SESSION II.
1906.
NEW ZEALAND.

INTERNATIONAL RAILWAY CONGRESS.

(REPORT OF THE GENERAL MANAGER OF NEW ZEALAND RAILWAYS ON THE PROCEEDINGS OF THE INTERNATIONAL RAILWAY CONGRESS, HELD AT WASHINGTON, D.C., U.S.A., ON 4TH TO 13TH MAY, 1905.)

Presented to both Houses of the General Assembly by Command of His Excellency.

THE International Railway Congress, 7th session, was formally opened by the Hon. Chas. W. Fairbanks, Vice-President of the United States, at Washington on Thursday, 4th May, 1905.

Before dealing with the business I consider it desirable to define the constitution of the International Railway Congress, its object and scope.

1. The International Railway Congress is a permanent association established to promote the progress and development of railways.

2. It is composed of railway administrations which have formally joined, whether State or private, and either owning or working lines for public traffic.

3. The Congress is represented by a permanent Commission which it elects. The headquarters of the Commission is at Brussels and its members give their services gratuitously.

4. The duties of the Commission are to—(*a*) Organize the Congress meetings; (*b*) prepare a programme of questions for discussion; (*c*) publish reports of the discussions; (*d*) set on foot any investigations; and (*e*) issue reports and publications which may further the objects of the Congress.

5. The Commission is composed of ex-Presidents of the sessions of Congress, who are members *ex officio*, and forty-eight elective members. The elective members are as far as possible chosen to represent the different nations.

6. At its first sitting after a session of Congress the Commission appoints five of its members to form an executive committee.

7. The executive committee is responsible for superintending and managing investigations, reports, and publications, the editing of the "Bulletin," and for furnishing the members of the Congress such special information as they may require.

8. The cost of the meetings of the permanent Commission and the executive committee is defrayed by a fund formed of (*a*) the annual subscriptions of members, and (*b*) subsidies and other miscellaneous receipts. Railway administrations pay a subscription of £4 per annum, plus a sum proportionate to the system. This variable sum necessary to meet the expense of the Congress may not exceed 4d. per mile of railway.

9. The subscriptions entitle each member to receive reports of the proceedings—plus one.

A schedule of the members and their official designations is attached from which it will be seen that all parts of the world were represented at the Congress.

The following are the transactions of the Congress :—

SECTION 1.

WAY AND WORKS.

Wooden sleepers or cross-ties. Selection of species of timber used and processes of preservation.

Reporters.—Mr. J. W. Kendrick, third Vice-President, Atchison, Topeka, and Santa Fe Railway, America; Mr. Haaser, Engineer-in-Chief, Midland Railway, France; Mr. J. E. Spring, late Chief Engineer in the Railway Department of the Government of India.

The proper seasoning of sleepers in the open air was generally advocated. On the Paris-Lyons and Mediterranean Railway Company's line, France, creosoted sleepers have been used for many years with excellent results. Creosote (oil of tar) containing from 10 to 15 per cent. of naphthaline and 67 per cent. of phenol is used. The cost per sleeper is about 5s. 4d. Gauge of tracks 4 ft. 8½ in.

The ties are subjected to vacuum in a cylinder and then the creosote is injected under a heavy pressure. The quantity of creosote used varies according to the density of the wood. For oak sleepers 14 lb. to 15 lb. of creosote per sleeper is used, while in the case of beech it is possible to inject from 45 lb. to 50 lb. per sleeper.

Naphthaline is considered beneficial, some of it being added to all creosote which lacks the standard proportion. A considerable discussion arose as to what proportion of naphthaline should be used. The practice of the Paris–Lyons and Mediterranean Railway Company was generally approved.

The Dutch Railways have used the zinc treatment for fifteen years, and have got a life of fifteen years for beech sleepers.

Questions of Mechanical Wear.

On the Paris–Lyons and Mediterranean Railway of France bed-plates give very satisfactory results, and reduce the wear of sleepers to a minimum.

The practice of the Great Western Railway of England is to bed the chairs and bolt them to the sleepers at the workshops prior to distribution to the platelayers or surfacemen. It is contended that this system is the best in use, as the large bearing-surface of the chair exceeds that given by the bed-plates; the latter are, of course, not useable on double-faced or a bull-head rail. In America bed-plates are largely used, especially at joints and for soft timbers. Experiments are being made with hard-wood shims, pieces of hardwood taking the place of bed-plates. After several months' trial they have been reported on favourably; their general adoption is, however, highly improbable.

In Russia sand ballast only is used; in consequence of which the wear caused by the friction between the rail and sleeper is very destructive. The timber used is soft.

Conclusions of Congress.

1. The pickling of sleepers in order to lengthen their lives is to be generally recommended. The selection of the antiseptic and the method of performing the pickling operations depend on individual conditions.

2. Creosote seems to be the best preservative of sleepers. It has been successfully tried for a longer time than any other antiseptic, and the results have proved that a creosoted sleeper will last in main-line service many times as long as an untreated sleeper.

3. Either hard or soft woods may be used, the selection depending on local conditions.

4. Specifications must be exact, and great care should be exercised by the inspector before accepting sleepers for treatment. When accepted the sleepers should be piled at least 6 in. above the ground in open stacks in such a manner as to allow free access of air and light. The grounds surrounding the piles of sleepers should be kept clean and free from decaying matter.

5. The uncovering of sleepers by removing the ballast from the top surface does not appear to diminish the life of the wood even for untreated timber, and it has the advantage of enabling the track inspector to discover at once any defects in the track-fastenings, &c., and to apply a remedy. In some special cases, and especially in warm climates, it may be desirable to cover the timber with ballast.

6. It is of importance to combine rigid inspection in accepting sleepers with great care in the selection of ballast. The latter must be permeable, must be capable of being well packed and the packing well maintained, and give good adhesion between the sleeper and its seat. As far as this is concerned, the measures which are best for the preservation of the wood are also best for the stiffness of the track.

7. In order to prevent deterioration of the ballast, and at the same time help to preserve the sleepers, the careful drainage of the roadbed cannot be too carefully insisted upon, in order to insure that water may run off properly.

8. To prevent mechanical wear of the rails upon the sleepers it is of the utmost importance to fasten the rail to the sleeper in such a way as to prevent as much as possible all vertical, lateral, and horizontal movement between the two. The old American method of using spikes only will not suffice. Lag screws seem to be necessary to obtain satisfactory results.

9. It is only by keeping careful and accurate records of the numbers of sleepers treated, the manner in which they were treated, and where and when they were placed in the track, together with a record of when they were taken out of the track, that it is possible to determine whether any one particular treatment is giving satisfaction and is a good investment. Every railway management using treated sleepers is urged to have them all marked, preferably with dating-nails; and a careful system of records should be instituted at the earliest possible time.

Note.

No comparison can be made between the United States (including Canada) and the English systems for the reason that in the case of the former chairs are not used, and in the case of English lines they are used almost exclusively, the conditions being totally different. The American practice, especially on the best lines, conforms more closely to the New Zealand style. Hardwood sleepers, if procurable at a reasonable cost, are beyond doubt the most economical and satisfactory, failing which soft-wood creosoted sleepers make a very good substitute, but they are not so economical or suitable for use on curves or bridges.

Creosoting as done in New Zealand has given highly satisfactory results, and the methods employed are quite up to date. The chief drawback to creosoting in New Zealand is the cost of creosote, and it is highly desirable that its manufacture in New Zealand should be undertaken.

In view of Congress conclusion No. 2, which states that creosote seems to be the best preservative &c., it is satisfactory to know that it is the antiseptic which is exclusively used in New Zealand. The practice in New Zealand also accords with Congress conclusion No. 9.

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 $\frac{1}{2}$ 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.

Note.

The use of the "spring rail frog" gives every satisfaction in America. It is also used in New South Wales with satisfactory results. The smooth running of high-speed trains through station-yards laid with "spring rail frogs" in America was very noticable. Safety is not sacrificed, and a much longer crossing life is obtainable. It might be desirable to give the "spring rail frog" a trial in New Zealand.

4. Concrete and Imbedded Metal.

The use of concrete strengthened by the use of imbedded metal in railway-works: Comparison from the point of view of cost of bridges of concrete strengthened by the use of imbedded metal, with those of metal.

Reporters.—America—Mr. J. F. Wallace, Chief Engineer, Panama Canal Commission; Russia—Mr. Kareircha; other countries—Mr. W. Ast, Austria.

Conclusions of Congress.

(1.) Reinforced concrete has received many and important applications on railroads both from the technical and economical points of view; it can fully and successfully compete with masonry and timber or steel construction.

(2.) Tests of reinforced concrete structures, theoretical researches on the question, and the results of practice justify the conclusion that such structures need not cause any apprehension, and that their application can be recommended to railway administrations.

(3.) Railway practice shows that carefully built reinforced concrete structures give excellent results, and require practically no maintenance. For this reason the use of reinforced concrete should be recommended, even if the cost of construction should be higher than for another system of construction.

(4.) Reinforced concrete structures are an especially great help in countries where materials, stone or iron, are difficult to obtain in large sizes.

(5.) Reinforced concrete permits of the rapid building of structures with readily obtained materials, and this avoids the necessity, so trying in practice, to give special orders to shops.

Note.

A notable example of reinforced concrete-work is now being undertaken at Auckland, where a large contract is being carried out for the Harbour Board.

SECTION 2.

5. Locomotives and Rolling-stock.

Locomotives of great power; increase in the power of locomotives by the adoption of high pressures and of the compound principle; improvements in construction from this point of view; use of nickel steel.

Reporters—America—Mr. J. E. Muhlfeld, General Superintendent of Motive Power, Baltimore and Ohio Railroad; other countries—Mr. E. Sauvage, Chief Consulting Engineer of the Western Railway of France.

Conclusions of Congress.

The power of locomotives is more limited in Europe than in America, owing to the lower allowance of weight per axle. European engineers generally agree in thinking that "compounding admits of the construction of engines giving the maximum power and economy." This system utilises the steam very well and does not appear to increase to any noticable extent the cost of maintenance of locomotives. It does make the maintenance of boilers more difficult, but that is due to their increased size and higher working-pressure, which are necessary in all cases. Almost all locomotives built in France in recent years have four balanced cylinders. These engines as well as compound engines of other systems are also employed in other European countries, especially Germany, Austria, Spain, &c. Several engineers in Great Britain and Ireland express equal satisfaction from their use, and insist on the advantage of separating the high- and low-pressure machinery. A number of American engineers also express opinions favourable to compound locomotives, which have given satisfactory results on the Atchison, Topeka, and Santa Fe Railway. The sentiment on this matter is, however, less unanimous in the United States than in Europe. The Congress has been informed of the experiments shortly to be made with four-cylinder balanced compound locomotives in New Zealand.

The introduction of American locomotives in Europe and European locomotives in America has had the advantage of making known on both sides some interesting details of construction, particularly the light weight of the parts of European locomotives and the siphon and sight-feed lubricators of American locomotives.

The constantly increasing use of cast steel is observed, which in the United States has even been tried for cylinders.

The use of the Walschaert valve gear is extending in the United States. Generally speaking, all the engineers who have spoken of piston valves appear well satisfied with them. A number of tests of automatic stokers have been made in the United States and on the Great Western Railway of England, but as yet the results have not been definite. It has also been found both in America and in England that without the aid of those devices, but with proper arrangements of grates, the heaviest firing necessary at the present time can be effected by hand without difficulty.

Finally the Congress has examined the use of articulated locomotives of great power on lines of irregular grades, particularly Mallet locomotives, and those designed by the North France and North Spanish railways.

Notes.

I had numerous discussions on locomotive questions with some of the leading locomotive engineers in America. Regarding the use of compound engines I found great diversity of opinion. Some of these gentlemen would have nothing to do with compound engines, while on the other hand others contended that compound engines were the best, and that by their use a considerable saving in fuel and also in the cost of maintaining the boilers was effected. The new type of four-cylinder balanced compound engines recently introduced by the American Locomotive Company, designed by Mr. Cole, and a similar type of engine built by the Baldwin Company and designed by Mr. Vaulclain, are giving satisfaction, and locomotive engineers hope for a favourable solution of the compound question by means of this new departure; new so far as America is concerned, but not so as regards France, Germany, and other countries, where the four-cylinder balanced compound engine has been developed and brought to its present efficiency. Large numbers of four-cylinder balanced compound engines are now being built in America, and I was informed that those already in use were giving much satisfaction.

The use of superheated steam was discussed and there is a general consensus of opinion amongst locomotive men in its favour. The Canadian Pacific Railway Company have a large number of locomotives fitted with superheaters, and their Superintendent of Motive Power claims a considerable economy by their use, and the fact remains that the number of engines fitted with superheaters is being increased.

Locomotives of great power: A very large number of these have been built for the American railways. The designs have not been good in all cases, and the result has been that breakdowns and failures have been numerous. Experience has shown up the weaknesses and defects generally, and these having been remedied the big engine is bound to stay, but it has its limitations even in America, and it would appear that the limit has been reached. American railways without their big locomotives and other high-capacity trucks could not cope with the enormous amount of freight offering.

Locomotive practice in New Zealand is in many respects similar to the American practice and this may perhaps be accounted for by the large number of American locomotives in use on New Zealand lines. What is wanted in New Zealand is a blend of English and American designs, by taking the best and most suitable from the English and American standards as a standard for New Zealand. The tendency generally is to work at high boiler-pressure, and especially so does this remark apply to America, France, and Germany. In Great Britain the increase of boiler-pressures is not so marked. There is a marked difference between the American designed locomotives and that of any other country. The American as a rule provides large boilers which give easy steaming and a reduction of wear and consequent cost of maintenance. Bearing-surfaces are also as a rule on a liberal scale. This means keeping engines on the road instead of having to be laid up in shops for repairs. During the last five years the English practice has been greatly changed, and to-day the proportions are more on American lines, notably in respect to boilers, the heating-surface of English boilers having been much augmented.

American engines lack the finish and are not built with the same care as those built in Great Britain, where the workmanship is, as it always has been, of the highest order.

The use of nickel steel is not general, engineers especially in America not having much confidence in it. Some crank axles for four-cylinder balanced compound locomotives are, however, now being tried. The consensus of opinion is in favour of locomotives of great power for lines where the traffic is congested. Locomotives of high power and high-capacity wagons reduce train mileage, which in turn means reduction in cost of working. High-capacity wagons cannot, however, be exclusively used, as they are not economical unless full loads are obtainable.

That American locomotive-builders can build as good a locomotive of English design as can be obtained from any country I am fully convinced. When I visited the Baldwin Works recently I saw a contract in progress for twenty powerful locomotives for New South Waes. An excellent job was being turned out. They had to stand the test of comparison with like engines supplied by the excellent British firm of Beyer, Peacock, and Co. (Limited). The cost of the engines delivered at Sydney in working-order was to be considerably less than the colonial or British cost. I do not think that Baldwins can possibly make the contract pay. The good work which I saw was, I consider, largely due to the able inspector, Mr. Howe, who represented New South Wales Railway Commissioners.

The Mallet Articulated Locomotive: This engine, No. 2400, was specially built by the American Locomotive Company (Limited) for the Baltimore and Ohio Railroad. It is the most powerful steam locomotive in existence, and was specially designed for working a heavy mineral traffic over a mountainous route having grades of 1 in 20, and numerous sharp curves. The weight of this engine in working-order is about 215 tons; tractive power, working compound, is 74,000 lb., and when working simple 84,000 lb.; the load hauled, over 2,000 tons; boiler-pressure, 230 lb.; consumption of coal per mile, 584 lb. One engineman and one fireman are found sufficient. This engine has given great satisfaction in service, and it is probable that the type will be repeated. This information is interesting inasmuch as a Mallet engine is being built at Petone for use on the Rimutaka Incline.

6. Pooling Locomotives.

Reporters.—America—Mr. G. W. Rhodes, Assistant General Superintendent, Burlington and Missouri River Railroad; Belgium—Mr. Hubert; Russia—Mr. Kareischa; Austria—Mr. W. Ast; France—Mr. Boell.

Conclusions of Congress.

The Congress finds that in Europe and in countries other than North America the general sentiment is very much in favour of the single-crew system, and unfavourable to complete pooling, which is only used when necessitated by a sudden increase of traffic. However, for certain services various combinations of double-multiple crews or of mixed crews are used according to circumstances.

In North America pooling is, on the contrary, very general, though little used for passenger-service, and a tendency to using single crews is generally manifest. It is, however, in place to remark that the organization of train services depend to a large extent on local conditions.

Notes.

The discussion on this subject went to prove that it was more economical to allot engines to certain crews. Enginemen took a pride in their own engines, and exercised far greater care in working them than was the case if rarely having the same engine continuously.

The pooling system was more expensive as regards fuel and stores, and it was a most difficult matter to fix the responsibility for damage and undiscovered defects. In England some railways go so far as to paint the engineman's name on the engine, and the date it was given into his charge. The New Zealand practice is to allot engines to single crews who run the engines—that is, each engineman has as far as is practicable his own engine.

7. Automatic Couplers.

Advantages and disadvantages of automatic couplers; improvements effected in their construction; their use in conjunction with other couplings.

Reporters.—America—Mr. A. W. Gibbs, General Superintendent of Motive Power, Pennsylvania Railroad, America; England—Mr. F. W. Pettigrew, Locomotive Carriage and Wagon Superintendent, Furness Railway, England.

Conclusions of Congress.

The Congress recognises the universal use of the automatic car-couplers in the United States, Canada, and Mexico. While the type (master car-builders) remains the same as first adopted, the details have been continually improved. Devices for automatic coupling the air-brake, air-signal, and steam-heat pipes are used to some extent. They are only in the experimental stage. In countries other than those mentioned above several systems of automatic car-couplers, either of the American (M.C.B.) type or other type have been tried. The necessity of working with couplers of a different type from those in use causes great difficulty during the transition stage. Several representatives were in favour of the American (M.C.B.) type on account of its great strength, especially where large cars are used, while other representatives favoured the use of such types of couplers as could be more readily applied to existing stock, so as to reduce the period of transition. The British representatives expressed the opinion that the system used in Great Britain and Ireland is at present satisfactory as regards rapidity of handling as well as the safety of the employees.

Note.

This subject does not affect New Zealand materially, as the coupler in use is automatic—a combined central buffer, coupler, draw gear. No side-buffers are used, and I know of no safer appliance as regards the employee. Were it necessary to make a change, which could only be done at enormous expense, I should certainly recommend an automatic coupler of the type M.C.B., as used in America.

8. Electric Traction.

Progress made in electric traction on important lines of railways—continuous current, alternating current, polyphase current; experiments made with high-tension currents.

Reporters.—America—Mr. W. D. Young, Electrical Engineer, Baltimore and Ohio Railroad; France—Mr. Paul Duboir, Engineer of the Central Service Motive Power of the Orleans Railway, Paris, France; Great Britain and Belgium—Mr. Ernest Gerard, General Inspector, Chief of the Cabinet of the Belgian Minister for Railways; Italy—Mr. Victor Tremountani, Chief Inspector of the Electrical Section of the Mediterranean Railway of Italy.

Conclusions of Congress.

The section recognises that electric traction should be considered at present as an important auxiliary of steam traction, being capable of handling certain portions of railway traffic with economy and advantage. It is impossible in a general exposition to point out the exact service to which electricity can be most readily applied, the application being essentially a question of local conditions, each particular case requiring special study. In this study there must be taken into account the expense of electrification, and the following points: (1.) Conditions of service—that is, the frequency and weight of trains; and (2) the physical conditions of the line, such as length, profile and plan.

In comparing the expenses of operation by electricity and by steam, the interest and depreciation on the electrical installation must be considered. The increase in revenue which the improvements in service will generally produce should also be given consideration. An important point in the use of electricity is the increase in the present station facilities resulting from the reduced number of movements in the stations by the use of electric traction. From the information furnished to the Congress it would appear that with the third rail as now used security can be assured under favourable conditions without it being necessary to cover or protect the third rail for its entire length. The Congress has heard with much interest the results experienced with high-speed electric traction between Marienfield and Zossen, and also of the tests and first applications for traction purposes of the alternating monophase motors in service in several countries.

Finally, the Congress recommends that on account of their future usefulness exact data on the cost of electric traction be obtained.

Notes.

Mr. J. A. F. Aspinall, General Manager of the Lancashire and Yorkshire Railway Company, England, gave particulars of the conversion from steam to electric working of the line between Southport and Liverpool, the cost of which was £20,000 per mile, or about three and a half times the cost of the installation of a steam locomotive service. The weight of electric equipment of the trains is not less than the corresponding weight of locomotives. Electric traction was not adopted for the sake of economy but to increase the receipts. From this point of view the results have been satisfactory, as the traffic has largely increased, but the operation is more costly than locomotive power. The paramount reason for the conversion was the urgent necessity of decreasing the crowding of the Liverpool terminus during the busy hours of the day. The handling of steam trains necessitated four shunting and eight signal operations, whereas two shunting and four signal operations suffice for the electric trains. The line equipped is double, and carries a very heavy passenger traffic, Southport being a favourite watering-place.

