Railway Track Design and Manufacture.

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The object of this paper is to outline in as few words as possible the steps taken to overcome difficulties in track construction, that have arisen from time to time, in an endeavor to keep pace with the increased loads and speeds so necessary to modern civilization. It would be impossible to give any detail and I trust these few words may give some idea of the necessity of having more co-operation between manufacturer and user. Our United States friends have several well known track societies, and their publications and standards are practically accepted as standard in Canada. This may have its advantages, as it saves us any responsibility, but on the other hand it does away with the possibility of developing our own ideas, which are usually turned down until they revert back from other sources. This does not seem reasonable and it looks as though the Engineering Institute of Canada might take this into consideration along with its other worries. To bring this point before you, I may say that the proper construction of track and the efficient and economical maintenance involve the science of engineering, although broadly it is not recognized as such.

Of the three recognized stages having to do with tracks in service, either construction or maintenance are as much engineering as that of track location, and when one considers that track and roadbed represent a much larger investment than bridges, water works and sewers combined, the subject is well worth consideration, but in this short paper it would be impossible to go into any detail and the chief points of interest only will be dwelt on.

The word tramway is of Scandinavian origin and primarily means a beam of wood, where the first reference was made in 1555. In lowland Scottish "tram" was used both as a beam of wood, and specifically of such a beam employed as the shaft of a cart, and in some places today the name is still given to wheeled vehicles used for carrying coal in mines. "Tramway" therefore is primarily either a way made with beams of wood or one intended for the use of "trams" containing coal. The usage of today has converted the meaning into the form of electric traction as applied to city traffic and with which we are all familiar.

There has been considerable experimental work done since the first beams of wood were used to lighten the labor of hauling loads, and it was not till 1767 that attempts were made to use better wearing materials, and build on a more permanent basis. The first rails were made of cast iron about 3 ft. long, the section at the middle being shown as in fig. 1, and tapering in depth to the ends, thus making each rail a small girder. The rails were placed 5 ft. between the flanges, which served the double purpose of keeping the wheels in place and strengthening the casting. This rail was not satisfactory to the general public who found difficulty in crossing the flanges, and in 1789 the edge rail shown in fig. 2 was tried, the wheel being kept in place by guards of either blocks or timbers. This rail was used extensively as it did away with the faults of the first experiment.

