2. Rails for Lines with Fast Trains.

Cross-sections of heavier rails, manufacture and inspection; best metal to use for rails and tires; nickel alloys; rail joints; improvements in suspended joints; experiments with a view to reducing the number of joints; methods for preventing "creeping" especially on double-track lines and on steep gradients.

Reporters.—America—Mr. P. H. Dudley, Inspecting Engineer, New York Central and Hudson River Railroad; other countries (including Germany, Holland, Roumania, Russia, Denmark, Sweden, Norway, and Switzerland)—Mr. J. W. Post, Chief Engineer, Utrecht, and Mr. Van Bogaert, Brussels.

Conclusions of Congress.

1. The subgrade is the foundation which must sustain the effects of the moving loads as distributed through the wheel contacts to the rail section, sleepers and ballast, and is loaded and unloaded for the passage of each train, and partially for each wheel. An improvement in loading the foundation increases its stability, and is followed by an increase in capacity.

2. A well-fished rail-section and the foundation under it have lower strains, because the rail thus forms to some extent a continuous beam with several supports.

3. The weight of rails tends to increase with the speed. Track laid with heavy rails requires less maintenance and renewal. The rail is less subject to wear and breakage. With carefully maintained tracks, good rolling-stock, and well-balanced locomotives, the necessity for employing heavy rails is less urgent.

4. Enlarging the head of the rail permits an increase in the bearing of the fishplate. The wear on the surface of contact is consequently reduced, and with it also the deformation of the joint. For this purpose the steel of the fishplates should be almost as hard as that of the rails, with the limiting condition of avoiding brittleness. Well-designed fishplates help by their grip at the ends to transmit from one rail to the other the bending movements which are caused by the motion of the locomotives and cars.

5. The usual tests of quality (by tension, bending, or impact) and the ordinary methods of acceptance enable us to obtain a steel suitable for lines with fast trains, but they are insufficient for American railways, where the load on the wheels is greater. It is desirable, however, to seek for methods of investigation to detect flaws. There is a tendency to watch more carefully the physical treatment of rails by controlling the temperature during rolling in order to obtain a fine-grained metal. Some improvements in the method of manufacture tend to reduce the flaws in the ingots, and lead us to the hope that the number and length of these flaws will be reduced in the finished rails also.

6. To obtain a good quality of steel it is desirable to roll T rails with flanges at least 13 millimetres (slightly more than ½ in.) thick at the edges.

7. The metal of the rail should be sound, of fine grain, and should have an elastic limit of 40 to 42 kilos per square millimetre with an elongation of 10 to 15 per cent. measured on a length of 50 millimetres. The test pieces should be taken from the head of the rail.

8. Nickel steel is not used for rails in Europe. In America, where the wheel-loads are greater, nickel steel is being tried on specially busy tracks.

9. Several arrangements of the joints for T rails with angle bars, either suspended or supported, are in use. Both give good results. In America a successful attempt has been made to reduce the length of expansion joints on heavy rails of great length.

10. Welded joints are not to be recommended. It is desirable to use rails of great lengths. Eighteen metres—*i.e.* about 60 ft.—is a length which has become usual in Europe. In America the standard length is 33 ft. "Creeping" can be successfully prevented.

Note.

It will be observed that the Congress conclusions make no reference to tire steel. This subject should have been dealt with by the mechanical section. I ascertained, however, that nickel steel was not in use for tires. The general tendency is in the direction of specifying for a harder steel for tires. It is, however, an open question whether or not it is desirable to have excessively hard tires, which undoubtedly punish the rails more severely, especially on sharp curves such as abound in New Zealand.

3. Improved Rail-crossings (Frogs).

Improvement in rail-crossings; spring frogs; movable point frogs and crossings and continuous-rail crossings in which the gap at the throat of the frogs is done away with, which shall satisfy all the requirements of modern traffic, and stand heavy locomotives being run over it at high speed without any shock.

Reporter for all Countries.—Mr. C. W. Buchholz, Consulting Engineer, Erie Railroad, America.

Conclusions of Congress.

That on all main lines carrying heavy traffic with axle-loadings in the locomotive of over 50,000 lb. and with loads on the rolling-stock reaching as high as 40,000 lb. per axle, the spring "rail frog" or the "hinged spring frog" may be used with perfect safety where the traffic on the side-track connecting with the main track is very slight compared with the main traffic.

That the "movable-point frogs" may be used at all termini where the space for crossing from one track to another is limited, but that where the space permits, and where high speed is necessary, a series of switches, with the best designed switches and fixed frogs, are preferable.