Mr. A. Wilson, Assistant to the General Manager of the North Eastern Railway, England, supplied information on the use of electric traction on the suburban lines of Newcastle-on-Tyne. The cost of electric traction for the month of February, 1905, was as follows: Mileage of trains, 92,541; mileage of cars, 245,938; average number of cars per train, 2·75; average cost of power per car mile, 1·601d.; engineer's pay per car mile, 0·297d.; conductors' pay per car mile, 0·217d.; total cost of traction per car mile, 2·115d.; total cost of traction per train mile, 5·7d. Mr. Wilson, however, admitted the difficulty in making comparisons with steam traction. He maintained that electric working permits of a better utilisation of the existing lines, and experience has proved that the improved services which follow as a general rule lead to increased receipts. The North Eastern are apparently satisfied with the change, but I ascertained that the company bought current at specially low rates, and had not to incur a heavy capital expenditure on power.

The Lancashire and Yorkshire Company generate their own current, which I was informed cost the company much more than the North Eastern Company's current cost that company. In England there appears to be reluctance on the part of the railway companies to go in largely for conversions from steam to electric, largely on account of the very heavy expenditure involved. They are also holding back on account of the improvements which are being produced, which may result in a much greater economy of installation and working.

In America electric railways are numerous, and they are stated to be working very satisfactorily. Very costly experiments are being made by the two great manufacturing companies—the General Electric Company, at Schenedtady, New York, and the Westinghouse Company, at Pittsburgh. I was present at a trial of an electric locomotive built by the General Electric Company at Schenedtady. This locomotive worked at a voltage of 600, and collected the current from a third rail. Locomotives of this type, but without the most modern improvements, have been working successfully for ten or more years on the Baltimore and Ohio Railway. They were introduced to work a series of tunnels through which a heavy traffic passed, the smoke nuisance having become intolerable.

I was also favoured in being present when visiting Pittsburg at a trial of the Westinghouse Company's new locomotive, known as the "Westinghouse-Baldwin single-phase alternating-current locomotive." It is the first of its kind constructed in America, and is designed for a current of 25 cycles and a trolly voltage of 6,600. Its weight is 136 tons, which is carried on six axles. Horse-power normal, 1,350. When working at nominal full load output this locomotive will develop a draw-bar effort of 50,000 lb. at a speed of ten miles per hour, but draw-bar pulls of from 80,000 to 85,000 lb. have been recorded by the dynamometer car. This record, I think, entitles it to rank as the most powerful locomotive, steam or electric, in the world. The Westinghouse Company claims that the successful completion of so large and powerful an alternating-current locomotive, without the usual series of developments through gradually increasing sizes, which is ordinarily required when so great a problem is undertaken, marks a distinct advance in the production of electrical apparatus for heavy-traction work, and now that the first important step has been taken should certainly prove the forerunner of the use of electric traction on trunk-line railways which has so long been looked for.

Considerable developments are also taking place in the same direction on the Continent and elsewhere, but I am of the opinion that in the matter of the electric working of railways that American capital, energy, and inventive genius will lead the world.

In New Zealand, a country so lavishly endowed with water-power, the value of electricity for working the railways cannot be over estimated. It is a question which should have early consideration, and certain lines on which electric current can be obtained should be so equipped, the locomotives now being used on such lines being utilised on lines which must remain steam for all time. I am assuming that electric power would only be used where cheap water-generated current would be available.

When in America I arranged with the principals of the Westinghouse and the General Electric Companies to keep me posted up in the development of the electric locomotive.

SECTION 3.

9. Working.

Lighting, heating, and ventilation of trains.

Reporters.—America—Mr. C. B. Dudley, Chemist, Pennsylvania Railroad; other countries—Mr. Cajetan Banovits, Superintendent of Rolling-stock and Motive Power of the Hungarian State Railways.

Conclusions of Congress.

As regards lighting, the Congress notes the development of the use of incandescent mantles, heated by oil-gas, and sometimes by common gas, and of different systems of electric lighting. Cylindrical mantles seem to be stronger than globe mantles, but the latter distribute the light somewhat better. Various types of mantles are used in Europe by different managements, especially in France and Germany, and are beginning to extend to the United States. Systems of electric lighting are giving satisfaction on different roads. Attention is called to the advantage of this latter system in certain cases such as for intermittent lighting when passing through tunnels and operating fans. Acetylene gas has been much used mixed with Pintsch gas, especially in France and Germany, but a tendency is observed to abandon this mixture, owing to the use of mantles. On the other hand, mention is made of the use in America of pure, compressed acetylene, with some special precautions.

Steam heating has a tendency to extend in different countries. To obtain sufficient heat for very long trains, or in cases of very low temperature, care is taken either to use pipes of sufficient diameter, or to use compressed air mixed with steam. The adoption of a uniform coupling for all the cars in the same territory is an important question to be solved.

The Congress notes the different systems of car-ventilation that have been applied, especially that in use on the Pennsylvania Railroad.

Notes.

Lighting.—In America the use of oil-gas is being largely extended, some 26,000 cars being fitted with this light. Electric light is also in use on a large scale. The following five different systems are in use for generating electric light: (1) By the use of movable storage batteries; (2) by the use of storage batteries placed permanently under the cars and charged during stops of the latter; (3) by dynamos operated by the motion of the car axle; (4) by the use of a dynamo placed in a bogie car; and (5) by means of a steam-turbine driving a dynamo placed on the locomotive.

Acetylene lighting is used in the following three forms, but not extensively: (1) With acetylene-generators hung under the cars; (2) with receivers holding compressed acetylene; and (3) with acetylene dissolved in acetone in cylinders containing some absorbent material, such as discs of asbestos.

In Great Britain and Ireland the tendency is in favour of the electric light, Stone's axle light being generally used. Oil-gas is also used to a considerable extent, but it is not enriched by the addition of acetylene.

On the Continent oil-gas lighting (Pintsch's system) is largely in use; a considerable number of cars are also fitted with the axle light.

Passing through America I took special notice of the different systems of lighting, especially the use of compressed acetylene gas. The light was the most brilliant that I saw. Electric lighting—axle light—was also good. So also was electric lighting generated by means of a dynamo located in the baggage-car. The dynamo was worked by a turbine drawing steam from the locomotive. A special man was in charge of the dynamo, which I should imagine meant a very expensive light. For hot climates there can be no doubt as to which is the most suitable—viz., electric lighting—as the amount of heat given out is very small, and the power can also be utilised for driving fans for cooling purposes.

When in London I interviewed the Pintsch-gas people, and discussed the question of using mantles on the lamps supplied to the New Zealand railways, and was advised that there would be no difficulty and but small expense incurred in adapting the lamps to use the mantles. This is important, because recent improvements in the manufacture of mantles have resulted in the production of a mantle which has been found to satisfactorily stand the vibrations incidental to railway-car lighting. On the Continent, where very many thousands of lamps are in use, mantles are now being largely used, and the various railway companies are converting their lamps so as to use mantles. The Pintsch Gas Company claim a saving of at least 25 per cent. in the consumption of gas, and a much superior light where the mantle is used. This result can also be accomplished without the aid of an enriching gas such as acetylene.

Heating.—Heating by steam obtained from the locomotive boiler is now almost universal, and gives general satisfaction. The old-fashioned foot-warmer is not much in evidence. In America the cars as a rule are overheated, and during my trip through that country I had some unpleasant experiences. Great care is taken to heat up trains prior to the locomotive coupling on to the train. This is done by obtaining steam from the stationary boilers at the station from which the train starts. In New Zealand it would be difficult to heat trains by steam, owing to the mixed nature of the services. Piping horse-boxes and roadside vans would be necessary, and in many cases the locomotive boilers are not capable of supplying the steam that would be necessary. It is, however, a matter which should have special consideration, and possibly a few trials made.

Ventilation.—The best system in use is undoubtedly that adopted by the Pennsylvania Railroad Company, America. On the Continent I did not note anything special. In England exhaust ventilators are used, but there appeared to be no special provision for the ingress of fresh air. The ventilation of the modern New Zealand cars compares favourably with other systems which have come under my notice, with the exception of that in use on the Pennsylvania Railroad.

10. Automatic Block System.

What are the recent improvements in automatic block-signalling apparatus, and what progress has been made in their introduction?

Reporters.—America—Mr. C. H. Beatt, Ex-General Superintendent, Western District, New York, New Haven, and Hartford Railroad; other countries—Mr. Margot, Engineer-assistant to the Management of the Paris, Lyons, and Mediterranean Railway Company.

Conclusions of Congress.

That automatic signalling properly designed and installed be recognised as a suitable means of protecting train and switching movements. The Congress notes that there has been much improvement and extension of the automatic signalling since the last Congress, and that those railways which have used it have found it effective for their purpose. The Congress is not prepared to recommend automatic block signalling for general adoption to supersede existing systems, but considers there are cases where this system may present special advantages.

Note.

The automatic block system has made but little progress in Europe, where a comparatively small mileage of track is so equipped, and there is a reluctance to extend the system. In America the system has made and is making rapid progress, ten thousand miles of track being now operated. The signals are placed from a mile to a mile and a half apart, according to the grades. With this system the capacity of certain lines for carrying traffic has been largely increased, an important factor on American railways, where the business is so heavy.

11. Baggage, and Express Parcels.

Baggage; handling and protection of baggage; methods for avoiding detention; losses and diversions in transporting.

Reporters.—All countries—Mr. G. H. Daniels, General Passenger Agent, New York Central and Hudson River Railroad; Mr. J. H. Bradley, General Traffic Manager, American Express Company, New York.

Conclusions of Congress.

After hearing a large number of reports on methods pursued in America, Europe, and other countries throughout the world, for the transportation and protection of baggage and express parcels, it is the opinion of the Congress that the arrangements at present adopted by the different countries meet their requirements, and there are no grounds for recommending any particular system.

Notes.

The discussion was limited to the discussion of luggage. Sir Charles J. Owens, General Manager of the London and South Western Railway, would not admit the superiority of the American system. He thought it might be necessary in a country like America, where cabs are expensive and labour costly, but he does not think it advantageous for passengers. He advocated the use of the English system, which was the most convenient for the traveller, who got his luggage immediately on the arrival of the train. He objected to checking of any kind.

In America the general practice is for a passenger to take one small bag or case in the car, the balance of his luggage being taken charge of by a baggage or express delivery company, who deliver to any required address. This, however, by no means insures prompt delivery, and in many instances baggage which one may need urgently is not received until several hours after the arrival of the train. Many of the delegates had unpleasant experiences of this nature. Functions could not be attended for lack of the clothes in the hands of the express companies. I had a similar experience myself. It can, therefore, be readily understood why so many delegates denounced the American system.

The safest way to deal with your luggage is to take it to the station yourself half an hour before the starting-time of the train, check it, taking one small bag which will readily fit under the seat in the car. When your arrive at your destination, present your checks and take your luggage by cab to your hotel. I found this the most satisfactory system. Sending through baggage companies is costly, and, as already stated, the delivery is not prompt.

The entire absence of porters to carry your luggage is an unpleasant feature at some of the American railway-stations. Passengers are supposed to carry their one bag, known as a "grip," heavy luggage being found in the baggage-rooms.

Outside of Great Britain and Ireland the checking system in some form may be considered general. In America no charge is made for checking. In Hungary, where no baggage is carried free, checking is exclusively used. On the Central South African lines, where the people are familiar with the English system, it has been necessary to guard against fraud, owing to the fact that the passenger, after obtaining possession of his luggage, may later deny having received it. It therefore was considered necessary to employ a checking system. This, as a matter of course, involves the checking of all luggage carried in the luggage-van. In New Zealand checking is optional for the passenger, but failure to check on his part relieves the Railway Department of all responsibility. This system is much preferable to compulsory checking.

12. Suburban Traffic.

Arrangements for suburban passenger traffic.

Reporters.—America—Mr. A. W. Sullivan, Assistant Second Vice-President, Illinois Central Railroad, America; England—Mr. N. G. Drury, Superintendent of the Lines, Great Eastern Railway, England.

Conclusions of Congress.

To be in the highest degree remunerative the traffic must be handled rapidly, by simple inexpensive methods, and with the minimum working organization necessary for the purpose. The type of car is the essential factor. New lines to be constructed should be adapted to the best types of cars. On old lines, in order to utilise to the utmost the space between trucks, the curves should be compensated to provide the same clearances as up to the tangents. The locomotives should be sufficiently powerful

to haul trains of maximum size at the speeds required. The train-schedules should provide for the movement of all trains at a uniform speed and stopping at all stations on the same tracks. Separate tracks should be provided upon lines of heavy traffic for trains which are run at high speed and do not stop at all stations.

All necessary measures should be taken to accelerate the movement of passengers and start the trains promptly. In this way the expenditure of energy to regain the time lost is conserved and the promptness with which the services are conducted communicates itself to the passengers, who quickly learn to move more rapidly. The frequency of train movements should be in proportion to the volume of traffic to avoid prolonged waiting of passengers and congestion at stations.

Notes.

The Assistant General Manager of the Great Eastern Railway Company, England, considered that the main points in connection with suburban traffic are—(1.) The number of passengers to be carried: At Liverpool Street Terminus, London, the maximum round number of passengers arriving on an ordinary week-day is about eighty-six thousand. (2.) Motive power: On the Great Eastern single-expansion engines having four, six, and ten coupled wheels are used. (3.) Train-running speed: On the Great Eastern the average speed for local trains is 19½ miles per hour; 28 seconds stop at stations. (4.) Signals: The block system is generally employed on the Great Eastern. (5.) Station management: In order to distribute passengers as much as possible over a longer space of time the Great Eastern has divided the first morning hours in the working-class districts into "time zones," the fares varying according to the hour at which passengers take the train.

Mr. A. Mange, Secretary to the Paris–Orleans Road, said his company operated 12·4 miles of road electrically. One hundred trains are run daily, as against seventy-five where the line was worked by steam locomotives. Four tracks are used, two for express and two for local trains. There are two types of trains—heavy trains carrying a thousand passengers, and light trains carrying six hundred and fifty passengers.

During my stay in New York I spent some considerable time in observing the working of suburban traffic, especially on the underground and elevated railways, both of which are worked by electric motive power. The underground, more generally known as the "subway," is an excellent piece of work. Trains are numerous, and a very large number of passengers are carried. There are four tracks, two for express services and two for local services. One very noticeable feature in connection with both lines is the smartness of working at stations; there is no dilly-dallying on the part of passengers, who are always ready to join their train quickly. They make it a regular practice nearing their destination to be up on their feet and move towards the car-door generally before the train stops. Little or no luggage is carried on these trains. The same remark generally applies to the elevated railway in New York.

While in London I travelled on the "twopenny tube," and also on the Metropolitan line; both carry heavy traffic. The tube is worked by electric power, and the Metropolitan is being converted from steam to electric traction. The working was smart, but not equal to the New York subway and elevated lines. The passengers did not hurry in the same way. I also took the opportunity when in London of seeing the working of several of the large stations. Lack of room to deal with the ever-increasing business is one of the many difficulties which companies have to contend against, and extension of stations can only be accomplished at an enormous cost.

SECTION 4.

13. Slow Freight Rates.

General principles and descriptions of the different systems of rating slow freight goods.

Reporters.—America—Mr. M. C. Markham, Assistant Traffic Manager, Illinois Railroad; England—Mr. Smart, Secretary, Railway Clearing House, London; Italy, Spain, Portugal, France, Belgium, and Holland—Mr. Mange, Assistant General Superintendent of the Paris and Orleans Railway Company, and Mr. W. J. Vare Overbeck de Meyer, Chief of the Division of Tariffs of the Company operating the Holland State Railways.

Conclusions of Congress.

Tariffs should be based on commercial principles, taking into account the special conditions which bear upon the commercial value of the services rendered. With the reservation that rates shall be charged without arbitrary discrimination to all shippers alike under like conditions, the making of rates should as far as possible have all the elasticity necessary to permit the development of the traffic and to produce the greatest results to the public and to the railroads themselves.

Notes.

In England the tariffs are submitted to the Board of Trade, which settles by arbitration any disagreement between the companies and the public, but it has no right either to fix or modify tariffs. By the Railway Rates, Charges, Orders Confirmation Acts of 1891–92 there was established—(1) A general classification of the various classes of freight; (2) the maximum limit of supplementary charges; and (3) the maximum rate of transportation per ton for each class. In some cases tariffs have been specially reduced for large movements of freight between given points during a certain period. In making special rates companies are not allowed to discriminate between shippers, and no distinction is made in the tariffs as to the time of transit. The principles applicable in England are the same as those which control the establishment of freight charges in the United States, but what especially characterizes the freight charges of the United States is their very great flexibility due to the commercial and industrial conditions.

There are two sorts of tariffs—(1) the general tariff, which is relatively fixed, and (2) the tariff for special shipments, such as commodity tariffs, which are intended for great volumes of traffic, especially for the need of great industries, which explains why they are so changeable. Coal, metals, timber, &c., take an exceptionally low rate. Further questions of competition as well as of export enter sufficiently to warrant exceptionally low charges. Freight tariffs are regulated by the Interstate Commerce Commission, which requires their publication and which also intervenes in disagreements between the railroads and the public, leaving, of course, appeal to the Courts. Discrimination is illegal in America, but it is largely practised, and it is one of the burning questions with those who are ruined by its operation. No comparison can be fairly made between the tariffs of Great Britain, the United States, and New Zealand, the conditions being very different, especially in the matter of working-expenses.

14. Book-keeping.

Reporters.—America—Mr. A. H. Plant, Controller, Southern Railway, Washington; Russia and other countries—Mr. Jean de Richter, Assistant Chief of the line of the Imperial Railway of Russia, and Chevalier von Sohr, Auditor of the Nord Empereur Ferdinand Railway of Austria.

Conclusions of Congress.

1. The organization of the accounting department is so dependent on local and special conditions and requirements of each railway that it does not admit of any absolute rules of universal application.
2. The centralisation of the accounting department in each railway administration has apparently given excellent results on those railways which have adopted it.
3. Railway budgets should not show by their figures definite and rigidly fixed amounts for the greater part of the figures, but rather a scheme, because the conditions of railway-work require elasticity between wide limits according to the circumstances existing at the time.
4. The classification of expenses and revenue should be as simple as possible and as similar as possible in different countries.
5. The powers of authorising and ordering payments should be rigidly defined and as far as possible centralised. The cashier's office should be organized as simply as possible and in such a manner as to involve the minimum amount of transfers of specie, any reasonable exceptions being, of course, permitted.
6. The principal and final aim of accounting on a railway should be the establishment of a perfect balance-sheet of the whole enterprise, exhibiting the true financial status of the corporation and the current working results. The book entries should be supported by appropriate vouchers. Therefore, railway accounts should show the assets and liabilities divided as between capital and working.
7. The organization of station accounts, auditing, and distribution of revenue should be as simple and clear as possible. For this purpose it is advisable to eliminate the small amounts from the accounts, and audit by the use of improved methods, such as the use of express companies, franking-stamps, abstract statements, season contract tickets, cash-registers, and so forth.
8. Consequently it is of importance that study and experiment with simplified measures should be earnestly continued.
9. The most extensive use should be made of all modern devices for facilitating book-keeping and clerical work—for example, typewriters, calculating-machines, &c

Notes.

The discussions went to show that the systems used in America, France, and England are on the whole similar, the American system differing only as regards the transportation of small parcels.

15. Working Regulations.

Duration and regulation of work; length of time on duty and working regulations for railway employees and labourers.

Reporters.—America—Mr. G. S. Potter, third Vice-President, Baltimore and Ohio Railroad; Switzerland—Mr. Pedcide Weissenback, President of the Swiss Federal Railways; Other countries—Mr. Plulippe, General Inspector of the North Belgium Lines.

Conclusions of Congress.

The Congress considered,—

1. That it is impossible to establish uniform rules which are applicable to different special cases, because of the many peculiarities of railroad service.
2. That the rules to be applied should vary not only with the various classes of employees but also for each class with the greater or less exacting character of work done, which renders it necessary to give them sufficient clasticity to make them adaptable to all possible cases.
3. That, due to these conditions, it is impossible to reconcile the rigidity of the laws with the elasticity necessitated by the various arrangements required to meet the needs of the public, the employees, and the employing management.
4. It is held that it is desirable that the employer should have the greatest latitude to fix, under the control of competent authorities, the regulations of work.
5. To fully take into account the importance of the work to be done, the continuity and intensity or the labour required, in order to fix the number of working-hours to be required from the employees of any class.

6. To compute the number of hours according to an average, established through a sufficiently long period, which has been divided into periods of work, separated by suitable rest.

7. To proportion the average duration of work to the nature of the labour, and to the degree of responsibility required.

Notes.

Legal regulations control the conditions of labour of certain classes in Germany, Austria, France, Italy, Holland, Russia, India, and Australia, while in England the law merely confers the control upon the Board of Trade.