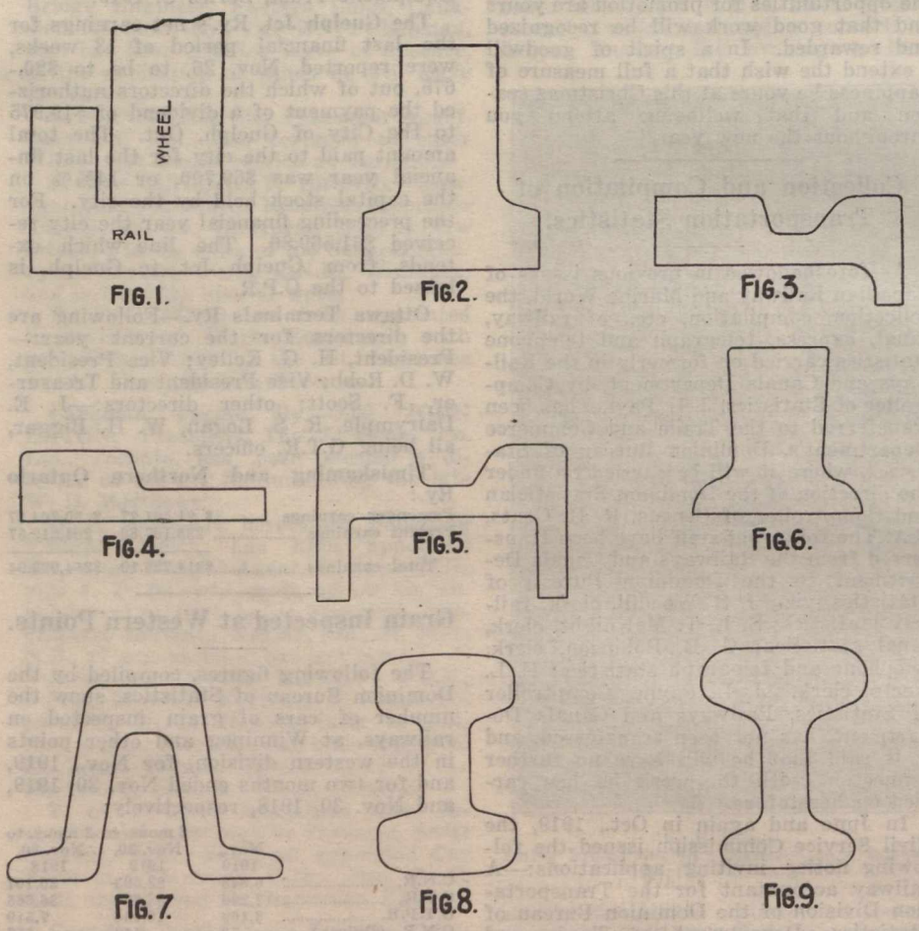

Fig. 1. Plate rail, 1767, cast iron. Fig. 4. Stringer rail without groove. Fig. 7. Bridge rail, 1837, 92 lb.
Fig. 2. Edge rail, 1789, cast iron. Fig. 5. Livesey rail. Fig. 8. Double head rail, 1837.
Fig. 3. Stringer rail, 1800. Fig. 6. Flat bottom rail, 1830, 36 lb. Fig. 9. Bull head rail.

About 1800 a complete change of design was required, owing to the introduction of flanged wheels. The first flanged wheels had a tread of 1¾ in. which probably established the standard track gauge of 4 ft. 8½ in., as used by us today, the first flanged rails having been laid 5 ft. between flanges as mentioned above. Improved methods of manufacture allowed of rolled rails being made about 1820. These rails were supplied in 18 ft. lengths, weighing 2.8 lb. per yard and of the section shown in fig. 3, the rails being spiked to longitudinal ties. This rail was not satisfactory, owing to vehicle wheels catching in the groove and the design was altered to fig. 4, which section was used extensively on American roads.

Fig. 5 shows the first step in obtaining vertical stiffness combined with side spiking.

Important developments in rails were rapid owing to increase in wheel loads, due to the introduction of steam traction and briefly were as follows:

Flat bottom rail (fig. 6), introduced in 1830, weight 36 lb.
Bridge rail (fig. 7), introduced in 1837.
Double headed rail (fig. 8), introduced in 1837.
Bull head rail (fig. 9), introduced in 1840.

The combination of the flat bottom and bull head rails gave the T rail, as used today. The girder rail, as used on public right of way, was first patented in 1859 and successfully rolled in 1877.

Rail joints have been the chief source of revenue to patent attorneys for a number of years and it is difficult to find two people with the same ideas as to what a joint should be. The evolution of joint fastenings has advanced through four stages: 1, Spikes at the end of a rail. 2, The chair, which maintained the ends of the rail in alignment and served as a bearing plate on the joint tie. 3, The fish plate, which kept the rail in alignment and gave partial support to the head. 4, The angle bar, which combining the features of the fish plate, effected a great improvement in both the vertical and horizontal stiffness of the joint and generally speaking is the universal joint fastening of today.

Experiments are being continually tried to eliminate the joint by welding and casting, but the results obtained have up to the present not been of such a nature as to warrant a wholesale adoption. One of the largest Canadian electric railways has developed a joint which is giving very satisfactory results; their method being to bolt up the plate as tight as possible with plates slightly staggered. The plate is then electric welded top and bottom to the rail.

This does away with bonding the track and tests show a perfect joint after severe service. To take care of expansion split points are introduced at proper intervals.

The total cost of joints as described is about $3 each for rails weighing 80 lb. per yard and increasing in proportion to the weight of rail.