Rails, Fastenings and Tie Plates.

At the annual meeting of the Canadian Society of Civil Engineers in Winnipeg recently, H. G. Kelley, Chief Engineer G.T.R., Chairman of the committee, presented the following report:

At the annual meeting two years ago your committee on rails, fastenings and tie-plates, presented drawings of the various sections of rail used as standard by the railways of Canada and the United States, and also of some sections which had been proposed and were then being placed in service experimentally. At the last annual meeting your committee reported upon a standard drop testing machine, which received the approval of the Society, and which is now in universal use in the mills of both countries. The experiments with the new sections have not progressed sufficiently for your committee to present a statement of the results in this report, but the use of the new testing machine is proving most satisfactory, and is producing a uniformity of results in the physical tests at the different mills, which is of much value in the collation of statistics.

In considering the subjects for this year's report, it has seemed to your committee, that the next logical step is to consider the service to which a rail is subjected, and the physical qualities requisite for such a rail, leaving for future investigations the consideration of how such physical qualities can be obtained.

With the increasing traffic of railways there followed naturally and of necessity an increase in car capacity and of engine weights. From a freight car weighing about 16,000 lbs., with a carrying capacity of 20,000 lbs., there came gradually an increase to cars having a carrying capacity of 40,000 lbs., 60,000 lbs., 80,000 lbs.. and finally 100,000 lbs., with an allowable overload of 10%. In this transition of car weight and capacity, it is interesting to note, that whereas the cars weighing 16,000 lbs., had a carrying capacity of 125% of their empty weight, that the cars of to-day carrying 100,000 lbs., with a maximum empty weight of 40,000 lbs., have a carrying capacity of 250% of their empty weight. Freight cars having originally about 36,000 lbs., upon 8 wheels, or 4,500 lbs. a wheel, were superseded gradually by cars having, when overloaded 10%, 150,000 lbs. upon 8 wheels, or 18,667 lbs. a wheel. Engines having 12,000 lbs. per driving axle, or 6,000 lbs. per driving wheel, gave place to engines having 50,000 lbs. per axle, or 25,000 lbs. per driving wheel.

The original weight of rails varied from 35 to 45 lbs. a yard, but with the increasing weight of equipment the change was rapidly made to 56, 60, 65, 72, 80, and finally to as high as 100 lbs. per yard. The effects of these heavy loads upon track having been investigated both theoretically by mathematical analysis and practically by carefully conducted tests upon the rail and track, under actual train movements. Allowing 100% for the impact of rapidly moving trains over the standard track in use in this country, with engine axle loading of 50.000 lbs.. we obtain the following, in which the third column would probably be more nearly the correct one theoretically, provided the stresses were due to the effect of the assumed load only.

Weight of rail per yard	Fibre stress per square inch (Tension) Between 3 ties as a continuous girder having stable supports.	Between 3 ties as a continuous girder having an unstable centre support
60 lbs.	24,878 lbs.	28,000 lbs.
80 lbs.	16,668 lbs.	18,750 lbs.
100 lbs.	11,417 lbs.	12,842 lbs.

The stresses shown in column 3 do not reflect accurately the actual condition to which a rail may be subjected, for there is a reversion of stress of tension to compression like the swing of a pendulum under the passage of every wheel. In addition, the rail is subjected to a continual series of shocks, due to imperfect counter-balancing of engines, flat spots on wheels, irregularity of track surface, the oscillation and jar of equipment, the tension due to contraction in a falling temperature, and the effect of the tractive force of the engines.

To determine the actual effect upon rails by passing trains, a series of careful experiments were conducted on the New York Central and Hudson River Rd., with a delicate automatic recording machine, by which the actual deformation of the rail could be measured for each passing wheel of a train, and the actual stresses in the rail determined. These investigations demonstrated that at speeds of 30 to 40 miles per hour, engines having about 20,000 lbs. upon a driving wheel would produce tension stresses in the bottom flange of 80 lb. rails somewhere in excess of that shown in the third column of the preceding table, but well within the safe allowable limits of unit stress for good rail steel.

Experiments upon joints have also shown that a tensile stress of 12,000 lbs. per sq. in. could be produced in the unloaded rail due to its contraction in a falling temperature, before the grip of the angle bars would permit the rail to slip and relieve itself. An accumulation of these varied stresses in the lighter sections of rail, might therefore bring the total stress up close to the "elastic limit" or "yield point" of some of the rail steel.