In England, as in countries having no such laws, as Hungary, Belgium, Denmark, Spain, Luxemburg, Roumania, and Servia, the conditions of labour are very much the same as in the countries which have legal regulations. Almost all the legal or private regulations separate employees in two well-defined classes.

In America, with some exceptions, railroads are not regulated, except by general laws regulating the work in all industries as to the number of hours constituting a working-day, the work of women and children, legal holidays, and restrictions of labour on Sundays. Only a few States have special laws restricting the number of working-hours and regulating the rest to be given to the railroad employees.

From general observations I have come to the conclusion that the regulations in force on the New Zealand Railways compare very favourably with most countries.

16. Provident Institutions.

General principles of plans for the retirement and insurance of railway employees and workmen.

Reporters.—English-speaking countries—Mr. M. Riebenack, Pennsylvania Railroad; other countries—Mr. Lemercier, Doctor of Laws, Secretary of the Eastern Railway Company of France.

Conclusions of Congress.

From the reports presented and the discussion at the meeting, it appears that in all European and American countries there exists for the benefit of the employees and their families a great variety of philanthropic and provident institutions which the railroad companies have considered themselves morally obliged to create and subsidise. As to insurance and retirement institutions, the Congress finds that in a general way measures are taken to organize or facilitate the insurance of employees against sickness, accident, incapacitation, and death. For sickness the question is solved in some countries by legally obligatory insurance, or by funds voluntarily established by the railway companies, or by the participation of employees in mutual insurance societies more or less subsidised by the management, or by the direct help of the latter. As to accidents while at work, provision is generally made either by independent and voluntary insurance, by legal provisions, or in some countries by compulsory insurance. It follows from the report presented that provision is made against incapacity due to age, or against death, by insurance arrangements made with companies not connected with the railroad, supplied by the contributions of the employees and the management, which funds are set apart for the carrying-out of the insurance, or by other means. As to the latter funds, and as far as institutions are concerned which guarantee a fixed pension to the employees or their families by means of yearly contributions, the Congress finds that in order to work properly they should be organized on scientific insurance principles; but that while theoretically it may be possible to establish an absolute equality between the contributions to be made and the risks to be covered, in practice it is found that these risks are of a nature too complicated and too varied to certainly attain the result desired. The maintenance of these institutions where they exist imposes on the companies considerable expense, which increases greatly when the age-limit entitling to a pension is lowered. While consenting to a considerable expense, it is always to be apprehended that, in consequence of conditions which are impossible to foretell, such as the lowering of the rate of interest, &c., the expense may exceed the resources, thus giving rise to the necessity of revising periodically either the amount of the contributions or the age of admission to the retirement allowance. According to information received, it is possible to avoid these difficulties and at the same time to leave more to the personal initiation of the employees by having recourse to arrangements based on contributions, made either to institutions, mutual insurance companies or others, the proceeds of which can be arranged by each employee to guarantee such risks as best correspond with his individual circumstances.

Notes.

As to insurance, the English-speaking countries leave much to individual initiative. In some cases there are also retirement-funds, which differ from the American system inasmuch as the employee does not contribute to the fund. The age-limits in England are lower than in America, the Pennsylvania Railroad excepted. This company has a relief fund for the aged, maintained by a payment of 1 per cent. of their salaries, and which is used to supplement their pensions. Provident organizations in America include mutual insurance, railway relief departments, endowment insurance, and employees' relief associations. Life and accident insurance are contracted for with insurance companies, managed independently from the railroad companies, which agree to issue insurance policies suitable to the different conditions. A policy is given to each employee. Some companies have organized a system of accident insurance on a basis similar to that of the accident insurance companies. Mutual benefit or relief insurance is similarly organized. Endowment insurance, or insurance by donation, is quite different. It has its origin in a donation, the annual interest of which goes to a fund, from which allowances are made to sick or infirm employees, or those injured by accident, or in case of death to their families.

Railway relief departments are organized and managed by the companies with the co-operation of the employees. They act in cases of sickness or accident, also in cases of death. Nine American companies, having a total mileage of 31,000 miles and 320,000 employees, two-thirds of whom are members, maintain such departments; the annual expense for the whole would be about £400,000. Employees relief associations form, as a rule, small organizations exclusively among the employees, and managed entirely by them. The companies do not interfere in the management, but occasionally subsidise these associations. In France, retirement funds are maintained to a great extent by the contributions to the companies, and they insure a pension in proportion to the average salary of the last years of service, with a reversion to the widow and children. The pension matures when the years of service exceed a certain limit, or in case of accident.

In connection with this important question, I went to some trouble in preparing a paper dealing with the New Zealand Superannuation Fund. I regret to say, however, that through the discourtesy of the President of the section, I was prevented from reading it. The incident occurred in this way: The South Australian representative had just spoken, and I desired to follow on. The President immediately asked in French if any member desired to speak. It was not interpreted in English in accordance with the rules, consequently I was unable to comprehend what he said. I protested that I was in order on behalf of myself and others; but to no purpose. The meeting was largely composed of Frenchmen, and the British and colonial representatives were outvoted every time. The New Zealand Superannuation Fund in my opinion stands in the forefront as a liberal and wise measure. I much regret that I was debarred from explaining its provisions.

SECTION 5.

17. Influence which the Construction of Light Railways may have on the Traffic of Main Lines.

Co-operation of the main lines in the construction and working of light railways.

Reporter.—All countries—Mr. De Burlet, General Manager of the National Light Railways of Belgium.

Conclusions of Congress.

It may be said in general that light railways when they are really tributaries to main lines are unquestionably useful auxiliaries to the latter; consequently the friendly co-operation of the main lines and concessions by the latter of desirable facilities are fully justified, and it is to be desired that all railway managements should adopt as broad and simple conditions as possible to facilitate junctions, and the operation of interchange of traffic with light railways.

18. Direct Financial Co-operation by the State (General Government) and by Localities interested (Counties, Districts, Parishes, etc.) in the Development of Light Railways.

Results obtained in Belgium by the institution of a central authority for studying the projects, supervising the construction, and organizing the working of secondary railways, constructed with the financial assistance of the State and of the districts affected.

Reporters.—France, Belgium, Germany, and England—Mr. Colson, Councillor of States, Chief Engineer of Roads and Bridges, Paris; other countries—Mr. E. A. Ziffer, Civil Engineer, President of the Lemberg-Czernowitz-Jassy Railway, Vienna.

Conclusions of Congress.

Light railways merit in the highest degree the attention of public authorities. Their construction makes it possible to encourage the progress and development of districts which previously have remained in the background, and it is accordingly not only in the interest but the duty of the Governments to assist them. It is desirable, therefore, not to adhere to the old types and old methods of construction, operation, and regulation, but to introduce every facility possible adaptable to local needs and available resources. It is also desirable that State Government and local authorities should accord to light railways, either under the form of subsidies, relaxation of requirements, or other methods of assistance, the support which they need both for construction and operation, so that all parts of the country may be adequately served. When the authorities of a country do not themselves construct or work light railways, but turn them over to private companies, it is indispensable that the terms of the concessions should be so defined as to harmonize the interests of the working company with those of the public.

Notes.

In France the first law relating to light railways dates from 1865, which authorised departments to establish lines, allotting to them according to their wealth subsidies of one-quarter, one-third, or one-half of the sum which the department and the other interested parties furnished. This law provided for construction only, and was amended in 1880, when provision was made for subsidising the working of the lines. About that time, 1880, nearly 2,250 miles of light railways were absorbed by the large systems, there remaining only as light railways about 625 miles, four-fifths of which were of normal gauge. Average cost of construction, 240,000 francs per kilometre, approximately £9,383 per mile. Average gross receipts in 1903, about 10,000 francs (£416). Net income about 2,400 francs (£100). The lines were consequently not successful financially. The results of the law of 1880 have been satisfactory. At the end of 1903 there were in operation 11,000 kilometres (6,875 miles) of light railways. In addition there are 3,300 kilometres (2,062 miles) either under construction or for which concessions have been granted. The gauge in general use is 1 metre. The cost of construction was about 60,000

francs per kilometre, about £4,000 per mile. In 1903 the gross receipts per kilometre was 3,700 francs (£154), and the net receipts about 700 francs (£30). The schedule for maximum rates for the companies must have the approval of the Minister for Public Works of the Interior and of Finance. A considerable number of these lines are more or less dependent on larger companies which make a speciality of constructing and working railways. The earlier concessions guaranteed companies against deficits in operation and 5 per cent. on the construction capital. At present there is no guarantee against deficits in operation. The guarantee on the capital is 4 per cent.

In Belgium the construction of light railways is secured to the National Society of Vicinal Railways created by the laws of 1884 and 1885. It is a public organization in which are represented the State, the province, and the communes interested. The company is privileged; no one can obtain a concession unless the society refuses to accept it. It has thus the preference for all concessions. The concession is granted by Royal decree. Private persons can hold shares, but in general the State subscribes the larger part, often one-half, and the province and the communes almost the whole of the balance. The State, the province, and the communes are allowed, instead of paying in capital in the form of shares, to make annual payments for ninety years, which guarantee the shares issued by the society. The administration is intrusted to a council of five members, three appointed by the King, one of whom is chairman, the shareholders appointing the other two. There is also a supervising council of nine members elected by the shareholders, one for each province of the Kingdom. The society constructs the lines and then leases them, sometimes by public bids, and sometimes by private agreement. This organization has produced excellent results. In 1903 the society had obtained concessions for 1,922 miles, 1,452 of which were in operation. The normal gauge is 1 metre. The gross receipts were 5,000 francs per kilometre (£330 per mile), and the net receipts 1,900 francs (£126).

In Germany the federal legislation of the Empire only interferes as far as supervision is concerned, and has nothing to do with the question of subsidies. It distinguishes main lines, branch lines, and narrow-gauge lines. Narrow-gauge lines and a portion of the branch lines are light railways, and the legislation of the different States of the Empire has dealt with these in various ways. For example, the Bavarian State railway system of 1,600 kilometres (994 miles) of light railways, which are called local, are of normal gauge. For these the persons interested were required to furnish some portion of the capital. In other cases, on the contrary, concessionary companies of small lines were subsidised. Only in Prussia, "small railways," as they are there called, have acquired considerable importance under a law of a special organization. The small railways of Prussia are under the law of 1892. They are divided into town tramways and secondary railways. The latter have extended to about 4,000 miles. Their construction must be sanctioned by the President of the States. The concessions for them are given sometimes to companies, sometimes to districts, and sometimes to communes. At first it was intended to leave the task of subsidising them to the Parliaments, the districts, or the communes, but the Government has been compelled to subsidise also. On general principles its help equals that of the provinces or districts—sometimes more. The subsidy is furnished as capital, but the State participates in the profits of operation, either as a shareholder or as a bondholder. Concessions were formerly given to companies, but the present tendency is to give them to districts, which frequently build themselves. The bulk of the lines are leased to companies, who operate them for a consideration, retaining a certain portion of the net receipts. The average cost of construction was as high as 65,000 francs per kilometre (about £4,336 per mile). The gross receipts were 4,800 francs (£320 per mile); the net, 1,400 francs (£93 per mile).

In Great Britain the rapid development of main lines prevented the construction of secondary lines until the passing of the Light Railways Act of 1896. This Act reduced very considerably the formalities which made the construction of light railways so difficult. Permission to construct can now be granted by the Administration instead of by Parliament. The procedure is simplified especially as far as condemnation and proceedings are concerned. The law authorises County Councils, districts, and cities to borrow money to subsidise light railways; it authorises the Treasury to make advances to them; finally, in certain cases, to give subsidies up to one-half of the construction capital. Under this plan some real light railways have been constructed for agricultural districts. Many projects have been considered, but all have not been carried out; the necessary capital being difficult to obtain, especially because of their high cost, which is estimated to be on the average 91,000 francs per kilometre (about £6,100 per mile).

In the United States it may be said that no light railways exist.

In Turkey there are light railways, and a minimum amount of gross receipts is guaranteed.

In the Argentine Republic free land only is granted.

In Austria in some cases the companies take the concessions, build, and operate the railways. The State subsidies assume various forms. In some cases a profit is guaranteed, or shares are taken, unlike other countries, where the Governments take bonds. Usually the lines are taken over for State operation at a very favourable price to the small lines. Sometimes also the State builds for the account of local railways, employing the most economical methods possible. When the State guarantees the net profit of a light railway, it usually builds and works the road itself. When a district guarantees, the line is built by that district and operated by the State. But the districts of Lower Austria not only build but operate the railways.

In Bohemia 697 miles have been built at a capital outlay of 137,215,468 francs (£5,717,311). The district has contributed in the form of loans and preferred stock, 73 per cent.; the State in the form of subscription to capital stock, 7 per cent.; and other interests, 20 per cent. In Hungary the financial assistance from the authorities usually consists in subscribing up to 15 per cent. of the common stock; 65 per cent. must be contributed by the company as preferred stock. As a rule the lines are operated by the management of the State railways.

In Denmark the State often assists by guaranteeing 4 per cent. on the capital invested, and it also guarantees the cost of the land. The State contributes one-half or three-quarters of the cost.

In Egypt free land is granted, and the Government also allows a net profit of 900 francs per kilometre (£60 per mile), but the guarantee is of no practical value.

In Italy the system of subsidies also prevails. This system has been modified by different laws. At first the subsidy did not exceed 1,000 francs per kilometre (£67 per mile). The law of of 1881 raised the amount to 3,000 francs per annum per kilometre (£200 per annum per mile); and, even later, to 8,000 francs (£536 per mile). It is now 6,000 francs (£400 per mile).

In Norway there has been no special legislation on this subject. Special subsidies are stipulated for each line. Frequently the State assumes one-half of the cost of construction. One-half of this portion takes the form of a subsidy, the other half being represented by shares of stock.

In the Netherlands the financial assistance of the State and provinces is not defined by any special law. Each concession is dealt with separately.

In Switzerland no law exists, but some cantons give aid in the form of subscriptions to stock.

I have gone into this question pretty fully, thinking it may be of special interest. The so-called light railways are in many cases substantially built, and will compare favourably with the New Zealand lines.

In France it will be observed that most of the light railways are of the normal gauge. This is very desirable for all lines which connect or may in the future connect with main lines.

19. Organization of Cheap Service and Simplification of Conveyance.

Organization of a cheap service on main lines, branch lines which carry little traffic, and on light railways; simplification in the conveyance of passengers, parcels, and goods; special motors and rolling-stock.

Reporter.—All countries, except America, Austria-Hungary, Germany, and Holland—Mr. Joseph Rocca, Engineer, Chief Inspector of the General Directory of the Mediterranean Railway of Italy.

Notes.

As to technical working, nearly all managements are satisfied to have the track inspected once or twice a day. Some have done away with track-watchmen, replacing them by labourers employed on maintenance-work, who inspect the track in the morning on their way to work. In other cases this duty is intrusted to the gang foreman. To simplify the station service, the crossing of trains is restricted to certain stations. To reduce the number of employees at crossing-points it would be necessary to do without their co-operation in matters affecting the movements of trains; all these matters for the entire line must be concentrated in the hands of a single official. Such an arrangement has been in use experimentally on a line 60 kilometers (37 miles) long belonging to the Hungarian State Railways for nearly six months, without developing any disadvantages.

A similar measure might overcome another difficulty encountered at small stations—viz., the complexity of the tariffs. An employee of limited education is not qualified to understand all the rules for the application of the tariff. It might perhaps be possible to intrust the application of the tariff to an official living at the junction station. One of the most efficient methods of reducing operating-expenses will always be the reduction of the expense of traction. Now the numbers of trains cannot well be reduced without causing dissatisfaction to the public, or even reducing receipts. The running of mixed trains for this purpose only partially meets the reasonable demands of the public, while the separation of freight from passenger traffic always involves an increase in the number of trains. To avoid an excessive increase in the cost of the service, the only recourse is to reduce the weight of the trains and the number of employees. Some of the measures introduced for this purpose involve dispensing with the brake-van and the fireman on the locomotive. Automotor-cars have been introduced on many light railways, and on branches of main lines for passengers and parcel business. In some cases the automotor hauls an ordinary car as a trailer. The motive power is generally petrol, used in a Daimler engine, and steam used as in a locomotive. Electric (accumulator) cars are also used. In Hungary a number of cars are working, but their construction leaves room for improvement in design.

The Great Western Railway Company of England have upwards of fifty automotor-cars working, which number is being rapidly increased. They are steam-cars of a powerful design, having cylinders of 12 in. diameter and 18 in. stroke supplied with steam from a large vertical boiler carrying a pressure of 160 lb. per square inch. When in England I went to Plymouth, where I saw the cars in service. They are working a frequent service on a branch line running to Plymouth. The line runs through a thickly populated district. Prior to the introduction of the automotor the passenger business suffered severely on account of tramway competition. The stations were also too far apart. Specially low fares have been made for the new service, and a large number of new stopping-places made. These are provided with cheap sheds and short platforms. In some cases considerable expense has been incurred in building overbridges and in making approaches to the stations. The cars are operated by a staff of three, and they are not reversed at stations. The engineman drives from the leading end of the car or cars, as would be the case when two cars are on. The fireman attends to the boiler, and the guard sells tickets at "halt" stations. He also collects all tickets. The cars are large, carrying from sixty to eighty passengers, all of one class. When one car is run no smoking is permitted, with two cars the second is used as a smoker. The speed attained is quite thirty miles per hour. The cost of the cars is considerable, varying with their size, reaching as high as £3,000. The same object could be gained by using a small locomotive and two cars. The Great Western Company are the largest users of automotors in England. Other companies use them also, but not to the same extent.

The Great Northern Company are experimenting with a petrol-engine, but so far without much success.

The Great Western are apparently satisfied with the results of their enterprise, and expect in time to have 100 cars working. When visiting Barry I saw two cars which had been in use, but had to be laid up because they were not capable of running at the same rate of speed at which the train they displaced ran. The public would not stand the slower service.

On some lines two classes are provided for, but for services of this kind there should be only one class, with provision, if possible, for smokers.

It may be desirable to try services of the kind described in New Zealand, but I cannot recommend the building of special automotor cars to work them.

A small locomotive such as are in use, say, Class D or F, and the ordinary cars slightly modified would meet all requirements. The Class F engine is exactly the same horse-power as the automotor in use on the Great Western Railway.

20. Traffic Conveyed by Automobiles.

Organization of services by automotors and automobiles, where there is insufficient traffic for a railway.

Reporters.—All countries—Messrs. Kerounes, Lechelle, and E. Sarticeut, North Western Railway of France.

Conclusions of Congress.

Experiments with automobile cars and with the automotors hauling trailers have been numerous during the last few years to an important extent both for use on lines with little traffic and for use on busy lines. It may be expected that from now on these care will constitute a valuable means of transportation which on some lines will have a great future. It does not appear doubtful that, owing to the saving of an employee in the driving, to the material reduction in the cost of traction, to a better utilisation of the rolling-stock, to the smaller extent of station installations required, perhaps also owing to less wear of rails, automobile and automotor cars will make it possible materially to reduce the cost of working lines with little traffic, and will in the cases of other lines result in a material improvement in the working of some classes of service. Their use will certainly effect a change in the system of operation in the cases of a great number of lines, and appears to have a real future before it. The period of actual operation has, however, only just begun, and definite economic results cannot yet be clearly discerned in favour of a given type of motor or of a given system of working. It is desirable that railway managements should continue their experiments in this direction, and more especially investigate the classes of service to which this new motor is suitable, and the advantages it offers the public and the railway managements, particularly in the matter of cost. Finally it is important that any changes recognised, or which may be hereafter recognised, as likely to facilitate the advantageous use of automobile and automotor cars should be introduced into regulations in force.

Notes.

This subject has to a great extent been dealt with in the preceding question—No. 19. Some additional information having been given, I have considered it advisable to refer to it even at the risk of a certain amount of repetition.

The Paris–Orleans Railway Company put an automotor-car in operation in 1903 as an experiment. The car was designed to replace an existing light train on a light railway with an automotor-car and two trailers capable of running at a speed of 20 kilometers (12 miles) per hour on a 1 in 50 grade, and 60 kilometres (36 miles) per hour on level sections. The car was 130-horse power. It was divided into sections for mails, luggage, and passengers. There was also a platform at the end; twenty-six passengers were carried, and it was capable of hauling two third-class cars as trailers, each capable of carrying thirty-two passengers, making a total for the train of ninety passengers. The results have been sufficiently satisfactory to induce the company to continue the trial on a larger scale. The Central South African railways are also experimenting in the same direction. The cost of cars in use is set down at from £3,000 to £3,500.

The President of the section ruled that "automobiles on roads" was not open to discussion, and could not be considered, but it was generally understood by members that it was the subject for consideration and not automotors for use on railways. The Great Western Railway, England, has a large number of petrol-buses in use, which run into parts of the country not served by railways. Both passengers and goods traffic are dealt with. These services are much appreciated by the public, and are a source of revenue to the company. The chief item in the expenditure is the wear of rubber tires, the cost of which is not less than 3d. for every mile run.

