taken parallel with the rail, and shewing the inner side of the outer jaw, against which the wooden key bears. Fig. 1*c* is an elevation, and Figs. 1*d* and 1*e* are horizontal sections through the jaw, as indicated.

In these views thus enumerated, the arrangement for preventing the key from working loose or falling out is clearly made to appear. It will be seen that there are grooves in the inner side of the outer jaw, not running all across, but terminal, as shewn distinctly by sections at Fig. 1*d*, and by dotted lines in the plan, Fig. 1*b*, and in Fig. 1*h*. It will, moreover, be noted that the jaw has a curved bevel at its edge, so as to admit of the easy entrance of the key, the space between the jaw and the rail narrowing from the entrance to the commencement of the grooves by $\frac{1}{8}$ in. or $\frac{3}{16}$ in., as shewn clearly in Figs 1*d*, 1*e*, and 1*h*. The key, in passing this narrow point, must necessarily be compressed, but expands again so as to fill the grooves. It is thus firmly held in, the projecting divisions between the grooves preventing any vertical movement, and the projecting ridge at the ends any horizontal movement. Figs. 1*f* and 1*g* shew views of the key before driving in, and Figs. 1*h* and 1*i* after driving in.

Fig. 2 is a section of the rail and chair of the Cambrian Railway. The rail is steel and weighs 72 lbs. to the yard, and the chair weighs 30 lbs. We shall hope to give further information, with regard to this railway, at some future time.

At Fig. 3 is represented a rail section and sole-plate and fish-plate joint of the Cork and Bandon Railway, Ireland. On this line there still remain some iron rails, though all laid within the last seven years have been steel. About three miles of the original Cork and Bandon Main Line are still laid with iron double-headed rails, weighing 65 lbs. per yard, which are still in good order, and have been in, it seems, since the line was opened in 1851, and this under a traffic which gave the largest receipts per mile in Ireland. The weight per yard of the rails used are various. The iron single-headed rail, 63 to 65 lbs.; iron flange rail, 72 lbs.; the steel, both double-headed and flange, weigh 68 lbs. per yard. The lengths are also various. The original iron rails were only 14 ft. 9½ ins. The flange iron rails are 24 ft. in length. The steel double-headed rails are either 42 ft. long, with 30 per cent., 2 ins. shorter for convenience in laying on curves, or else 30 ft. long with 30 per cent., 2 ins. shorter for curves; there are also 5 per cent. of yet shorter lengths. The steel flange rails are 30 ft. long, with 30 per cent., 2 ins. shorter for curves, and 5 per cent. still further diminished length. The rails are laid with a cant to one side of 1 in 20. The weight of the chairs used is 28 lbs., and the joint chair, now being discarded, 36 lbs. They are held down by either two wrought iron spikes, or one spike and one compressed oak treenail.

In the case of the flange rails where no chair is used, they are either laid on wrought iron sole-plates, as shown at Fig. 3, or else bedded on the sleeper without the interposition of any other material, and held down by dog-spikes only. When laid on sole-plates they are secured by two clips and two fangbolts, as will be observed in the drawing. At the joints of the 30 foot rails, two sole-plates are given, one at one side of the joint, and one in the centre, except on sharp curves, where one is placed on each side as well as one in the centre. The sole-plates weigh 4 lbs. 8 ozs.; two clips, 3 lbs. 15 ozs.; two bolts, 5 lbs. 6 ozs.; making a total of 13 lbs. 13 ozs. Where the sole-plates are not adopted, the dog-spikes used are 5 ins. in length, and weigh 10 ozs. In no case are any holes punched through the flanges of the steel rails.

The fish-plates are wrought iron, and of the section shewn in the Fig., they weigh 19 lbs. per pair. The fish-bolts weigh 1¼ lbs. each, and one of Grover and Co.'s steel spring washers is placed between the fish-plate and the nut, which we are informed effectually prevents the nut loosening. The sleepers are 8 ft. 11 ins. long, 9 ins. wide, and 4½ ins. deep. They are creosoted, and both rectangular and half-round in section. The former weigh about 1 cwt., and the latter about 3 qrs., and they are laid 3 ft. apart, centre to centre, on an average. The weight of Permanent Way per yard, where dog-spikes alone are used, taken in detail, steel, 136 lbs.; wrought iron 1½ lbs.; wood (half-round sleepers), 84 lbs.; thus forms a total of 221½ lbs.

The ballast used is broken stone between Cork and Kinsale, and gravel between Kinsale Junction and Bantry and Skibbereen. The total length of line open is 76¼ miles, and the maximum weight on locomotive axle is 16 tons.