The question has sometimes been asked, has the weight of the rail section increased as rapidly as the wheel loading? To this may be answered, yes. In the days when a 60 lb. rail section was a common standard, an engine axle loading of 24,000 lbs. was not infrequent; this loading produced a tension in the rail under the conditions of column 3 of the table of 13,440 lbs. per sq. in., as compared with 12,842 lbs. per sq. in. for a 100 lb. rail. under an axle loading of 50,000 lbs.

From a study of the preceding conditions it is evident that certain physical characteristics must be secured, in a steel rail, to meet the requirements of modern transportation necessities; briefly these may be recalled as follows: The steel must be sound and free from physical defects. It must be sufficiently hard to resist abrasion reasonably and also deformation of section. It must be of uniform texture, tough, but not brittle. It must have a high limit of elasticity and ultimate tensile strength.

The question naturally arises, can such a rail steel be produced? The answer is, that it has been produced in the past, that it is produced today, although not uniformly, and therefore, that it should be produced uniformly in the future. How to produce a rail steel uniformly possessing such qualities, and how to identify positively when such a steel has been produced, is a work, first, for the manufacturers, and second, for the manufacturers and users of rail jointly, and this knowledge must be the basis of a satisfactory specification in the future. That such a result can be reached is earnestly to be hoped, but it will require the co-operation and serious endeavor of both interests to accomplish this most desired and necessary result.

Officers Canadian Society of Civil Engineers.

Following are the officers for the current year, as elected at the annual meeting at Winnipeg recently:—

President—C. H. Rust, City Engineer, Toronto.

Vice Presidents—H. Holgate, Montreal; C. E. W. Dodwell, Resident Engineer Public Works Department, Halifax, N.S.

Councillors—District 1, Professor L. A. Herdt, M.A.E., E. E. McGill University, Montreal; Phelps Johnston, Vice President Dominion Bridge Co., Montreal; H. G. Kelley, Chief Engineer G.T.R., Montreal; J. M. Shanly, Consulting Engineer, Montreal; J. G. Sullivan, Assistant Chief Engineer C.P.R., Winnipeg; H. H. Vaughan, Assistant to Vice President C.P.R.. Montreal. District 2, P. S. Archibald, Commissioner New Brunswick Coal and Ry. Co., General Manager Elgin and Havelock Ry., Moncton, N.B.; F. W. W. Doane, City Engineer, Halifax, N.S.; R. McColl, Provincial Engineer, Halifax, N.S. District 3, A. E. Doucet, District Engineer National Transcontinental Ry., Quebec; J. T. Morkell, Enginer Quebec Central Ry., Sherbrooke, Que.; P. E. Parent, District Engineer Marine Department, Quebec. District 4, C. R. Coutlee, District Engineer Georgian Bay Ship Canal, Ottawa; D. MacPherson, Assistant Chief Engineer National Transcontinental Ry., Ottawa; W. J. Stewart, Chief Hydrographer, Marine Department, Ottawa. District 5, Prof. H. E. T. Haultain, C.E., Toronto University, Toronto; A. F. Stewart, Chief Engineer Mackenzie, Mann & Co., Toronto; C. L. Fellowes, Deputy City Engineer, Toronto. District 6, Prof. E. E. Brydone-Jack, B.A., C.E., Manitoba University, Winnipeg; J. A. Hesketh, Assistant Engineer C.P.R., Winnipeg; J. G. Legrand, Bridge Engineer G.T. Pacific Ry., Winnipeg. District 7, F. F. Busteed, General Superintendent C.P.R.. Vancouver; J. S. Dennis, Manager Irrigation Department Alberta and B.C. Land Departments C.P.R., Calgary, Alta.; J. H. Kennedy, C.E., Chief Engineer Vancouver, Victoria and Eastern Ry., Keremeos, B.C.

St. Leonards-Van Buren Bridge.—In connection with the bridge being erected between these points by a commission representing Canada and the State of Maine, a bill is under consideration by the Maine Legislature providing for the incorporation of a company with the title of the St. John River Toll Bridge Co., with a capital of $40,000. to build a bridge and to charge tolls. The provisional directors are:—W. H. Cunliffe, F. W. Mallett. A. G. Finlayson. D. C. Burpee. J. R. Burpee, and W D. Burpee. (Feb., pg. 135.)

The Lethbridge, Alta., Herald, in copying considerable matter from our January issue, said:—"The Railway and Marine World is a mine of information on railway and marine matters."

The Board of Railway Commissioners, which has under consideration the question of transcontinental rates from Winnipeg westbound. as distinguished from those from Vancouver eastward, will not deal with the matter finally until the next sitting in Vancouver, which will probably be held in the spring.