GENERAL REPORT DEALING WITH SUBJECTS WHICH ARE MORE OR LESS ASSOCIATED WITH RAILWAY-WORKING IN CANADA, UNITED STATES OF AMERICA, FRANCE, AND GREAT BRITAIN.

In treating the various subjects to which I shall refer in this report, it will be necessary to further consider some of the questions previously dealt with in my special report on the International Congress proceedings; such being the case, a certain amount of repetition is unavoidable.

I sailed from New Zealand on the 22nd March, and arrived at Suva on the 25th March. On 27th March I sailed for Honolulu, which port was reached on 5th April. During the short time at my disposal I examined the tramway system. The service is good; the cars are very fine, large, and comfortably seated. Left Honolulu on the night of the 5th April, and arrived at Vancouver on the 13th April.

I called on the General Superintendent of the Canadian Pacific Railway, and discussed railway matters with him. Later on I inspected a large lumber sawmill, the daily output of which is 150,000 ft. The sawn timber is shipped for various ports, a large quantity being also railed east. The bulk of this timber is carried in box wagons, the loading of which is somewhat difficult. Coal to some extent is also carried in the same trucks. This is a special feature on the Canadian-Pacific Railway system. Empty wagons must be used as far as is practicable for any traffic offering, although they may not be very suitable for the business. Traffic was heavy and trucks scarce at the time of my visit, and consignors were only too pleased to get stock of any kind to keep them going. Taupaulins are not used on the Canadian Pacific Railway.

Through the courtesy of the General Superintendent of the Canadian Pacific Railway, I was enabled to inspect an electric railway which connects Vancouver and New Westminster, a distance of twelve miles. The time taken to run the mileage was thirty-four minutes. The power required to operate the line is obtained from a waterfall over one hundred miles distant from Vancouver. New Westminster is situated on the Fraser River. It is the centre of the great salmon-canning industry; a year's catch has reached 150,000,000 lb. Chinese labour is almost exclusively used for catching, canning, &c.

Left Vancouver for Montreal on the 15th April by express train. It was a heavy one, comprising eight passenger-cars, one dining-car, and two vans. Each passenger-car had a coloured attendant. The dining-car has a staff of about five, exclusive of the conductor, who supervises the working of the car, and controls the whole of the staff on all cars. The wages paid to attendants are low, but from the number of men employed it will be apparent that the cost of working is high. The cars were excellent and the equipment good. Catering left little to be desired; the charges were, however, much in excess of those obtaining in New Zealand.

The scenery crossing the Rockies is very fine. Snow was fairly abundant, and the temperature low, but the cars were well heated by steam—occasionally too hot—so the cold caused no discomfort.

Considering the time of the year, the track ran fairly well, but the maintenance is not up to the New Zealand standard. Taking a railway across the Rockies was a most difficult engineering undertaking, and the line is a monument to the skill of the engineer concerned. The grades are necessarily heavy, and the curves numerous, necessitating the employment of powerful locomotives. On some of the grades over which I travelled three powerful 95-ton locomotives were employed. Sleepers cost 1s. 2d. each; their life is about six years. There are many miles of snow-sheds through the Rockies. They are costly to build, and their life is about the same as for sleepers.

I stopped one day at Banff, a favourite health resort during the summer months. The Canadian Pacific Railway own a fine hotel there, which is open during the tourist season. There is a sulphur spring and a swimming-bath, the temperature of the water being 98°. The accommodation at the baths is by no means luxurious.

On the 18th April, when travelling over the prairies, a truck containing fish became derailed. The damage was considerable, despite which, after a delay of thirty minutes, we were moving again towards the next station, where the truck was shunted off.

The Canadian Pacific Railway Company are the proprietors of a large number of excellent hotels, which are located at all towns of importance on the company's extensive railway system.

Checking luggage at the Canadian Pacific Railway is carried out in much the same way as it is in New Zealand. No charge is made. Express companies have their agents at all the principal hotels. Agents also meet all important trains. In Canada and in the United States passengers travel with very little luggage, generally one small bag called a "grip," which can be readily placed under a seat. All heavy luggage is checked. The rough handling of luggage is proverbial; mine was no exception to the general rule, and it suffered considerably. The prompt delivery of your luggage at your hotel or private house is not always obtainable, several cases of serious delays having come under my notice.

When crossing the prairies I noticed large numbers of immigrants dumped down on the open plains with their belongings, but without, so far as I could see, any place of shelter. I was informed that they soon settled down, and became good colonists. It seemed to me that a considerable amount of grit was required to enable them to face their difficulties.

Whistling by locomotives is not much in evidence; the engine whistles when approaching a station, not when starting, and very little for signals or other movements of train. The bell which is fitted on all engines is much used, and is continually kept going while engines are running within station limits, when running through and across streets, and for crossings generally.

Lighting on the Canadian Pacific Railway is effected by various means—viz., kerosene-oil lamps, compressed acetylene, and electricity. In each case the lighting was good, especially the acetylene; the gas being compressed and carried in the usual cylinders placed under the cars. Electric lighting

was good, but expensive to generate, steam being drawn from the locomotive boiler to work a turbine which in turn worked the dynamo which generated the current. This involved the attention of a special attendant.

Pintsch gas, in common with the electric axle light, is largely used in the States. The improved mantle now being manufactured will enable large economies to be made in the consumption of gas, with a much improved light. Arrangements have been made to give this system a trial in New Zealand at an early date.

I broke the journey to Montreal at Ottawa, and took the opportunity of calling on the Minister for Railways, and the Premier, Sir Wilfred Laurier. I arrived at Montreal on the 22nd April. This is the headquarters of the Canadian Pacific Railway, and I called on the chief officials, but unfortunately most of them were absent.

Went on to Quebec, where I inspected a large plant for dealing with coal imports, and electric railways and a large grain-elevator. It was too early in the season to see the grain-elevator in operation. Notices forbidding expectorating are posted on all railway-stations, in tram-cars, and public places. The penalties for expectorating are very heavy. Glass insulators are in general use on telegraph-lines. Mile-posts are fixed at a reasonable height where they can readily be seen by trainmen. The cattle and sheep yards which I saw were very primitive, and would not meet the views of the New Zealand cattle and sheep owner.

Returned to Montreal on the 26th April, when I again called on the chief officials of the Canadian Pacific Railway, but they were still absent from headquarters. I managed, however, to see the Chief Engineer and the Chief Passenger Manager, and obtained some information from them. The Canadian Pacific Railway comprises a system of some 7,000 or 8,000 miles of railway, and had an endowment of 26,000,000 acres of land to build their railway to Vancouver. The company are large shipowners, trading to China, Japan, and also to Great Britain.

Visited the workshops of the Canadian Pacific Railway Company, where 3,600 men were employed. In addition to the maintenance of rolling-stock, four locomotives are built each week, also eighty-four large box trucks and numerous carriages, &c. The workshops are new throughout, and they are fully equipped with the most modern tools and labour-saving devices. All machines are driven by electric power, generating plant being especially fine. The electric cranes in use are very numerous, and materials are handled at a minimum cost. The shops are also admirably arranged, all raw material passing continuously through the various shops. Rough, strong work with the essential parts well finished is the rule for locomotive and wagon work, and is all that is required. New Zealand should, I consider, work as far as possible on the same lines. One large shop was specially used for the manufacture of points and crossings, and I took a special interest in the methods employed. I did not, however, see anything better in the machinery equipment than ours. I spent a considerable time discussing the manufacture of points and crossings with the shop foreman, who was very courteous and anxious to impart, and possibly obtain, some information. I received much courtesy at the hands of Mr. Vaughan, the Superintendent of Motive Power, a position similar to Chief Mechanical Engineer in New Zealand, and also from his assistant, Mr. Johnston. With the former I discussed the relative advantages of the various types of compound locomotives. At present he is building simple engines only, and is converting his Vaulclain compounds, built by Baldwins, to simple engines. Mr. Vaughan is a firm believer in the use of superheated steam. He claims considerable economy in the use of fuel and water. I have arranged with the Chief Mechanical Engineer for a trial in New Zealand of the superheating system. Plenty of light and elbow-room were two distinctive features of the works. In my subsequent visits to numerous locomotive-workshops I frequently made comparisons between them and the Canadian Pacific Railway's Montreal shops, but in all cases I came to the conclusion that the latter must take the premier position.

In America many of the railway companies are cab and hansom proprietors, and well-appointed vehicles deal with all passenger traffic from many stations. The fares are reasonable, and they are paid to an official in charge of the vehicles at the stations. The drivers wear neat uniforms.

Arrived at New York on the 28th April. Had several trips on the elevated railway. The motive power is now electricity; originally it was steam. The railway is carried on an iron viaduct, in some cases down the centre of the street, and in others over the footpaths. The noise is very objectionable. The services are very numerous, and run continuously night and day. Passengers are well educated in the matter of joining and leaving trains rapidly. I timed stops as low as five seconds at stations. The carriages are comfortably seated, and heated by electric heaters. The pulling-up of trains was rough on several occasions when I travelled, due to the incompetent handling of the Westinghouse brake. The passengers took it all as a matter of course, and I heard no complaints.

Went over the great new suspension bridge, called the New East River Bridge. It is a splendid piece of work. Also saw the Brooklyn Bridge, the traffic over which is enormous, especially between 7 a.m. and 9.30 a.m., and 5 p.m. and 7 p.m. Accidents are very numerous, caused by the rush of passengers to obtain seats on the tramcars which work the traffic.

On Monday, the 1st May, the delegates to the International Congress (a large number of whom were assembled in New York), were taken for a tour of inspection by the entertainment committee at New York, representing the American section of the International Railway Congress. Our first visit was to the Grand Central Station of the New York Central and Hudson River Railroad. There are on an average 1,170 daily train-movements to and from this station, increasing in busy seasons to over 2,000. This company operates 3,512 miles of road, and controls 12,048 miles. Locomotives number 1,733, passenger-cars 2,167, and freight-cars 64,475. During the year 1904, 16,218,174 passengers were carried in and out of the terminal station, and 1,248,735 pieces of baggage were handled, of which number five valises and one trunk went astray. The accommodation for this large business being inadequate, and

the conversion from steam to electric working having been decided upon, a new station has been designed. The yard will cover 51 acres, with twenty miles of tracks. Two power-houses, each of 40,000-horse power, are under construction. Curtis's steam-turbines are to be used for generating the current. The electric working will extend some thirty miles from the terminus, thus covering the suburban area. The cost of improvements and conversions is estimated at from £8,000,000 to £10,000,000 sterling.

Having completed the inspection of the station, we were conducted to the new subway, which has a mileage of twenty miles. The party were run over the whole system at a high rate of speed, frequently exceeding forty miles per hour. The Interborough Rapid Transit Company work the elevated railway (forty miles) as well as the subway (twenty miles). On heavy days about 1,300,000 passengers are carried on the two systems. The subway is admirably constructed. There are four lines—two for express traffic, and two for slow or local traffic. Each express train comprises five motor-cars and three trailing-cars; each local train comprises three motor-cars and two trailers. Express trains run at an average speed of twenty-five miles per hour. The speed of local trains averages about eighteen miles per hour. All cars are heated and lighted with electricity. The cars are 51 ft. long, and seat fifty-two passengers. End doors are used, sliding side-doors would, I think, have been preferable. The passengers, are, however, very smart in leaving and taking seats, and the stops at various stations are wonderfully short. To give an idea of the power required to operate the subway I quote the following figures: Ultimate generating-capacity at best efficiency, 75,000 k.w; number and power of boilers, 60, 600-horse power; number of reciprocating-engines, 9; capacity of engines, 8,000-horse power; capacity of generators, 5,000 k.w.; number of turbines, three; capacity of turbines, 3,750-horse power. This is an exceptionally fine plant, and is kept in perfect condition. We spent a considerable time looking over this installation, and the delegates generally were much impressed.

The party was then taken across the river by special ferry-boat to Long Island City, where the tunnel shafts and the power-house of the Pennsylvania Railroad, built for the tunnels, is now under construction. The cost of taking the line into New York City and building a new station is estimated at about £10,000,000. The Pennsylvania Company controls 10,500 miles of road, and it has been estimated that the system has under load, and most of it under movement, an average of 100,000 cars per day.

At the conclusion of this very interesting inspection, we again took the steamer to the power-house of the Metropolitan Street (surface) Railway. The system comprises a mileage of five hundred miles, serving a population of 2,500,000. The installation is known as a double-conductor system with metallic return circuit. Being under ground, the feeder-wires and electric conductors are protected from damage by wind and weather. The cost of maintenance is said to be less than the overhead-trolly system. The power-station contains eleven 3,500-k.w.-generating units. Steam is supplied by eighty water-tube boilers, each boiler representing 250 nominal horse-power. The coal supply is taken by steam-shovel and automatic conveyers to the coal-bunkers, which have a capacity of 9,000 tons. From the bunkers the coal descends by gravity to the automatic shovels with which the boilers are equipped. The consumption is about 2·8 lb. of coal per kilowatt, and for the maximum output would be about 718 tons per day. There is another large generating plant in connection with the system, equal to eight generating units of 3,500 k.w. each. We did not inspect this plant.

Having concluded a very interesting visit to the power-house, we returned to the steamer, and were taken for a trip on the river to see the wharves and coal-shipping appliances. A landing was made to inspect the Pennsylvania Railroad terminal at Jersey City, after which we crossed the river and finished a busy day, which commenced at 9 a.m. and terminated at 6 p.m.

On the 2nd May, in company with the other delegates, I left New York for Washington, *via* Philadelphia by the Royal Blue line (Baltimore and Ohio Railway, Philadelphia and Reading, and the Central Railroad of New Jersey). It is a four-track road for many miles, well laid, and the running at the high rate of speed we travelled was excellent. The rails are 100 lb. to the yard. Automatic signals were in use, placed about a mile or a mile and a half apart. The wayside stations are beautifully kept, spare pieces of land being used for flower-beds, shrubs, or grass, the latter being kept closely cut.

The special train which conveyed the delegates to Washington was considered one of the finest and most luxurious which had been seen on any railway. It was drawn by a modern locomotive of great power, and, during part of the run, attained a speed of seventy-five miles per hour. I did not observe any raised platforms at the stations *en route*, and the fine station at Philadelphia, which deals with eight hundred trains daily, was no exception. The train arrived at Philadelphia punctually at 11.15 a.m.

The delegates then proceeded to the Baldwin Locomotive Works. An hour and a half was spent in going over the various shops. The time was quite inadequate, it being impossible to see the shops properly in a day. Having paid a subsequent visit to Philadelphia, I shall later on again refer to the Baldwin Works.

Leaving Philadelphia about 3.45 p.m., we arrived at Washington on time, 6.30 p.m. The travelling was excellent. I noticed several of the cars were fitted with a glass case containing an axe, saw, and a heavy hammer. The case was attached to the ceiling or roof of the car, and was intended for use in case of accidents. The tools would enable passengers blocked in to cut their way out.

Having specially reported on the Congress proceedings, I shall pass on to a brief reference to the American Railway Appliance Exhibition, held at Washington during the sitting of the Congress. It formed a great attraction to the delegates, many of whom spent all their spare time inspecting the numerous exhibits. I was informed that the exhibition was superior to the exhibits shown at St. Louis. There were not so many locomotives, cars, and wagons to be seen, but the list of exhibits was said to be the most comprehensive ever seen in the United States. Electricity was well represented by the two

great American companies—namely, the Westinghouse Company and the General Electric Company. Machinery of all kinds was on view—points and crossings, signals, pneumatic tools, &c. I spent a considerable time at the exhibition, and made notes of some machinery which would be valuable in our workshops. A special feature of the exhibition was the Baldwin Company's locomotive exhibit. It was a large four-cylinder balanced compound engine, very well finished, and a most powerful machine. I was fortunate in meeting the designer of this engine, Mr. Vaulclain, and I had an hour's discussion with him on locomotive practice.

Saturday, the 13th May, was the closing day of the Congress. The last act was to appoint a meeting-place for the next Congress. It was decided to hold it in Switzerland in the year 1910.

During my stay at Washington a visit of great interest was made to the New Union Station at Washington. The estimated cost of this station—£3,600,000—is being defrayed jointly by the Pennsylvania and the Baltimore and Ohio Railway Companies and the Government. When finished the station will be the finest in the United States.

At the close of the Congress the delegates had an invitation from the Associated Railroads to tour through America. Two tours were arranged, one called "the short tour," extending over a period of ten days, and a long tour, lasting fourteen days. Having ascertained that the short tour would be the best business tour, I selected it. One train was set apart for the short-tour party, which numbered sixty, and three trains were told off for the long-tour party, which numbered two hundred. The trains were very fine, the best carriages in the States being placed at our disposal. American railway men considered the trains the finest which had ever been run. The sleeping-accommodation, dining-cars, and all the appointments were excellent. Special locomotives were detailed to haul the trains, and all other trains had to give way to the delegates' trains. The Associated Railroads spared no expense, and took an infinite amount of trouble to make the tour as pleasant and as profitable as possible to the delegates, in which respect there was only one opinion, that being that American railroad companies had been consistently successful. Among delegates there was a general consensus of opinion that the general equipment of these trains was the finest in the world.

The short tour commenced on the 14th May. The delegates left Washington late on that day, slept on the train the same night, and arrived at Altoona the following morning.

After breakfast a start was made to inspect the Altoona workshops and yards belonging to the Pennsylvania Railroad Company. The annual capacity of the shops is 300 new and 1,000 repaired locomotives, 300 new passenger-cars, and 3,600 new freight-cars. The total number of employees in Altoona shops, offices, and yards is 13,032; floor area in acres, 48·03; yard-area in acres, 242·39. The time at our disposal was quite inadequate for a proper inspection. I was fortunate in having as my guide, for a considerable time, Mr. Gibbes, the Chief Superintendent of Motive Power. He was most courteous and gave me much information. The shop-methods I found much the same as is the practice in New Zealand. Electric driving of machinery is much in evidence. A large number of pneumatic tools and hoists were in use and there was ample room for machines, no crowding. Electric cranes for engine-lifting and other purposes were to be seen in every shop where lifting was necessary. In the car and wagon shops a large number of pressed-steel hopper trucks were under construction. The work being turned out in all the shops was good. The company owns 4,668 locomotives, and are adding 500 to their stock.

The locomotive-repairs shops, also at Altoona, are quite distinct from the construction-shops. I saw nothing very special there, except the electric cranes and other lifting appliances, which were excellent. The machinery is not driven by electric motors. These shops are old and there is insufficient room to carry on the business satisfactorily. Saw a large round house or engine-shed. It was being used for repairing engines, not for sheltering them. The engines generally were not so well maintained as in Great Britain or New Zealand, and the cleaning is very indifferent. There are two extensive receiving-yards, one for the west-bound and one for the east-bound traffic, each for loaded trucks. There is also an empty receiving-yard and three classification or sorting yards. Each of the latter is provided with a hump or raised bank; the wagons to be sorted or weighed are pushed up the hump or bank and after weighing are run by gravitation into the various sidings as required. The work was very expeditiously carried out, but a large number of brakesmen were required, as each truck had a brakesman on top to work the brake.

To give some idea of the magnitude of the business done in the great Altoona yards I quote a few statistics: Freight-trains east-bound into Altoona from Pittsburg division during twenty-four hours, 99, or one train every 14½ minutes; freight-trains west-bound from Altoona division in twenty-four hours, 67, equal to one train every 21½ minutes. The average weight of east-bound freight-trains, 2,786 tons, and for west-bound, 1,650 tons. The freight hauled in 1904 was 272,371,096 tons. To deal with this vast business 199,213 cars of various kinds were used. The company has an excellent cab service; as an example I quote Washington, where eighteen four-wheelers, six victorias, and two omnibuses are in use. The total number of employees of all classes in 1904 was 152,135.

After an exceptionally interesting day we left for Pittsburg at 5 p.m., arriving at our destination at 8.45 p.m., the 117 miles having been run without a stop.

Pittsburg is the centre of great industrial enterprises. A sixth of the world's steel production is manufactured there. In 1903 some £8,000,000 worth of electrical and auxiliary manufactures were produced. It is also the home of the air-brake, which is now largely used in all parts of the world, and many other industries too numerous to mention.

To give an idea of the magnitude of the railway business I quote a few figures: In 1902, 76,950,000 tons were transported by rail; the coal production was 36,137,346 tons; steel rails, 712,300 tons, which is not far short the total production of Great Britain; petroleum, 30,000,000 barrels. A network of railway lines surround the city, feeding the various industries with fuel and raw material, taking back the finished product.

The reception committee had arranged for two special trains to convey the delegates to the works selected for inspection. The route taken afforded an excellent opportunity for seeing the city, which reminded me of some of the great manufacturing cities of England, a city of flame and smoke, much smoke. The first visit made was to the extensive works of the Westinghouse Electric and Manufacturing Company. Several hours were spent in going over the works, and an experiment with an 135-ton electric locomotive witnessed. Also an experiment with a series of air-brakes, all of which proved satisfactory. Mr. George Westinghouse was present, and treated the delegates with marked courtesy and hospitality. Time was too short to do justice to the works, but I arranged with the company to keep me posted as to any new development in electric traction. The company expend large sums in experiments in this direction.