Figs. 4 to 4*b* represent the rail and chair of the Lancashire and Yorkshire Railway. The rail weighs about 86 lbs. per yard, and is of the B section. It is 2⅝ ins. broad, and 5½ ins. deep, and a 30 foot length is about to be adopted, so we are

informed. The chair weighs 56 lbs., and is secured to the sleeper by two spikes and two treenails, the centres of the holes being placed in slightly diagonal lines. The area of the base (or sole) of the chair is 120 inches.

We shall hope to be able to give further information on this line on some future occasion.

The chair and rail section of the Great Northern Railway of Ireland are represented at Figs. 5 to 5*c*. Both bull-headed and flange rails are used by this company, the former, as will be observed, being the one shewn in the drawing.

It is steel, weighs 76 lbs. to the yard, and has a sectional area of $7\frac{1}{2}$ square inches. The length of bull-headed rail adopted is 26 ft., and it is laid in the chairs with a cant to one side of 1 in 20. The chairs weigh 35 lbs. each, with three holes for spikes, as will be noted in the drawing. The spikes are $\frac{3}{4}$ in. in diameter, and weigh $15\frac{1}{2}$ ozs. each. The fish-plates are steel, with a weight of 15 lbs. $6\frac{1}{2}$ ozs., and the bolts weigh 1 lb. 7 ozs. each.

The sleepers have a length of 8 ft. 11 ins., are 10 ins. wide, and 5 ins. thick, and weigh 158 lbs. when creosoted. They are laid at a distance apart of 3 ft., centre to centre, except at the joints, where the distance is 2 ft. It may be mentioned that the creosoting of the sleepers is done at the company's creosote works, Dundalk.

The weight of Permanent Way thus amounts in detail, steel 160 lbs., wrought iron $1\frac{1}{4}$ lbs., cast iron $64\frac{1}{2}$ lbs., wood 146 lbs., forming a total of $371\frac{3}{4}$ lbs. The ballast used is generally gravel, though in some places broken stones. The total length of line open is 503 miles, and the maximum weight on locomotive axle is 13 tons.

We shall hope to give further details and drawings of this company's line later on, relating more especially to that part laid with flange rails.

It may be remarked here that, of course, the gauge on this line is 5 ft. 3 ins., being that adopted throughout Ireland generally.

We illustrate at Figs. 6 to 6*b*, the chair, rail, and fish-plate joint of the Festiniog narrow gauge railway. Both steel and iron rails are used on this line, though of the same section. The steel, which have only latterly been introduced, are $49\frac{1}{2}$ lbs. to the yard, and the iron $47\frac{1}{4}$ lbs. to the yard. The sectional area is 4·55 square inches, and the length is 24 ft. The chair weighs $18\frac{1}{4}$ lbs., and is held down by spikes weighing $4\frac{1}{2}$ ozs. each. The fish-plates are of wrought iron, weigh 27 lbs. per pair, and are of the section shown at Fig. 6*b*. The fish-bolt and nut weighs 1 lb. The sleepers, which are of old grown larch, and are not creosoted, have a length of 4 ft. 6 ins., width 9 in., and thickness $4\frac{1}{2}$ ins., and a weight of only 36 lbs. They are placed 2 ft. 9 ins. apart between centres, except at the joints, where the distance is 2 ft. The weight of Permanent Way per yard, where steel rails are used, taken in detail, steel 99 lbs., wrought iron 9 lbs., wood 40·87 lbs., cast iron 41·06 lbs., thus forms a total of 189·93 lbs. per yard.

The ballast used is gravel. The length of line open is 16 miles 17 chains of single line worked by engine, and $13\frac{1}{4}$ miles of main passenger line. The maximum weight on locomotive axle is 6 tons.

At Figs. 7 and 7*a* are represented an elevation and plan of the chair used on the Brecon and Merthyr Railway. Some of the rails on this line are iron, but three-fourths of the line is steel, steel rails at 72 lbs. per yard replacing the iron at 70 lbs. Their length is 24 ft., and they have a sectional area of $7\frac{1}{2}$ square inches. The chair weighs 34 lbs., and is held down by four iron spikes weighing $1\frac{5}{8}$ lbs. each. Both steel and iron fish-plates are in use at present, weighing 13 lbs., with bolts weighing $1\frac{1}{2}$ lb. The sleepers are 9 ft. in length, 10 ins. in width, and 5 ins. in thickness, and weigh 135 lbs. each; they are not creosoted, and are placed 3 ft. apart.

The weight per yard of Permanent Way taken in detail, steel (rails and fish-plates) $150\frac{1}{2}$ lbs., wrought iron 12 lbs., cast iron 64 lbs., wood 135 lbs., thus amounts to a total of $361\frac{1}{2}$ lbs.