After lunch, tendered by the company, we took train and went on to Carnegie's great homestead and steel-works. The various mills were in full swing, rolling various sections of steel (but no rails and armour plates) in various stages of manufacture.

Having completed the visit we again took train, arriving at the central station at 5 p.m. An hour later we left by special train for Cleveland, where we arrived the same evening.

Cleveland is an important manufacturing centre, having some 3,400 industries with an annual output of £30,000,000. A specialty is the manufacture of coal and iron-ore handling machinery. Tugs were placed at the disposal of the delegates, and under the guidance of an influential reception committee we went down the river for a view of the ore- and coal-handling machinery located near the docks. Coal was being shipped at a hoist or lift at the rate of 40 tons every three minutes. The system is an excellent one for hard coal, but it would not be suitable for the friable New Zealand coal.

Leaving the tug we next visited the works of the Williams-Seaver-Morgan Company, which cover an area of about 6 acres. The company manufacture coal- and ore-handling machinery, hoisting, hauling, and conveying machinery, and many other specialities. All machine tools are equipped with variable-speed motor drives. The shops are modern.

This visit concluded, we proceeded to view the works of the Brown Hoisting Machinery Company. This company manufacture hoisting and conveying machinery and general appliance for dock, railway, and steel works, &c. The shops are well found with modern high-speed tools, cranes, &c. Electric motors are exclusively used.

A visit was next made to the King Bridge Company, where forty-five minutes were spent inspecting the various shops and the bridges under construction. The capacity of the plant is 30,000 tons of finished bridge-work per annum.

The final visit of the day was made to the Lake Shore and Michigan Southern Railway Company's locomotive and car shops and marshalling-yards at Collingwood. The shops are commodious and well designed. They were completed in 1902, and are equipped with all modern machinery, cranes, &c., electrically driven. Repairs only are dealt with in these shops. They maintain in good order 450 locomotives, 650 carriages, and a considerable freight equipment. A well-arranged store is a feature in connection with the shops. The general arrangement of the shops and the disposition of the machinery are very good, and cleanliness and order are very conspicuous. The yards are similar to those at Altoona, but not so extensive. A short time was spent in seeing trains marshalled. Five thousand trucks are dealt with daily.

Left for Buffalo at 5.45 p.m., and arrived there at 10.15 p.m.

The principal receipts at Buffalo are grain, flour, lumber, and iron-ore. To deal with the enormous grain business twenty-two elevators, having a storage capacity of 25,000,000 bushels, have been provided. The elevators are capable of dealing with 5,000,000 bushels daily. The development of electric power at Niagara provided unequalled advantages for all lines of manufacture.

The International Traction Company at Buffalo own the best-equipped trolly system in the country, with a track of some 350 miles in Buffalo and along the Niagara frontage, operated, heated, and lighted by Niagara Falls power.

Wet weather prevented the carrying-out in full of the programme which had been arranged for by the reception committee, a trip on Lake Erie and an inspection of the grain-elevators being the only part of an elaborate programme which was carried out.

Went on to Niagara, where we were conducted over the American power plant of the Niagara Falls Power Company, which has an output of 105,000-horse power. The power plant of the Niagara Falls Hydraulic Power Company, having a horse-power of 50,000, was also inspected. These companies have water-rights for an additional 145,000-horse power. On the Canadian side three companies are now constructing power plants having a collective horse-power of 450,000. There is a feeling in the minds of many that the diversion of so large a volume of water will destroy the grandeur of the falls; on the other hand many say there is no perceptible difference in the flow, and that Niagara can be drawn on for a further very large horse-power.

After seeing the rapids by searchlight we left for Schenectady, which city was reached on the morning of 20th May. An early start was made, and we first visited the extensive works of the General Electric Company, the total floor-space of which covers nearly 58 acres. The shops are well equipped with up-to-date appliances, and a very large business is done. The company, in conjunction with the American Locomotive Company, are building fifty electric locomotives for the New York Central and Hudson River Railroad Company. The manufacture of the Curtis steam-turbine is undertaken by the company, and at the date of my visit Curtis turbines having a horse-power of 220,000 had been supplied, and orders were in hand for the supply of 420,000-horse power. The company gave a demonstration with one of their electric locomotives, which was successful. It weighed 100 tons, and attained a speed of sixty miles per hour.

Our next visit was to the works of the American Locomotive Company, where a large business is done. The shops are well arranged, and the machinery is of a modern type, electrically driven.

Left for Boston at 2.15 p.m. and arrived at our destination at 11.15 p.m., having lost an hour through the breaking of a crank-pin on the engine which was hauling our train.

A visit was made to the North Union Station, where a large amount of business is done. Average number of passengers per day, 80,000; maximum for one day, 200,000; number of passenger-trains daily (summer schedule), 610.

After inspection of the station, we proceeded by special train to view the Boston and Maine freight-terminals; after which we boarded a steamer and were taken for a trip to East Boston, South Boston, and a run down the harbour. *En route* many wharves were passed, also coal-loading appliances and large grain-elevators.

Returning to Boston, a visit was made to the Boston terminal station, where a force of 2,500 persons are employed, including office forces of the several railways being the station and express companies, trainmen, &c. About 27,000,000 passengers use the station annually, 2,000,000 pieces of baggage are handled, 150 tons of United States mail daily, 530,000 parcels annually, 20 tons papers outwards daily, 20 tons papers inwards daily, 100 tons papers outwards Sundays. The various buildings cover about 13 acres. Seating capacity of passenger-cars that can be placed alongside platform of station, 28,104. This station is said to be one of the finest and best-arranged in America; unfortunately the time allowed for the visit was too short, and the inspection was a hurried one. One thing which struck me particularly was the absence of raised platforms; platforms between carriages were level with the rail tops; stools were used to step on to the bottom step on car.

Left for New York at 4 p.m., travelling by train as far as Falls River, where we took the steamer "Priscilla," which is a splendid boat, capable of berthing one thousand five hundred passengers, arriving at New York early on the 23rd May.

This concluded a most instructive and interesting tour. The arrangements made for the delegates were excellent, and the various reception committees did their utmost to make the tour successful. No trouble and no expense was spared. Personally, I feel greatly in their debt.

I remained in New York until the 26th May, and during my stay I saw various firms and others on railway matters.

From the 26th May to the 29th May inclusive I was at Philadelphia, and spent much time at the Baldwin Works, where about 13,500 hands were then employed. Piecework is the rule, ten hours being a day's work. The men work very hard. About five engines were being turned out daily. Electric motors are largely used for driving the machines. The lifting appliances are numerous, and all electric. I do not consider the Baldwin shops an ideal to be copied. The great drawback is the want of room.

Visits were also made to the Sellaes and Niles Bement machine shops, where I saw good modern tools suitable for railway-works.

A visit to the extensive carriage-works of the Brill Company was most interesting. The company are chiefly engaged on tramway-cars, and were just completing a number of cars for England. The daily output of the works was thirteen cars.

Left for Baltimore on the 29th May, arriving there early on the same day. Major Pangborne, who paid a visit to New Zealand some years ago, met me at the station, and was most attentive during my brief stay at Baltimore.

Under his guidance I visited the power plant which operates the electric locomotives. The locomotives weigh 80 tons, and they can be worked in series, one gang (two men) operating several motors. The engines do their work well. Steam traction is preferred, but the company had to abate the smoke nuisance. Two locomotives have hauled a 2,000-ton train through the tunnels over a grade of 1 in 100. The system has been at work since 1896. I had a run on the locomotives; they were easily controlled.

I also visited the workshops of the Baltimore and Ohio Railway, where I spent several hours. The Superintendent for Motor-power went round the shops with me. The shops are well arranged and well equipped with modern tools, electric driving being a special feature. The company own a very powerful articulated locomotive, with a tractive power of 74,000 lb. when working compound and 84,000 lb. when working single. This is the most powerful steam locomotive in existence. It has given great satisfaction on the heavy grades for which it was designed. The articulated engine now being built at Petone and nearly finished is of similar design, and I have no doubt will do equally good work proportionate to its size. I took a good many notes of the way the work was carried on in the shops, which will be of value to the Locomotive Branch.

30th May.—General Hood, the President of the tramway system, ran me over the tramways for some two hours in his special car. There are about four hundred miles of tramway in the city and suburbs. The company pays the city 9 per cent. of its gross earnings for the right to use the streets. The gauge is 5 ft. 4 in., and the track is designed to be used by carts as well as tramcars. The 9 per cent. referred to is used for the maintenance of the parks. The company maintain the streets 1 ft. 6 in. outside the rails.

Through the courtesy of the Baltimore and Ohio Railway Company, a tug was placed at my disposal, and a trip was made down the harbour to visit the Maryland Steel-rail Mills. The President of the company took me through the works, and I saw the whole process of rail-making. On the way back I inspected the coal-staiths of the Baltimore and Ohio Company. They are very similar to those at Westport, but much higher, and the coal is badly smashed up. I was some time on the staiths, and had a long chat with the foreman in charge.

1st June.—Arrived at New York. During the balance of the time at my disposal up to the 3rd June I visited several firms and obtained much valuable information.

On the 3rd June I sailed for Liverpool on board the s.s "Campania." My visit to Canada and the States had been a busy one, but also pleasant, due very largely to the great courtesy and hospitable treatment which I received at the hands of both Canadians and Americans.

Arrived at Liverpool on the 10th June. The luggage arrangements were very good, and a large quantity was disposed of with much celerity and no confusion. A special train conveyed the majority of the passengers to London. I was unfortunate in reaching England during Whitsuntide, as many railway people and the principals of business firms were holiday-making.

What strikes a visitor to England after having passed through Canada and America is the comparative smallness of the locomotives and rolling-stock generally; tunnels, platforms, and other clearance limitations prohibiting the use of larger stock.

During my stay in London I visited the St. Pancras, Paddington, Waterloo, and the Broad Street Great Eastern stations. The latter deals with 90,000 passengers in and 90,000 passengers out daily, and I observed the methods used. I also had several trips on the Metropolitan and "twopenny tube."

A noticeable feature at all large English stations is the large number of porters employed. As a class I found them ever courteous and anxious to assist passengers, but not so smart in appearance as the New Zealand porters. Tipping is universal on English railways.

I paid several visits to the High Commissioner's Office, and saw the High Commissioner and the Consulting Engineer, and discussed many important matters with them, dealing chiefly with the supply of rails and materials generally.

I also saw the Pintsch gas people, and discussed the question of mantles for use in car-lighting with them. The firm claims to have succeeded in producing suitable lamps for the use of mantles, and I arranged for the supply to New Zealand of a few trial lamps. By the use of mantles it is claimed that a saving of 25 per cent. of gas is effected, while a 50 per cent. better light is produced.

An exhibition of railway appliances was opened while I was in London, and I spent some time there. The exhibits were not very numerous, and I saw nothing special beyond a Peebles railway motor-car, of which I obtained full particulars.

By appointment with the Westinghouse Brake Company, I saw their General Manager, and discussed brake business with him.

At the invitation of Mr. Mathieson, late Commissioner of Railways, Victoria, Australia, and now General Manager of the Midland Railway Company, I went over Midland Railways (London) goods department, after which I spent some time with that gentleman, who was anxious to assist me in any way, and gave me some information *re* his working of the Midland.

I met Mr. Drummond, the Locomotive Superintendent of the London South Western Railway, on several occasions, and obtained information *re* railway motor-cars. I also went over the workshops at Nine Elms; they are about to be closed, and modern up-to-date shops opened.

I made a special visit to Plymouth for the purpose of seeing the railway motor-cars of the Great Western Railway Company at work. The company gave me every facility, and told off the Superintendent of the motor-car service to show me the cars in work. I made numerous trips on the cars, and obtained full particulars of their designs. The service I saw working consisted of one motor-car and a trailer, the two cars being capable of carrying from 160 to 200 passengers on emergency. Three men—an engineman, fireman, and guard—were employed, and the engines of the motor were nearly as powerful as the New Zealand Class R. The motor was not turned, but pushed and hauled, according to the direction of travel. A fairly high speed, up to thirty miles an hour, was obtained. The engineman drives from the motor end when the motor hauls; when it pushes he drives from the leading end of the motor-car, if no trailer on; when a trailer is on he drives from leading end of trailer. The fireman attends to the boiler only. The guard deals with tickets in much the same manner as is done in New Zealand. The fares are low, and the service is running in competition with a tramway. Stopping-places, called "halts," are necessarily very numerous. There is only one class in the motors on the Great Western; on some of the other railways two classes are provided. Smoking is not allowed when one car only is running, but when a trailer is also on, one of the cars is sometimes set apart as a smoker. The accommodation for luggage is limited; small parcels only are taken. The Great Western Company are well satisfied with the result of their experiment, and a large number of motor-cars are at work—fifty-three when I was in England—and orders had been issued to bring the number up to a hundred.

The Great Western are running a large number of petrol- and steam-motor omnibuses in various parts of the country as feeders to their railways, and these have been instrumental in developing a considerable amount of new business. Other companies are following suit. The Great Northern Company are experimenting with petrol-engines, but I heard an indifferent account of them, and steam seems to be the favourite power.

When in Ireland I saw the General Manager of the Great Northern Railway Company, and learned from him that his company had one car at work, and he was disposed to put some more on as being well suited for light branch traffic. He considered, however, that the motor should be sufficiently powerful to haul a few wagons of live-stock when required.

In Wales I saw two handsome cars which had failed to meet the public approval. They were put on to take the place of certain trains hauled by the ordinary locomotive. Owing to their engine-power being deficient, they could not run at the same speed as the trains they were designed to replace, and as a consequence had to be withdrawn.

In New Zealand there is an opening for the "railway-motor service," so called, but I would not suggest or recommend building the motor or engines as part of the cars, but in lieu thereof would use small engines of the D, F, and L classes. Several of the English companies are now adopting this method, thus finding work for their small obsolete engines. The first car, I recommend, should be tried on the Auckland suburban service, and designs are now being prepared. It should, however, be clearly understood at the outset that first (smoking), second (smoking), first (non-smoking), and second (non-smoking) accommodation cannot be given; and the design will provide for one class only, second class for preference, with smoking and non-smoking accommodation in the proportion of about one-third smoking

and two-thirds non-smoking. A small luggage compartment will also be provided. Further reference to this subject is unnecessary, as I have in my Congress report dealt pretty fully with it.

In Cork I had some time to spare, so I had a look at a 2 ft. 6 in. gauge line. The stock was good and well designed, but I do not think it would meet with public approval in New Zealand. What is known as a light railway in England is in many cases more substantially built (heavier rails) than our 3 ft. 6 in. gauge. Most of the lines are the standard, 4 ft. 8½ in. gauge.

I visited the Inchicore works of the Great Southern and Western Railway Company, Ireland, where I served my apprenticeship many years ago. The shops are well run and much enlarged and improved since my days there. The company build their own locomotives and car and wagon stock. I saw some very fine locomotives which had been built for express work. The carriages were good, and I liked them better than the English carriages; more roomy. The Great Northern Company of Ireland also owns some very fine stock, the modern carriages being very good. Creosoting sleepers was being done at Inchicon when I was an apprentice there. I saw it in full swing when going over the ground. The system is the same as is in operation in New Zealand.

With the view of ascertaining how coal was being shipped at a big coal-export port I visited Cardiff and Barry in company with Mr. Fraser, Chief Engineer, and Mr. H. McLachlan, Secretary of the New South Wales Government Railways. The Great Western Company courteously arranged for the visit to Cardiff, and placed their District Goods Manager at our disposal, and I have to thank that gentleman for the trouble he took to post me up in the working of the various coal-shipping appliances, &c. There are two methods of loading coal at Cardiff. One is by means of an hydraulic lift or elevator which raises the wagon a sufficient height to tip the coal into a shoot which delivers the coal into the ship. The shoot is adjustable so as to minimise the amount of fall and so to reduce breakage. Hydraulic capstans are numerous. In some cases the coal is delivered from the shoot into a large skip which is lowered by a crane attached to the lift to the bottom of the ship's hold. The trucks come square on to the ships and they are tipped endways. Two roads hold full wagons and two roads are for empties, each road holds about twenty wagons; modern wagons carry 10 tons, but there are a large number which carry 8 tons. The skip contains a little over 3 tons and has to be lowered three times for each truck of coal. There are no hopper wagons in use. This system is preferable to staiths but is not equal to the system in use at Greymouth and Westport where the coal is placed on board by cranes without being tipped on to a shoot and thence by a skip to ship. The skip is only used when the fall into the hold is excessive. The second method of loading is by means of the Lewis-Hunter patent coaling-cranes. Three or more cranes can be worked simultaneously and 9,234 tons of coal have been shipped into one vessel in twenty-eight working hours. The working is as follows: A large box or skip capable of holding a truck-load of coal is placed in a pit attached to a tip, the truck is run on to the tip and the coal is discharged through the end door of the truck into the skip or box. The crane lifts the skip, swings round, and lowers it into the ship's hold. This is considered the most perfect system of loading coal. The cranes are very massive, but they work very slowly, the hoisting and slewing speed being quite 50 per cent. slower than the working of the New Zealand cranes. The conclusions I arrived at with regard to this system was that it was better than No. 1 system, but that it was not so good as our crane shipping. As a general rule the coal is weighed on a weighbridge close to the lift or tip; the empty truck is also weighed. Extensive siding accommodation is provided. Storage for five thousand trucks is common. The trucks are owned by the colliery owners.

A briquette plant was working at Cardiff. Pitch was used as the binding material; the cost of pitch per ton was £1 15s. The briquettes were sold at the rate of 14s. 9d. per ton. The manufacturers buy small coal from the collieries at a low rate. The continental railways are the best customers for briquettes. They are loaded carefully by cranes and stowed on board ship like bricks would be.

In 1897, 12,116,100 tons of coal was shipped from Cardiff, since which date the business has considerably increased. Seven railway companies have communication with the Bute Docks (Cardiff). In addition to the coal business there is very large general business, Cardiff ranking as the third largest port in the United Kingdom.

My next visit in connection with the shipping of coal was to the Barry Docks, which are about half an hour's run by train from Cardiff. The undertaking is known as the Barry Railway Company, having a capital of about £6,020,440. The directors of the company were having a board meeting, and I was introduced to and lunched with them. After lunch a train was placed at my disposal, and the company's manager conducted me over the docks, warehouses, &c. One hundred miles of siding are laid in connection with the docks. In 1903 the exports were 8,855,180 tons and the imports 389,596 tons. The docks are more modern than those at Cardiff, and there is ample room for expansion. The system of loading coal at the Barry Docks is by means of elevator tips somewhat similar to those in use at Cardiff. Some of the tips are fixed, and some are movable, so as to suit the hatchways of different ships. The trucks are brought in at a high level to the lift, which raises or lowers them to suit the height of the ship. There are two empty and two full roads for each tip converging into one road close to the tip. Full trucks are weighed close to the tips and empties when returning from the tip to the empty siding. The full trucks are fed to the tip by hydraulic capstans. The empty trucks run back from the tip to the empty road by gravitation. A 4-ton crane is attached to each tip and is used as required to lower the coal from the shoot to the ship's hold. This is absolutely necessary, because of the large size of the ships. The greatest quantity of coal shipped from one tip in an hour is 490 tons. The trade was slack when I made my visit, due to the cancellation of orders by Russia and Japan.

My next visit was to Bath, where I went over the works of Messrs. Stothert, Pitt, and Co., the eminent crane engineers, and discussed with the firm the details of the hydraulic crane which they had in hand for Greymouth. From Bath I proceeded to Swindon where I visited the locomotive workshops

of the Great Western Railway Company. Experiments were being made with compound engines and superheated steam for simple engines. The company had a very fine testing plant, the only one of its kind in Great Britain. The shops are very extensive and give employment to a large staff. Modern machinery has largely displaced old machines and electric driving is largely used.

My next trip was to Coventry, where I inspected Hubert and Co.'s tool-shops. The firm are specialists for lathes and milling-machines. The works employ one thousand three hundred men, and the system of working is excellent. Their lathes have been in use in the New Zealand shops for some short time and have largely assisted in the building of rolling-stock. The Coventry shops are run on piecework exclusively.

Leeds claimed my attention for a short time, during which I went over the works of the Leeds Forge Company, and Taylor Bros.' steel and iron works. At the former, large orders for high-capacity rolling-stock were in hand. Pressed steel is the company's speciality, and their hydraulic-press installation is the finest in Great Britain. Taylors Bros.' works were not in full swing, the heat being too great to work—July. Large orders for railway material were being executed, tires, axles, and the celebrated Yorkshire iron. The firm also manufacture gun-tubes for the British Government.

Sheffield was visited, and the Hadfield steel-works, Firth's steel-works, and Vickers, Sons, and Maxim's works were duly inspected. Steel-work, points and crossings, &c., largely occupy the Hadfield Company's works. I was specially interested in their shop arrangements but did not see much to copy. Firth's works are very extensive and the company go in for a great variety of work. Their testing plant is a good one. Nickel steel was being largely produced. Vickers, Sons, and Maxim is the firm who have supplied the New Zealand railways with tires and axles for many years. The company are large manufacturers of tires, axles, and steel-works generally as used on railways; they are also gun-manufacturers, and builders of warships. I saw some splendid guns just receiving their finishing touches.

Time did not permit of further visits, although two or three months longer could have been profitably spent in England and Scotland.

On the 10th July I left London for New Zealand *via* the Suez Canal. Registered luggage and mails are loaded into large boxes, two fitting on a truck. I paid 1s. 3d. for conveyance of 40 lb. to Paris. At Dover the boxes are lifted off the trucks and placed by an hydraulic crane in the steamer's hold. On arrival at Calais a crane lifts the boxes out of the ship and places them on trucks for Paris. The work was done very expeditiously. Seats in the train for Paris were reserved prior to departure of the train from London for Dover, the cost of reservation being 1s. 3d.

The French carriages were larger than the English and very comfortable to travel in. The external painting of the cars was inferior, and the locomotives were not so clean as in Great Britain. The track was good and a high rate of speed was maintained. The catering in the dining-car was not good, and dirty table-linen did not improve matters. The car was also a very bad-running one. Pintsch gas is largely used for lighting, and electricity is also used to some extent. Heating is by steam. Overbridges are not numerous, and passengers must look after their own safety in much the same way as they have to do in America. The four-cylinder compound locomotive is universally used. The wagon stock is on English lines, and large-capacity trucks are not much used.

At Marseilles and Naples I did not observe anything special in railway practice.

I arrived at Fremantle late in the day on the 17th August. A stay of six hours was made. I ran up to Perth and saw the station, which is a fine building. It was too late to see any of the railway people.

On the 22nd August I arrived at Port Adelaide and spent the day with Mr. Pendleton, the Commissioner. Visited the Islington Workshops where I met Mr. Roberts, the Chief Mechanical Engineer. The shops have been greatly improved and enlarged since my first visit some four years ago. A number of very well-designed modern tools have been installed. Mr. Roberts claims to be able to build locomotives at a less cost than they can be imported from England or procured from local manufacturers.

I went on to Melbourne by the night express, and was met on the Melbourne platform next morning by my old colleague Mr. Hudson and a number of other prominent railway officers. I called on the Chief Commissioner and Mr. Hudson, and had an interesting time with them. Accompanied by Mr. Woodroofe I went over the Newport Workshops. They have been equipped with modern tools and generally considerably improved. The Commissioners now build their own locomotives, ten being built yearly. Like South Australia they say that they can build cheaper than they can import or buy from local manufacturers. I noticed many devices in the Newport and also in the Islington shops which would be valuable in the New Zealand shops, and I have instructed Mr. Beattie, Chief Mechanical Engineer, to obtain full details.

My time in Sydney was limited, and I was unable to visit the Sydney workshops.

A controversy of considerable interest was taking place between the Chief Mechanical Engineers of South Australia and Victoria, who claim to be able to build for less than they can import, and the Chief Mechanical Engineer of New South Wales, who argues and proves to his own satisfaction that, as he cannot build cheaper or as cheaply as he can import, neither can South Austraila nor Victoria do so. In New Zealand our locomotives so far have not been built as cheaply as the imported engines. Piecework is in vogue in Australia. In New Zealand the amount of piecework is practically nil, and is confined to brass castings and steam-hammer forging.

My trip round the world ended on the 31st August when I arrived at Wellington.

In conclusion I desire to express my thanks for the opportunity which the Government has given me to visit America and Great Britain. I have observed the workings of many railway systems, which I trust may prove to be of some value to the colony.

It is difficult to make comparisons with New Zealand, where the conditions are so different from those of other countries. I am convinced, however, that the maintenance of the lines and rolling-stock is quite equal to the average railway in Great Britain and much better than many American railways. Our rolling-stock is well up to date. In some respects New Zealand is ahead of Great Britain. I refer to the equipment of all New Zealand rolling-stock (running on the principal lines) with the Westinghouse brake. In Great Britain the vacuum air-brake (and to a less extent the Westinghouse brake) is applied to engines and passenger stock only. Safety appliances generally in use in New Zealand are of a most modern type.

Several of our workshops require remodelling, and some additional machinery is required to bring them in line with modern ideas, and to enable work to be more economically produced.

Our fares and charges generally are very low and, considering the high cost of stores and the rate of wages paid, the New Zealand railways are doing fairly well. More sumptuous carriages could be supplied and other luxuries such as they enjoy in other countries, but I contend that the management endeavours to provide comfortable travelling without extravagance.

For a young and growing country, such as New Zealand is, I think the progress made in railway extension and working generally is satisfactory.

I have, &c.,
T. RONAYNE,
General Manager, New Zealand Railways.

ALPHABETICAL LIST OF DELEGATES REGISTERED IN THE SECTIONS.

SECTION 1.

Eduardo Alfonso, Chemins de fer de Madrid à Saragosse et à Alicante (Espagne).
F. H. Alfred, Père Marquette Railroad (Etats-Unis).
W. F. Allen, American Railway Association (Etats-Unis).
G. C. C. Ambt, Ministère de l'intérieur et des travaux publics et chemins de fer de l'Etat (Danemark).
G. A. Anderson, Under Secretary of State for India (Indes anglaises).
Charles Johnstone Armstrong, Central South Africa Railways.
Sir George Armytage, Lancashire and Yorkshire Railway (Grande-Bretagne).
E. B. Ashby, Lehigh Valley Railroad (Etats-Unis).
Aumont, Chemin de fer du Nord (France).
Auvert, Chemins de fer de Paris à Lyon et à la Méditerranée (France), de l'Etat prussien.
Franz Baltzer, Gouvernement allemand et chemin de fer.
Robert Barker, South Eastern and Chatham Railway (England).
E. H. Barnes, Grand Rapids and Indiana Railway (Etats-Unis).
Frank Barr, Boston and Maine Railroad (Etats-Unis).
Bauchal, Chemins de fer de l'Ouest (France).
Baume, Ministère des travaux publics (France).
Le chevalier Friedrich von Bazant, Chemins de fer de l'Etat (Autriche).
John N. Beckley, Toronto, Hamilton, Buffalo Railway (Etats-Unis).
W. H. H. M. Berentzen, Cie pour l'exploitation des chemins de fer de l'Etat néerlandais.
Walter G. Berg, Lehigh Valley Railroad (Etats-Unis).
Th. Geo. Betts, Chemins de fer Stockholm-Vesteras-Bergslagens (Suède).
J. C. Bland, Grand Rapids and Indiana Railway (Etats-Unis).
Félix Boix, Chemins de fer du Nord l'Espagne.
T. A. Brandt, Cie pour l'exploitation de chemins de fer de l'Etat néerlandais.
W. L. Breckinridge, Chicago and Quincy Railway (Etats-Unis).
Santiago Brian, Buenos Ayres Western Railway (République Argentine).
C. T. Brimson, Quincy, Omaha and Kansas City Railroad (Etats-Unis).
Bruneel, Ministère des chemins de fer, postes et télégraphes et chemins de fer de l'Etat (Belgique).
C. A. Brunn, Erie Railroad (Etats-Unis).
C. W. Buchholz, Erie Railroad (Etats-Unis).
John Byrne, Pittsburg, Shawmut and Northern Railroad (Etats-Unis).
D. Eduardo Canizares y Mayano, Ministère du fomento (Espagne).
Cartault, Chemins de fer de Paris à Lyon et à la Méditerranée (France).
E. C. Carter, Chicago and North Western Railway (Etats-Unis).
Chas. S. Churchill, Norfolk and Western Railway (Etats-Unis).
C. B. Clark, Cleveland, Cincinnati, Chicago and St. Louis Railway (Etats-Unis).
A. G. Cochran, Missouri Pacific Railway (Etats-Unis).
Rafael Coderch, Chemins de fer de Madrid à Saragosse et à Alicante (Espagne).
Collot, Chemin de fer de ceinture de Paris (France).
E. B. Cushing, Southern Pacific Company (Etats-Unis).
W. C. Cushing, Pennsylvannia Lines, West of Pittsburgh (Etats-Unis).
W. Dawson, London and North Western Railway (Grande-Bretagne).
Dehoul, Commission permanente du Congrès.
Descubes, Chemins de fer de l'Est (France).
W. C. Downing, Terre Haute and Indianapolis Railroad Lines (Etats-Unis).

P. H. Dudley, New York Central and Hudson River Railroad (Etats-Unis).
L. H. N. Dufour, Cie pour l'exploitation des chemins de fer de l'Etat néerlandais (Pays-Bas).
James Dun, Atchison, Topeka, and Santa Fe Railway (Etats-Unis).
Edouard Elskes, Chemins de fer fédéraux (Suisse).
C. F. Ernst, Chemins de fer de l'Etat (Danemark).
Sir Charles B. Euan-Smith, K.C.B., C.S.I., Buenos Ayres Great Southern Railway (République Argentine).
George F. Evans, Maine Central Railroad (Etats-Unis).
John E. Fairbanks, Section américaine de la Commission permanente du Congrès.
R. Fane-de-Salis, North Staffordshire Railway (Grande-Bretagne).
E. O. Faulkner, Atchison, Topeko, and Santa Fe Railway (Grande-Bretagne).
E. H. Fitzhugh, Grand Trunk Railway (Canada).
James Fraser, Agent-General for New South Wales in London, and New South Wales Government Railways.
Frosterus, Chemins de fer de l'Etat (Finlande).
H. Gehrts, Ministère des travaux publics (Siam).
W. McC. Grafton, Terre Haute and Indianpolis Railroad Lines (Etats-Unis).
H. E. Greafe, Commission permanente du Congrès.
W. M. Greene, Baltimore and Ohio South-western Railroad (Etats-Unis d'Amérique).
J. E. Greiner, Baltimore and Ohio Railroad (Etats-Unis).
L. G. Haas, Baltimore and Ohio Railroad (Etats-Unis).
J. T. Harahan, Illinois Central Roalroad (Etats-Unis).
Francis R. Hart, Cartagena Magdalena Railway (Colombie).
F. T. Hatch, Terre Haute and Indianapolis Railroad Lines (Etats-Unis).
J. C. Haugh, Queen and Crescent Route (Etats-Unis).
Charles M. Hays, Grand Trunk Railway (Canada).
Joseph Hobson, Grand Trunk Railway (Canada).
Guy Hopkins, Commission permanente du Congrès.
Maj. F. K. Huger, Seaboard Air Line Railway (Etats-Unis).
William Hunter, Philadelphia and Reading Railway (Etats-Unis).
Alexander Izat, C.I.E., Bengal and North Western Railway (Indes anglaises).
Jegou D'Herbeline, Chemin de fer de Paris à Orléans (France).
Robert Job, Philadelphia and Reading Railway (Etats-Unis).
John Johnson, Chemin de fer de Frövi-Ludvika and Banghammar-Kloten (Suède).
L. E. Johnson, Norfolk and Western Railway (Etats-Unis).
Thomas H. Johnson, Pennsylvannia Lines, West of Pittsburgh (Etats-Unis).
V. A. Juul, Chemins de fer de l'Etat (Danemark).
H. G. Kelley, Minneapolis and St. Louis Railroad (Etats-Unis).
A. V. Kellogg, Southern Pacific Company (Etats-Unis).
G. H. Kimball, Chicago and Alton Railway (Etats-Unis).
H. C. King, Great Western Railway (Grande-Bretagne).
C. E. Knickerbrocker, New York, Ontario and Western Railway (Etats-Unis).
Jean Kologrivoff, Ministère des voies de communication (Russie).
Jozeph de Kotz, Chemins de fer unis d'Arad and Csanad (Hongrie).
J. Kruttschnitt, Southern Pacific Company (Etats-Unis).
Peter F. Kupka, Chemin de fer Nord Empereur Ferdinand (Autriche).
Hon. C. N. Lawrence, London and North Western Railway (Grande-Bretagne).
Alexander R. Lawton, Central of Georgia Railway (Etats-Unis).
Le Grain, Chemins de fer de l'Etat (France).
Harald Gemke, Chemins de fer de l'Etat (Suède).
L. F. Loree, Commission permanente du Congrès.
G. E. Louth, Great Western Railway (Grande-Bretagne).
A. Lovell, Atchison, Topeka, and Santa Fe Railway (Etats-Unis).
D. W. Lum, Southern Railway (Etats-Unis).
H. P. Maas-Geesteranus, Chemin de fer Hollandais (Pays-Bas).
E. Maristany, Chemins de fer de Madrid à Saragosse et à Alicante (Espagne).
F. H. McGuigan, Grand Trunk Railway (Canada).
B. McKeen, Terre Houte and Indianapolis Railroad Lines (Etats-Unis).
W. McNab, Grand Trunk Railway (Canada).
D. McNicoll, Canadian Pacific Railway.
William Melville, Glasgow and South Western Railway (Grande-Bretagne).
Ferreira de Mesquita, Cie royale des chemins de fer portugais.
Hon. Victor Howard Metcalf, Department of State (United States of America).
Mikhailoff, Sté de Moscou pour la construction et l'exploitation des voies latérales ferrées en Russie.
Curtis Willard, Chicago, Peoria, and St. Louis Railway (Etats-Unis).
W. H. Mills, Great Northern Railway (Irlande).
Eugéne Mirabaud, Chemin de fer de Gafsa (Tunisie).
T. S. Moise, Central of Georgia Railway (Etats-Unis).
F. W. Morse, Grand Trunk Railway (Canada).
S. Thornley Mott, City and South London Railway (Grande-Bretagne).
W. E. Mullins, Central Vermont Railway (Etats-Unis).
Djelal Munif, Bey, Ministére du commerce et des travaux publics (Turquie).
Muntz, Chemins de fer de l'Est (France).
A. C. Needles, Norfolk and Western Railway (Etats-Unis).

J. B. Nicholson, Cincinnati, New Orléans and Texas Pacific Railway (Etats-Unis).
D. Nishi, Ministère des communications (Japon).
W. C. Nixon, Atchison, Topeka, and Santa Fe Railway (Etats-Unis).
Jos. O. Osgood, Central Railroad of New Jersey (Etats-Unis).
C. S. R. Palmer, Western Australia Government Railways.
Frederick Palmer, East Indian Railway (Indes anglaises).
Ramon Peironcely, Chemins de fer de Madrid à Saragosse et à Alicante (Espagne).
Ralp Peters, Long Island Railroad (Etats-Unis).
Ingemar Petersson, Chemins de fer de l'Etat Suède).
François Pfeuffer, Sté Autrichienne hongroise privilégiée des chemins de fer de l'Etat (Autriche).
A. H. Plant, Southern Railway (Etas-Unis).
Pontzen, Ministère des travaux publics (France).
Rabut, Chemins de fer de l'Ouest (France).
Jos. Ramsey, jun., Wabash Railroad (Etats-Unis).
John P. Ramsey, Chicago, Peoria, and St. Louis Railway of Illinois (Etats-Unis).
D. C. Rattray, Lancashire and Yorkshire Railway (Grande-Bretagne).
Antonio Ravaioli, Ministère des travaux publics (Italie).
J. W. Renner, Pennsylvannia Lines, West of Pittsburgh (Etats-Unis).
M. Riebenack, Pennsylvannia Railroad (Etats-Unis).
Jason Rigby, M.I.C.E., Buenos Ayres Great Southern Railway (République Argentine).
Thomas Rodd, Pennsylvannia Lines, West of Pittsburgh (Etats-Unis).
M. Romniceano, Ministère des travaux publics et chemins de fer de l'Etat (Roumanie).
Thomas Ronayne, Agent-General for New Zealand in London and New Zealand Government Railways.
John Rowlandson, Great Central and Midland Joint Committee (Grande-Bretagne).
Sabouret, Chemins de fer de l'Ouest (France).
Richard Sarre, Gouvernement allemand.
J. M. Schoonmaker, Pittsburgh and Lake Erie Railroad (Etats-Unis).
Professor Hermann von Schrenck, Ilinois Central Railroad (Etats-Unis).
J. Schrœder van Kolk, Ministère du Waterstaat, du Commerce et de l'Industrie (Pays-Bas).
S. B. Schuyler, Missouri Pacific Railway (Etats-Unis).
Sejourne, Chemins de fer de Paris à Lyon et à la Méditerranée (France).
D. B. Sevostianoff, Chemins de fer Sud-Est russes.
H. J. Simmons, El Paso and Southwestern Railroad (Etats-Unis).
Willard A. Smith, Department of State, United States of America.
Captain L. Victor Stahle, Chemin de fer Stockholm-Rimbo (Suède).
A. Stewart, Southern Railway (Etats-Unis).
Stieltjes, Ministère du Waterstaat, du Commerce et de l'Industrie (Pays-Bas).
Strapp, Commission permanente du Congrés.
J. C. Stuart, Erie Railroad (Etats-Unis).
Col. James L. Taylor, Commission permanente du Congrès.
H. J. Thompson, Madras Railway (Indes anglaises).
Tolstopiatoff, chemins de fer de l'Empire russe (Ligne de Moscou-Yaroslaw-Arkhangelsk).
F. J. des Tombe, Cie pour l'exploitation des chemins de fer de l'Etat néerlandais.
R. Trimble, Pennsylvania Lines, West of Pittsburgh (Etats-Unis).
L. H. Turner, Pittsburgh and Lake Erie Railroad (Etats-Unis).
Van Bogaert, Ministère des chemins de fer, postes et télégraphes et chemins de fer de l'Etat (Belgique).
Manuel da Terra Pereira Vianna, Chemins de fer de l'Etat (colonies portugaises).
Theo. Voorhees, Philadelphia and Reading Railway (Etats-Unis).
C. G. Waldo, Commission permanente du Congrès.
J. H. Walsh, Quebec Central Railway (Canada).
H. S. Waterman, Detroit and Mackinac Railway (Etats-Unis).
Louis Weissenbruch, Ministère des chemins de fer, postes et télégraphes et chemins de fer de l'Etat (Belgique).
P. v. d. Wetering, Tramways, néerlandais (Pays-Bas).
Sten Hjalmar Sigurd Wikland, Chemins de fer de l'Etat (Suède).
B. L. Winchell, Chicago, Rock Island, and Pacific Railway (Etats-Unis).
Serafin S. Wither, Ministère des travaux publics (Equateur).
A. A. Woods, Queen and Crescent Route (Etats-Unis).
F. G. Wright, Great Western Railway (Grande-Bretagne).
J. B. Yohe, Pittsburgh and Lake Erie Railroad (Etats-Unis).
Lieut.-Colonel H. A. Yorke, R.E., C.B., Board of Trade (Grande-Bretagne).
W. D. Young, Baltimore and Ohio Railroad (Etats-Unis).
J. Zagorski, Ministère des travaux publics, voies et communications et chemins de fer de l'Etat (Bulgarie).

SECTION 2.

A. Agathodes, Chemins de fer Pirée-Athènes-Péloponèse (Grèce).
F. H. Alfred, Pere Marquette Railroad (Etats-Unis).
W. F. Allen, American Railway Association (Etats-Unis).
G. A. Anderson, Under-Secretary of State for India (Indes anglaises).
Charles Johnstone Armstrong, Central South Africa Railways.
W. C. Arp, Terre Haute and Indianapolis Railroad Lines (Etats-Unis).