The ballast used is refuse from iron works. The total length of line open $61\frac{1}{2}$ miles, and the maximum weight on locomotive axle is $14\frac{1}{2}$ tons.

Figs. 8 to 8*d* are various views of the details of the Permanent Way of the North-Eastern Railway. The rails, which are steel, weigh 82 lbs. per yard, are 30 ft. in length, and are laid in the chairs with a cant to one side of 1 in 24. As will be observed in the drawing, a wood cushion is used in the chair to bed the rail upon. From this, we are informed, considerable advantage is found in saving the wear and tear on both rails and chairs, and also in comfort to passengers travelling. The chairs weigh 40 lbs. each, and are held down by two twisted spikes weighing 22 ozs. each, represented at Fig. 1*d*. As there are four holes in the chairs, in the case of one or two being destroyed by the corners breaking off, the spikes can be drawn and inserted in the other holes. The fish-plates are wrought iron, weigh 12 lbs., and are secured by bolts and nuts weighing 24 ozs. each. The sleepers are 9 ft. in length, 10 ins. in width, 5 ins. thick, and weigh about 152 lbs. Eleven of them are placed under each length of rail, the distance between those at the joints being 2 ft. 3 ins. There is thus in every yard of single line a weight of 164 lbs. in steel, 45·6 lbs. wrought iron, 88 lbs. cast iron, and omitting keys and cushions, wood 167 lbs., amounting to a total of 464·6 lbs. The maximum weight on locomotive axle is about 15 tons, and the length of line open and in use $1{,}502\frac{1}{2}$ miles.

We purpose continuing this subject, and shall give descriptions and drawings of the Permanent Way of other railways in future numbers.

PLATE CXCI.

North Eastern

Fig. 8.

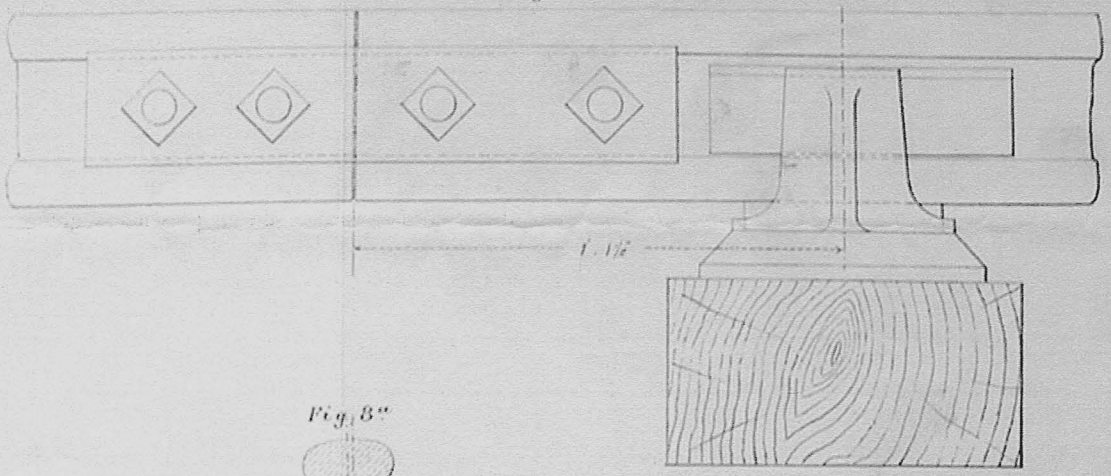

Fig. 8a

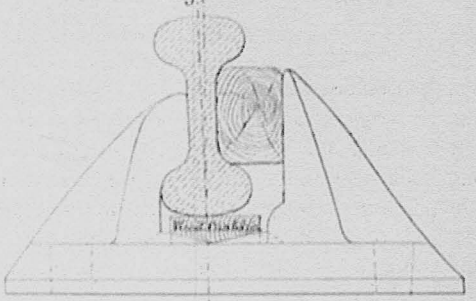

Fig. 8d

Fig. 8b

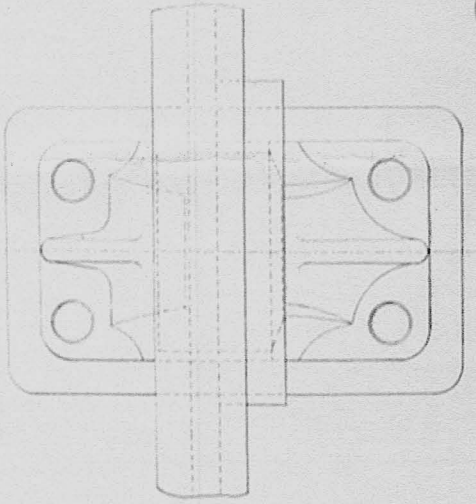

Fig. 8c