John A. F. Aspinall, Lancashire and Yorkshire Railway (Grande-Bretagne).
Asselin, Chemin de fer du Nord (France).
Franz Baltzer, Gouvernement Allemand et Chemins de fer de l'Etat prussien.
Bauchal, Chemins de fer de l'Ouest (France).
Baume, Ministère des travaux publics (France).
Daniel Berthelot, Chemins de fer économiques du Nord (France).
Ch. Geo. Betts, Cremins de fer Stockholm-Vesteras-Bergslagens (Suède).
G. F. Bidwell, Chicago and North Western Railway (Etats-Unis).
Boell, Chemins de fer de l'Etat (France).
A. C. Bonsor, South Eastern and Chatham Railway (England).
Charles W. Bradley, American Railway Association (Etats-Unis).
Brisse, Chemins de fer de l'Est (France).
H. D. Bulkley, Baltimore and Ohio Railroad (Etats-Unis d'Amérique).
C. Burk, Great Eastern Railway (Grande-Bretagne).
O. F. A. Busse, Chemins de fer de l'Etat (Danemark).
John Byrne, Pittsburgh, Shawmut, and Northern Railroad (Etats-Unis).
George H. Campbell, Staten Island Rapid Transit Railway (Etats-Unis).
D. Eduardo Canizares y Mayano, Ministère du formento (Espagne).
Lius Alberto Carbo, Ministère des travaux publics (Equateur).
Carcanagues, Chemins de fer de Paris à Lyon et à la Méditerranée (France).
Evelyn Cecil, M.P., London and South Western Railway (Grande-Bretagne).
Charpy, Chemins de fer de Paris à Lyon et à la Méditerranée (France).
Charles S. Churchill, Norfolk and Western Railway (Etats-Unis).
F. H. Clark, Chicago, Burlington, and Quincy Railway (Etats Unis).
William H. Clark, Secrétariat d'Etat des Etats-Unis d'Amérique.
Charles S. Clarke, Missouri Pacific Railway (Etats-Unis).
A. G. Cochran, Missouri Pacific Railway (Etats-Unis).
Collin, Chemin de fer du Nord (France).
Colonel W. V. Constable, R.E., Southern Malviatta Railway (Indes anglaises).
David Cooper, Glasgow and South Western Railway (Grande-Bretagne).
Axel Rudolph Corin, Ministère de l'intérieur et chemins de fer de l'Etat (Suède).
D. F. Crawford, Pennsylvannia Lines, West of Pittsburgh (Etats-Unis).
J. P. Crouch, Lancashire an Yorkshire Railway (Grande-Britagne).
E. B. Cushing, Southern Pacific Company (Etats-Unis).
J. F. Deems, New York Central and Hudson River Railroad (Etats-Unis).
E. R. Dolby, Commission permanente du Congrès.
W. C. Downing, Terre Houte and Indianapolis Railroad Lines (Etats-Unis).
Ch. Dragu, Ministère des travause publics et chemins de fer de l'Etat (Roumanie).
Bugald Drummond, London and South Western Railway (Grande-Bretagne).
Dubois, Chemins de fer de l'Ouest (France).
P. H. Dudley, New York Central and Hudson River Railroad (Etats-Unis).
Robert Eder, Chemin de fer Kaschau-Oderberg (Hongrie).
Henri d'Eichthal, Chemins de fer de l'Ouest (Algérien).
John E. Fairbanks, Commission permanente du Congrès.
L. B. Ferguson, Queen and Crescent Route (Etats-Unis).
Aristides Ferandez Mathews, Ministère du fomento (Espagne).
E. H. Fitzhugh, Grand Trunk Railway (Canada).
Flobert, Chemins de fer du Nord de l'Espagne.
W. E. Fowler, Canadian Pacific Railway.
James Fraser, Agent-General for New South Wales in London et New South Wales Government Railways.
H. W. Fuller, Chesapeake and Ohio Railway (Etats-Unis).
Lieut.-Colonel R. Gardiner, R.E., Madras Railway (Indes anglaises).
Ernest Gerard, Ministère des chemins de fer, postes et télégraphes et chemins de fer de l'État (Belgique), et Département des affairés etrangères (Congo).
Alfred W. Gibbs, Pennsylvannia Railroad (Etats-Unis).
E. B. Gilbert, Bessemer and Lake Erie Railroad (Etats-Unis).
L. G. Haas, Baltimore and Ohio Railroad (Etats-Unis).
J. F. Harahan, Illinois Central Railroad (Etats-Unis).
Charles M. Hays, Grand Trunk Railway (Canada).
Joseph Hobson, Grand Trunk Railway (Canada).
Hodeige, Ministère des chemins de fer, postes et télégraphes et chemins de fer de l'Etat (Belgique).
P. Homere, Ministère de l'intérieur (Grèce).
George Hughes, Lancashire and Yorkshire Railway (Grande-Bretagne).
W. H. Hyde, Great Eastern Railway (Grande-Bretagne).
Charles Jenny, chemins de fer du Sud de l'Autriche.
John Johnson, chemin de fer de Frovi-Ludvikav Banghammar-Kloten (Suède).
L. E. Johnson, Norfolk and Western Railway (Etats-Unis).
L. Rouët de Journel, Chemins de fer de Madrid à Alicante (Espagne).
H. G. Kelley, Minneapolis and St. Louis Railroad (Etats-Unis).
J. W. Kendrix, Atchison, Topeka, and Santa Fe Railway (Etats-Unis).
G. H. Kimball, Chicago and Alton Railway (Etats-Unis).
H. C. King, Great Western Railway (Grande-Bretagne).
Victor Leonard Klemming, Ministère de l'intérieur et chemins de fer de l'Etat (Suède).

Peter K. Kupka, Chemin de fer Nord Empereur Ferdinand (Autriche).
Laurent, Chemin de fer de Paris à Orléans (France).
Hon. C. N. Lawrence, London and North Western Railway (Grande-Bretagne).
Max Elder von Leber, Ministère T. R. des chemins de fer (Autriche).
Arthur Leeder, Chemins de fer de l'Etat (Autriche).
W. H. Lewis, Norfolk and Western Raliway (Etats-Unis).
Erwin Lihotzky, Sté Autrichienne-Longroise privilégiée des chemins de fer de l'Etat (Autriche).
Le chevalier von Loehr, Chemin de fer Nord Empereur Ferdinand and Chemin de fer Vienne-Aspang (Autriche).
G. E. Louth, Great Western Railway (Grande-Bretagne).
A. Lovell, Atchison, Topeko, and Santa Fe Railway (Etats-Unis).
G. S. McKee, Mobile and Ohio Railway (Etats-Unis).
Malcoln Bowman, Midland Railway (Northern Counties Committee), (Grande-Bretagne).
J. H. Manning, Delaware and Hudson Company (Etats-Unis).
G. J. de Marez Oyens, Sté du chemin de fer Central Neérlandais.
Margot, Chemins de fer Paris-Lyon-Méditerranée (France).
D. B. Martin, Baltimore and Ohio Railroad (Etats-Unis, d'Amerique).
J. P. McCuen, Cincinnati New Orleans and Texas Pacific Railway (Etats-Unis).
F. H. McGuigan, Grand Trunk Railway (Canada).
W. McIntosh, Central Railroad of New Jersey (Etats-Unis).
B. McKeen, Terre Haute and Indianapolis Railroad Lines (Etats-Unis).
C. S. McManus, Southern Railway (Etats-Unis).
D. McNicoll, Canadian Pacific Railway.
Ferreira de Mesquita, Cie royale des chemins de fer portugais.
Hon. Victor Howard Metcalf, Department of State (United States of America).
W. H. Mills, Great Northern Railway (Irlande).
A. E. Mitchell, Lehigh Valley Railroad (Etats-Unis).
Moffre, Chemins de fer du N'Cidi (France).
E. S. Moise, Central of Georgia Railway (Etats-Unis).
F. W. Morse, Grand Trunk Railway (Canada).
C. P. Mossop, North Eastern Railway (Grande Bretagne).
J. E. Muhlfeld, Baltimore and Ohio Railroad (Etats-Unis).
Muntz, Chemins de fer de l'Est (France).
A. C. Needles, Norfolk and Western Railway (Etats-Unis).
S. Nishi, Ministère des communications (Japon).
W. C. Nixon, Atchison, Topeka, and Santa Fe Railway (Etats-Unis).
Nordman, Chemins de fer de l'Etat (Finlande).
H. Blaise Ombrecht, Chemins de fer de Madrid à Sarragosse et à Alicante (Espagne).
J. R. Onderdonk, Baltimore and Ohio Railroad (Etats-Unis).
Guiseppe Ottone, Chemin de fer de la Sicile occidentale (Italie).
Sir Charles J. Owens, London and South Western Railway (Grande-Bretagne).
C. S. R. Palmer, Western Australia Government Railways.
F. Paul-Dubois, Chemin de fer Paris-Orléans (France).
F. W. H. Pegelow, Chemins de fer Stockholm-Vesteras-Bergslagens (Suède).
Ralph Peters, Long Island Railroad (Etats-Unis).
A. Pilkington, Madras Railway (Indes anglaises).
A. H. Plant, Southern Railway (Etats-Unis).
Pontzen, Ministère des travaux publics (France).
Robert P. Porter, Cuban Central Railways.
A. W. Quackenbush, Quincy, Omaha, and Kansas City Railroad (Etats-Unis).
Jos. Ramsey, jun., Wabash Railroad (Etats-Unis).
J. W. Rener, Pennsylvania Lines West of Pittsburg (Etats-Unis).
M. Riebenack, Pennsylvania Railroad (Etats-Unis).
A. E. Robbins, Wabash Railroad (Etats-Unis).
Giuseppe Robbo, Chemin de fer de la Sicile (Italie).
Guido Robbo, Chemin de fer de la Sicile occidentale (Italie).
Charles H. Rockwell, Chicago, Indianapolis, and Louisville Railway (Etats-Unis).
Thomas Ronayne, Agent-General for New Zealand in London and New Zealand Government Railways.
Jozef Rybak, Chemins de fer de l'Etat (Autriche).
E. G. Ryder, Commission permanente de Congrès.
Sabouret, Chemins de fer de l'Ouest (France).
R. P. C. Sanderson, Seaboard Air Line Railway (Etats-Unis).
Edouard Sauvage, Chemins de fer de l'Ouest (France).
J. M. Schoonmaker, Pittsburgh and Lake Erie Railroad (Etats-Unis).
Professor Hermann von Schrenck, Illinois Central Railroad (Etats-Unis).
Dr. Friedrich Schultz, Gouvernement Allemain.
S. B. Schuyler, Missouri Pacific Railway (Etats-Unis).
D. B. Sevostianoff, Chemins de fer Sud-Est russes.
Fr. Sieges, Cu auxiliarie internationale de chemins de fer (Belgique).
M. Wenceslas Sierra, Ministère de l'industrie, des tramways publics et de la colonisation (Chili).
José Joaquin da Silva Freire, Estrado de Fero Central de Brazil (Brésil).
R. E. Smith, Atlantic Coast Line Railroad (Etats-Unis).

Alexandre Sopkez, Ministère du commerce (Hongrie).
D. E. Spangler, Norfolk and Western Railway (Etats-Unis).
Capt. L. Viktor Stahle, Chemin de fer Stockholm-Rimbo (Suède).
Karl Steinbiss, Gouvernement Allemand et chemins de fer de l'Etat prussien.
A. Stewart, Southern Railway (Etats-Unis).
S. S. Stiffey, Hocking Valley Railway (Etats-Unis).
W. B. Stimson, Grand Rapids and Indiana Railway (Etats-Unis).
A. J. Stone, Delaware and Hudson Company (Etats-Unis).
Strapp, Commission permanente du Congrès.
J. C. Stuart, Erie Railroad (Etats-Unis).
Ernest Szlabcy, Chemins de fer de l'Etat (Hongrie).
De Cavernier, Chemins de fer économiques du Nord (France).
B. E. Taylor, Chicago, Indianapolis, and Louisville Railway (Etats-Unis).
H. D. Taylor, Philadelphia and Reading Railway (Etats-Unis).
Terraillon, Chemins de fer du Nord de l'Espagne.
Cheoktistoff, Ste de Moscou pour la construction et l'exploitation des voies latérales ferrées en Russie.
Cordeux, Chemins de fer de l'Est (France).
L. H. Turner, Pittsburgh and Lake Erie Railroad (Etats-Unis).
Cornelius Vanderbilt, Illinois Central Railroad (Etats-Unis).
J. J. W. Van Goenen Martinet, Chemin de fer Hollandais (Pays-Bras).
H. H. Vaughan, Canadian Pacific Railway.
Vuylsteke, Commission permanente du Congrès.
C. G. Waldo, Commission permanente du Congrès.
Max Weiss, Chemin de fer fédéraux (Suisse).
G. Whale, London and North Western Railway (Grande-Bretagne).
Wickersheimer, Chemins de fer de l'Etat (France).
G. W. Wilden, Erie Railroad (Etats-Unis).
F. G. Wright, Great Western Railway (Grande-Bretagne).
L. E. H. Yates, North Western Railway (Indes anglaises).
J. B. Yohe, Pittsburgh and Lake Erie Railroad (Etats-Unis).
Lieut.-Colonel H. A. Yorke, R.E., C.B., Board of Trade (Grande-Bretagne).
W. R. Young, Baltimore and Ohio Railroad (Etats-Unis).

SECTION 3.

C. H. Ackert, Southern Railway (Etats-Unis).
C. B. Adams, Wabash Railroad (Etats-Unis).
C. Aldington, Great Western Railway (Grande-Bretagne).
Eduardo Alfonso, Chemins de fer de Madrid à Saragosse et à Alicante (Espagne).
F. H. Alfred, Pere Marquette Railroad (Etats-Unis).
W. F. Allen, American Railway Association (Etats-Unis).
René Lévi Alveres, Chemins de fer der Madrid à Saragosse et à Alicante (Espagne).
G. C. C. Ambt, Ministère de l'interieur et des travaux publics et chemins de fer de l'Etat (Danemark).
Rafael Angerlo, Chemins de fer du Nord de l'Espagne.
C. W. Appleyard, Central South Africa Government Railways.
Sir George Armytage, Lancashire and Yorkshire (Grande-Bretagne).
W. C. Arp, Terre Haute and Indianapolis Railroad Lines (Etats-Unis).
E. B. Ashby, Lehigh Valley Railroad (Etats-Unis).
John A. F. Aspinall, Lancashire and Yorkshire Railway (Grande-Bretagne).
W. W. Otterbury, Pennsylvannia Railroad (Etats-Unis).
Auvert, Chemins de fer de Paris à Lyon et à la Méditerranée (France).
Franz Balzer, gouvernement allemand et chemins de fer de l'Etat (prussien).
Frank Barr, Boston and Maine Railroad (Etats-Unis).
John N. Beckley, Toronto, Hamilton, and Buffalo Railway (Etats-Unis).
G. F. Bidwell, Chicago and Northwestern Railway (Etats-Unis).
Bleynie, Chemins de fer du Midi (France).
Félix Boix, Chemins de fer du Nord de l'Espagne.
Boure, Chemins de fer de Paris à Lyon et à la Méditerranée (France).
W. H. Bower, Coal and Coke Railway Company (Etats-Unis).
Charles W. Bradley, American Railway Association (Etats-Unis).
J. H. Bradley, Commission permanente du Congrés.
Santiago Brian, Buenos Ayres Western Railway (République Argentine).
W. G. Brimson, Quincy, Omaha, and Kansas City Railroad (Etats-Unis).
Brisse, Chemins de fer de l'Est (France).
C. A. Brunn, Erie Railroad (Etats-Unis).
H. D. Bulkley, Baltimore and Ohio Railroad (Etats-Unis d'Amérique).
E. H. Burrows, Great Northern Railway (Grande-Bretagne).
H. P. Burt, Oudh and Rohilkhand Railway (Indes anglaises).
C. Busk, Great Eastern Railway (Grande-Bretagne).
O. F. A. Russe, Chemins de fer de l'Etat (Danemark).
Cartault, Chemins de fer de Paris à Lyon et à la Méditerranée (France).
Evelyn Cecil, M.P., London and South Western Railway (Grande-Bretagne).
J. E. Charnley, Lancashire and Yorkshire Railway (Grande-Bretagne).
Charpy, Chemins de fer de Paris à Lyon et à la Méditerranée (France).

Charles S. Churchill, Norfolk and Western Railway (Etats-Unis).
F. H. Clark, Chicago, Burlington, and Quincy Railway (Etats-Unis).
Charles S. Clarke, Missouri Pacific Railway (Etats-Unis).
Edwin Arnold Clear, Great Central Railway (Grande-Bretagne).
William Clow, Great Central Railway (Grande-Bretagne).
H. P. Coates, Uruguay Western Railway and Post Company (Uruguay).
A. G. Cochran, Missouri Pacific Railway (Etats-Unis).
Collot, Chemin de fer deceinture de Paris (France).
M. S. Connors, Hocking Valley Railway (Etats-Unis).
Colonel W. V. Constable, R.E., Southern Mahratta Railway (Indes anglaises).
David Cooper, Glasgow and South Western Railway (Grande-Bretagne).
Axel Reudoff Corin, Ministère de l'intérieur et chemins de fer de l'Etat (Suède).
Ernest Correvon, Chemin de fer à crémaillère de Viège à Zermatt et chemin de fer d'Yverdon à Ste Croix (Suisse).
Lieut.-Colonel C. H. Cowie, R.E., North Western Railway (Indes anglaises).
Joseph Crawford, American Railway Association (Etats-Unis).
E. B. Cushing, Southern Pacific Company (Etats-Unis).
George H. Daniels, New York Central and Hudson River Railroad (Etats-Unis).
E. L. Davis, North Eastern Railway (Grande-Bretagne).
A. F. Rice, Philadelphia and Reading Railway (Etats-Unis).
A. Douglas, St. Louis and San Francisco Railroad (Etats-Unis).
Donald Bell Downie, Agent-General for Natal in London and Natal Government Railways (Natal).
W. C. Downing, Terre Haute and Indianapolis Railroad Lines (Etats-Unis).
C. E. Doyle, Chesapeake and Ohio Railway (Etats-Unis).
Dreyfus, Chemins de fer de Paris à Lyon et à la Méditerranée (France).
William A. Dring, East Indian Railway (Indes anglaises).
Dugald Drummond, London and South Western Railway (Grande-Bretagne).
Dubois, Chemins de fer de l'Ouest (France).
C. B. Dudley, Pennsylvania Railroad (Etats-Unis).
P. H. Dudley, New York Central and Hudson River Railroad (Etats-Unis).
L. H. N. Dufour, Cie pour l'exploitation des chemins de fer de l'Etat Néerlandais (Pays-Bas).
Bento Fortunato de Moura Continho d'Almeida d'Eca, Ministère des travaux publics, du Commerce et de l'industrie (Portugal).
William D'Eichthal, Chemins de fer d'intérêt local du département des Landes (France).
Sir Charles B. Euan-Smith, K.C.B., C.S.T., Buenos Ayres Great Southern Railway (République Argentine).
John E. Fairbanks, Commission permanente du Congrès.
R. Fane-de-Salis, North Staffordshire Railway (Grande-Bretagne).
Aristides Fernandez-Mathews, Ministère du fomento (Espagne).
J. M. Ferris, Hocking Valley Railway (Etats-Unis).
E. H. Fitzhugh, Grand Trunk Railway (Canada).
Fontaneilles, Ministère des travaux publics (France).
Garcey, Compagnie internationale des wagonslits et des grands express européens (Belgique).
Lieut.-Colonel R. Gardiner, R.E., Madras Railway (Indes anglaises).
W. A. Garrett, Cincinnati, New Orleans, and Texas Pacific Railway (Etats-Unis).
E. B. Gilbert, Bessemer and Lake Erie Railroad (Etats-Unis).
C. A. Goodnow, Chicago and Alton Railway (Etats-Unis).
W. McC. Grafton, Terre Haute and Indianapolis Railroad Lines (Etats-Unis).
C. E. Grasemann, London and North Western Railway (Grande-Bretagne).
W. M. Greene, Baltimore and Ohio Southwestern Railroad (Etats-Unis d'Amérique).
Major William Morton Grinnell, Illinois Central Railroad (Etats-Unis).
H. F. Guichart, Tramways de Rotterdam (Pays-Bas).
Arthur Hale, Baltimore and Ohio Railroad (Etats-Unis).
Fairfax Harrison, Southern Railway (Etats-Unis).
H. C. Hodgson, Midland Railway (Grande-Bretagne).
Hon. A. H. Holland-Hibbert, London and North Western Railway (Grande-Bretagne).
W. W. Hoy, Central South Africa Government Railways.
Y. H. P. Hughart, Grand Rapids and Indiana Railway (Etats-Unis).
William Hunter, Philadelphia and Reading Railway (Etats-Unis).
C. W. Huntington, Central Railroad of New Jersey (Etats-Unis).
W. H. Hyde, Great Eastern Railway (Grande-Bretagne).
Alexander Tzat, C.T.E., Bengal et North Western Railway (Indes anglaises).
Samuel R. Jaques, Central of Georgia Railway (Etats-Unis).
E. T. Jeffery, Denver and Rio Grande Railroad (Etats-Unis).
Charles Jenny, Chemins de fer du Sud de l'Autriche.
A. W. Johnston, New York, Chicago, and St. Louis Railroad (Etats-Unis).
John Johnson, Chemin de fer de Frovi-Ludvika et Banghammar-Kloten (Suède).
L. E. Johnson, Norfolk and Western Railway (Etats-Unis).
G. C. Jones, Central Vermont Railway (Etats-Unis).
T. M. F. C. Yorissen, Chemin de fer Hollandais (Pays-Bas).
George Robert Youghins, Département des chemins de fer et aunaux du Dominion du Canada.
L. Rouët de Journal, Chemins de fer de Madrid à Saragosse et à Alicante (Espagne).
V. A. Juul, Chemins de fer de l'Etat (Danemark).
H. G. Kelley, Minneapolis and St. Louis Railroad (Etats-Unis).

J. W. Kendrick, Atchison, Topeko, and Santa Fe Railway (Etats-Unis).
G. H. Kimball, Chicago and Alton Railway (Etats-Unis).
Y. Kinoshita, Ministère des communications (Japon).
Joseph de Kotz, Chemins de fer unis d'Arad and Csanad (Kongrie).
C. A. Lambert, North Eastern Railway (Grande-Bretagne).
Hon. C. M. Lawrence, London and North Western Railway (Grande-Bretagne).
Harald Lemke, Chemins de fer de l'Etat (Suède).
Erwin Lihotzky, Sté Autrichienne Longroise privilégicé des chemins de fer de l'Etat (Autriche).
Le Dr. Antonio José Gomes Lima, Cie Nationale des chemins de fer portugais.
Alfredo Loewy, Chemins de fer de Madrid à Cacérès et Portugal et de l'Ouest de l'Espagne.
L. F. Loree, Commission permanente du Congrès.
George K. Lowell, Chicago, Indianapolis, and Louisville Railway (Etats-Unis).
Paget Vyvyan Luke, Isle of Man Railway (Grande-Bretagne).
James MacMartin, Delaware and Hudson Company (Etats-Unis).
Bowman Malcolm, Midland Railway (Northern Counties Committee), (Grande-Bretagne).
Mange, Chemin de fer Paris-Orléans (France).
Margot, Chemins de fer Paris-Lyon-Meditérranée (France).
Lionel Marie, Chemines de fer du Nord français (lignes Nord belges), (Belgique).
E. Maristany, Chemins de fer de Madrid à Saragosse et à Alicante (Espagne).
Colonel E. L. Marryat, Bengal and North Western Railway (Indes anglaises).
D. B. Martin, Baltimore and Ohio Railway (Etats-Unis d'Amerique).
James McCrea, Pennslyvannia Lines West of Pittsburg (Etats-Unis).
J. P. McCuen, Cincinnati, New Orleans, and Texas Pacific Railway (Etats-Unis).
F. H. McGuigan, Grand Trunk Railway (Canada).
B. McKeen, Terre Haute and Indianapolis Railroad Lines (Etats-Unis).
D. McNicoll, Canadian Pacific Railway.
William Melville, Glasgow and South Western Railway (Grande-Bretagne).
Jn. Js. Mercier-de-Molin, Chemin de fer de Lansanne à Ouchy (Suisse).
Hon. Victor Howard Metcalf, Department of State (United States of America).
Curtis Millard, Chicago, Peoria, and St. Louis Railway (Etats-Unis).
Eugène Mirabaud, Chemin de fer de Gafsa (Cunisie).
A. E. Mitchell, Lehigh Valley Railroad (Etats-Unis).
Le baron Hampus Erik Morner, Chemins de fer de l'Etat (Suède).
F. W. Morse, Grand Trunk Railway (Canada).
Hon. Paul Morton, Department of State (United States of America).
C. P. Mossop, North Eastern Railway (Grande-Bretagne).
Sir Francis Mowatt, G.C.B., Board of Trade et Great Northern Railway (Grande-Bretagne).
H. U. Mudge, Atchison, Topeka, and Santa Fe Railway (Etats-Unis).
J. E. Muhlfeld, Baltimore and Ohio Railroad (Etats-Unis).
W. E. Mullins, Central Vermont Railway (Etats-Unis).
A. C. Needles, Norfolk and Western Railway (Etats-Unis).
W. H. Nettelmann, Commission permanente du Congrès.
J. R. Onderdouk, Baltimore and Ohio Railroad (Etats-Unis).
Jos. O. Osgood, Central Railroad of New Jersey (Etats-Unis).
Giuseppe Ottone, Chemin de fer de la Sicile occidentale (Italie).
Sir Charles J. Owens, London and South Western Railway (Grande-Bretagne).
C. S. R. Palmer, Western Australia Government Railways.
Frederick Palmer, East Indian Railway (Indes anglaises).
F. Paul-Dubois, Chemin de fer Paris-Orléans (France).
J. R. Peachy, Commission permanente du Congrès.
Jean Pchar, Cie d'exploitation des chemins de fer Orientaux (Turquie).
George L. Peck, Pennsylvannia Lines West of Pittsburg (Etats-Unis).
F. W. H. Pegelow, Chemins de fer Stockholm-Vesteras-Bergslagens (Suède).
Ramon Peironcely, Chemins de fer Madrid à Sarragosse et à Alicante (Espagne).
De Pellerin de Latouche, Chemins de fer de Paris à Lyon et à la Méditerranée (France).
Perouse, Ministère des travaux publics (France).
Ralph Peters, Long Island Railroad (Etats-Unis).
Franz Petri, Gouvernement allemand.
Pieron, Chemin de fer du Nord (France).
A. Pilkington, Madras Railway (Indes anglaises).
A. H. Plant, Southern Railway (Etats-Unis).
C. H. Platt, Commission permanente du Congrès.
Pontzen, Ministère des travaux publics (France).
John P. Ramsey, Chicago, Peoria, and St. Louis Railway of Illinois (Etats-Unis).
Georg Rank, Chemins de fer de l'Etat (Autriche).
J. N. Redfern, Chicago, Burlington, and Quincy Railway (Etats-Unis).
T. H. Rendell, Great Western Railway (Grande-Bretagne).
J. W. Renner, Pennsylvania Lines West of Pittsburg (Etats-Unis).
F. C. Rice, Chicago, Burlington, and Quincy Railway (Etats-Unis).
M. Riebenack, Pennslyvania Railroad (Etats-Unis).
Jason Rigby, M.T.C.E., Buenos Ayres Great Southern Railway (République Argentine).
A. E. Robins, Wabash Railraod (Etats-Unis).
Guido Robbo, Chemin de fer de la Sicile Occidentale (Italie).
Charles H. Rockwell, Chicago, Indianapolis, and Louisville Railway (Etats-Unis).

M. Romniceano, Ministère des travaux publics et chemins de fer de l'Etat (Roumanie).
Thomas Ronayne, Agent-General for New Zealand in London, and New Zealand Government Railways.
E. L. Russell, Mobile and Ohio Railway (Etats-Unis).
Jozef Rybak, Chemins de fer de l'Etat (Autriche).
Richard Sarre, Gouvernement allemand.
Felix Sartiaux, Chemin de fer du Nord (France).
Constantin Schaffhausen-Schonberg Ek. Schaufuss, Ministère de svoies de communication (Russie).
Charles H. Schlacks, Denver and Rio Grande Railroad (Etats-Unis).
Carlo Schneyder de Wartensce, Chemin de fer Verona-Caprino-Garda (Italie).
J. M. Schoonmaker, Pittsburg and Lake Erie Railroad (Etats-Unis).
A. M. Schoyer, Pennsylvannia Lines West of Pittsburg (Etats-Unis).
J. Schroeder Vander Kolk, Ministère du Waterstaat, du Commerce et de l'Industrie (Pays Bas).
Dr. Friedrich Schulz, Gouvernement allemand.
S. B. Schuyler, Missouri Pacific Railway (Etats-Unis).
Fr. Sieges, Cie auxiliaire internationale de chemins de fer (Belgique).
Guillaume Sieges, Chemin de fer Central de Aragon (Espagne).
W. M. Skinner, Commission permanente du Congrès.
Harry Cuff Smart, Railway Clearing House (Grande-Bretagne).
R. E. Smith, Atlantic Coast Line Railroad (Etats-Unis).
D. E. Spangler, Norfolk and Western Railway (Etats-Unis).
Capt. L. Viktor Stahle, Chemin de fer Stockholm-Rimbo (Suède).
Karl Steinbiss, Gouvernement allemand et chemin de fer de l'Etat prussien.
Wm. Stephan, Commission permanente due Congrès.
A. Stewart, Southern Railway (Etats-Unis).
David Stewart, Sligo, Leitrim, and Northern Counties of Railway (Grande-Bretagne).
Stieltjes, Ministère du Waterstaat du Commerce et de l'industrie (Pays-Bas).
Emile Stiffson, Chemins de fer de l'Etat (Hongrie).
A. J. Stone, Delaware and Hudson Company (Etats-Unis).
A. W. Sullivan, Missouri Pacific Railway (Etats-Unis).
Elias Sunde, Ministère des travaux publics et chemins de fer de l'Etat (Norvège).
B. E. Taylor, Chicago, Indianapolis, and Louisville Railway (Etats-Unis).
Cerraillon, Chemins de fer du Nord de l'Espagne.
Cheoktistoff, Sté de Moscou pour la construction et l'exploitation des voies latérales ferreés en Russie.
Cornel de Colnay, Chemins de fer de l'Etat (Hongrie).
G. G. Tunnell, Chicago and North Western Railway (Etats-Unis).
R. Turnbull, London and North Western Railway (Grande-Bretagne).
L. H. Turner, Pittsburg and Lake Erie Railroad (Etats-Unis).
R. van Hasselt, Chemin de fer hollodais (Pays-Bas).
Vanrusselt, Commission permanente du Congrès.
Verlant, Chemins de fer de Paris à Lyon et à la Méditerranée (France).
Villain, Ministère des travana publics (France).
Theo. Voorhees, Philadelphia and Reading Railway (Etats-Unis).
C. C. Walker, Chesapeake and Ohio Railway (Etats-Unis).
J. H. Walker, Quebec Central Railway, Canada.
J. M. Walker, America Railway Association (Etats-Unis).
H. S. Waterman, Detroit and Mackinac Railway (Etats-Unis).
Ralph Lewis Wedgwood, North Eastern Railway (Grande-Bretagne).
Max Weiss, Chemins de fer fédéraux (Suisse).
Louis Weissenbruch, Ministère des chemins de fer, postes et télégraphes et chemins de fer de l'Etat (Belgique).
Wickersheimer, Chemins de fer de l'Etat (France).
Hugh M. Wilson, Commission permanente du Congrès.
Alexander Wilson, North Eastern Railway (Grande-Bretagne).
B. L. Winchell, Chicago, Rock Island, and Pacific Railway (Etats-Unis).
Serafin S. Wither, Ministère des travaux publics (Equateur).
L. E. H. Yates, North Western Railway (Indes anglaises).
J. B. Yohe, Pittsburg and Lake Erie Railroad (Etats-Unis).
W. D. Young, Baltimore and Ohio Railroad (Etats-Unis).

SECTION 4.

C. H. Ackert, Southern Railway (Etats Unis).
W. M. Acworth, Board of Trade (Grande-Bretagne).
C. B. Adams, Wabash Railroad (Etats-Unis).
C. Aldington, Great Western Railway (Grande-Bretagne).
Edwin S. Allen, Commision permanente du Congrès.
W. F. Allen, American Railway Association (Etats-Unis).
R. Lévi Alvarez, Chemins de fer de Madrid à Saragosse et à Alicante (Espagne).
C. A. Anderson, Under-Secretary of State for India (Indes anglaises).
H. C. Ansley, Southern Railway (Etats-Unis).
C. W. Appleyard, Central South Africa Government Railways.
Aubert, Chemins de fer du Nord de l'Espagne.
Emile Auer, Chemin de fer du lac de Thoune (Suisse).

Auvert, Chemins de fer de Paris à Lyon et à la Méditerranée (France).
Le chevalier Friedrich von Bazant, Chemins de fer de l'Etat (Autriche).
W. G. Besler, Central Railroad of New York (Etats-Unis).
Bleynie, Chemins de fer du Midi (France).
Félix Boix, Chemins de fer du Nord de l'Espagne.
C. L. Bretz, Cumberland and Pennsylvania Railroad (Etats-Unis).
Santiago Brian, Buenos Ayres Western Railway (République Argentine).
W. J. Brimson, Quincy, Omaha, and Kansas City Railroad (Etats-Unis).
Brisse, Chemins de fer de l'Est (France).
H. D. Bulkley, Baltimore and Ohio Railroad (Etats-Unis d'Amérique).
E. H. Burrows, Great Northern Railway (Grande-Bretagne).
H. P. Burt, Oudh and Rohilkhand Railway (Indes anglaises).
C. Busk, Great Eastern Railway (Grande-Bretagne).
Luis Alberto Carbo, Ministère des trauvaux publics (Equateur).
D. D. Carothers, Baltimore and Ohio Railroad (Etats-Unis).
Evelyn Cecil, M.P., London and South Western Railway (Grande-Bretagne).
J. E. Charnley, Lancashire and Yorkshire Railway (Grande-Bretagne).
Charpy, Chemins de fer de Paris à Lyon et à la Méditerranée (France).
Hon. Clarence D. Clark, Department of State, United States of America.
C. B. Clark, Cleveland, Cincinnati, Chicago, and St. Louis Railway (Etats-Unis).
C. Peter Clark, Buffalo and Susquehanna Railroad (Etats-Unis).
William H. Clark, Secrétariat d'Etat des Etats-Unis d'Amérique.
Horace W. Clark, Mobile and Ohio Railroad (Etats-Unis).
T. E. Clarke, Delaware, Lackawanna, and Western Railroad (Etats-Unis).
Edwin Arnold Clear, Great Central Railway (Grande-Bretagne).
William Clow, Great Central Railway (Grande-Bretagne).
A. G. Cochran, Missouri Pacific Railway (Etats-Unis).
Rafael Coderch, chemins de fer de Madrid à Saragosse et à Alicante (Espagne).
David Cooper, Glasgow and South Western Railway (Grande-Bretagne).
F. Corcos, Commission permanente du Congrès.
Ernest Correvon, chemin de fer à crémaillère de Viège à Zermatt et chemin de fer d'Yverdon à Ste Croix (Suisse).
Lieut.-Colonel C. H. Cowie, R.E., North Western Railway (Indes anglaises).
W. F. Crane, El Paso and Southwestern Railroad (Etats-Unis).
J. P. Crough, Lancashire and Yorkshire Railway (Grande-Bretagne).
Abel I. Culver, Delaware and Hudson Company (Etats-Unis).
M. B. Cutter, Lehigh Valley Railroad (Etats-Unis).
Hon. James H. Davidson, Department of State, United States of America.
Henry G. Davis, Ministère du fomento (Pérou).
A. Douglas, St. Louis and San Francisco Railroad (Etats-Unis).
James Douglas, El Paso and Southwestern Railroad (Etats-Unis).
Donald Bell Downie, Agent-General for Natal in London and Natal Government Railways (Natal).
Th. Dragu, Ministère des travaux publics et chemins de fer de l'Etat (Roumanie).
William A. Dring, East Indian Railway (Indes anglaises).
Dubois, chemins de fer de l'Ouest (France).
P. H. Dudley, New York Central and Hudson River Railroad (Etats-Unis).
Eugène d'Eichthal, chemins de fer du Midi (France).
William d'Eichthal, chemins de fer d'intérêt local du département des Landes (France).
Edouard Elskes, chemins de fer fédéraux (Suisse).
Théodore N. Ely, Pennsylvania Railroad (Etats-Unis).
John E. Fairbanks, Commission permanente du Congrès.
R. Fane-de-Salis, North Staffordshire Railway (Grande-Bretagne).
Aug. Faure, Commission permanente du Congrès.
W. W. Finley, Southern Railway (Etats-Unis).
Stuyvesant Fish, Department of State; American Railway Association; Illinois Central Railroad (Etats-Unis).
E. Fisher, Toronto, Hamilton, and Buffalo Railway (Etats-Unis).
T. Fitzgerald, Baltimore and Ohio Railroad (Etats-Unis).
E. H. Fitzhugh, Grand Trunk Railway (Canada).
Flobert, Chemins de fer du Nord de l'Espagne.
Fontaneilles, Ministère des travaux publics (France).
R. Forrest, Barry Railway (Grande-Bretagne).
Gustav Franke, gouvernement allemand et Chemins de fer de l'Etat prussien.
H. W. Fuller, Chesapeake and Ohio Railway (Etats-Unis).
Garcey, Compagnie internationale des wagons-lits et des grands express européens (Belgique).
Lieut.-Colonel R. Gardiner, R.E., Madras Railway (Indes anglaises).
Amédée Gay, Chemins de fer de l'Ouest (France).
H. Gehrts, Ministère des travaux publics (Siam).
E. B. Gilbert, Bessemer and Lake Erie Railroad (Etats-Unis).
J. E. Gorman, Atchison, Topeka, and Santa Fe Railway (Etats-Unis).
George J. Gould, Missouri Pacific Railway and Wabash Railway (Etats-Unis).
C. E. Grasemann, London and North Western Railway (Grande-Bretagne).
J. E. Greiner, Baltimore and Ohio Railroad (Etats-Unis).
João Verissimo Mendes Guerreiro, Ministère des travaux publics du commerce et de l'industrie (Portugal).

J. Habran, Commission permanente du Congrès.
Arthur Hale, Baltimore and Ohio Railroad (Etats-Unis).
Russell Harding, Père Marquette Railroad (Etats-Unis).
Fairfax Harrison, Southern Railway (Etats-Unis).
C. C. Harvey, Queen and Crescent Route, (Etats-Unis).
F. T. Hatch, Terre Haute and Indianapolis Railroad Lines (Etats-Unis).
A. L. Hawley, El Paso and Southwestern Railroad (Etats-Unis).
Charles M. Hays, Grand Trunk Railway (Canada).
E. Heremans, Commission permanente du Congrès.
Charles Emile Heurteau, Ministère des travaux publics (France).
Emile Heurteau, Chemin de fer de Paris à Orléans (France).
George S. Hobbs, Maine Central Railroad (Etats-Unis).
Joseph Hobson, Grand Trunk Railway (Canada).
Hodeige, Ministère des chemins de fer, postes et télégraphes et chemins de fer de l'Etat (Belgique).
Edouard Holemans, Ministère des chemins de fer, postes et télégraphes et chemins de fer de l'Etat (Belgique).
W. W. Hoy, Central South Africa Government Railways.
T. J. Hudson, Illinois Central Railroad (Etats-Unis).
J. H. P. Hughart, Grand Rapids and Indiana Railway (Etats-Unis).
W. H. Hyde, Great Eastern Railway (Grande-Bretagne).
Samuel R. Jaques, Central of Georgia Railway (Etats-Unis).
E. T. Jeffery, Denver and Rio Grande Railroad (Etats-Unis).
L. E. Johnson, Norfolk and Western Railway (Etats-Unis).
G. C. Jones, Central Vermont Railway (Etats-Unis).
George Robert Joughins, Département des chemins de fer et canaux du Dominion du Canada.
V. A. Juul, Chemins de fer de l'Etat (Danemark).
Jean Kologrivoff, ministère des voies de communication (Russie).
Peter F. Kupka, chemin de fer Nord Empereur Ferdinand (Autriche).
C. A. Lambert, North Eastern Railway (Grande-Bretagne).
Hon. C. N. Lawrence, London and North Western Railway (Grande-Bretagne).
Alexander R. Lawton, Central of Georgia Railway (Etats-Unis).
Legrain, chemins de fer de l'Etat (France).
Harald Lemke, chemins de fer de l'Etat (Suède).
Guillaume Lers, ministère du commence (Hongrie).
Le chevalier von Loehr, chemin de fer Nord Empereur Ferdinand et chemin de fer Vienne-Aspang (Autriche).
Alfredo Loewy, chemins de fer de Madrid à Cacérès et Portugal et de l'Ouest de l'Espagne.
W. H. Macnamara, Board of Trade (Grande-Bretagne).
N. D. Maher, Norfolk and Western Railway (Etats-Unis).
Mange, chemin de fer Paris-Orléans (France).
Gaston Mankel, Commission permanente du Congrès.
Joseph Mankel, Commission permanente du Congrès.
Margot, chemins de fer Paris-Lyon-Méditerranée (France).
Lionel Marie, chemin de fer du Nord français, ligne Nord-Belges (Belgique).
D. B. Martin, Baltimore and Ohio Railroad (Etats-Unis d'Amérique).
Maruejouls, ministère des travaux publics (France).
F. H. McGuigan, Grand Trunk Railway (Canada).
B. McKeen, Terre Haute and Indianapolis Railroad Lines (Etats-Unis).
Hugh McLachlan, Agent-General for New South Wales in London, and New South Wales Government Railways.
W. McNab, Grand Trunk Railway (Canada).
D. McNicoll, Canadian Pacific Railway.
François Mentsik, ministère du commence (Hongrie).
Jn. Js. Mercier-de-Molin, chemin de fer de Lausanne à Ouchy (Suisse).
Hon. Victor Howard Metcalf, Department of State (United States of America).
T. Mimoto, ministère des communications (Japon).
Moffre, chemins de fer du Midi (France).
M. F. Molloy, Cincinnati, New Orleans, and Texas Pacific Railway (Etats-Unis).
F. W. Moore, Mobile and Ohio Railroad (Etats-Unis).
F. W. Morse, Grand Trunk Railway (Canada).
C. P. Mossop, North Eastern Railway (Grande-Bretagne).
Sir Francis Mowatt, G.C.B., Board of Trade et Great Northern Railway (Grande-Bretagne).
H. U. Mudge, Atchison, Topeka, and Santa Fe Railway (Etats-Unis).
J. E. Muhlfeld, Baltimore and Ohio Railroad (Etats-Unis).
Eduardo Lopez Navarro, ministère du fomento (Espagne).
Ernesto Julio Navarro, chemins de fer de l'Etat (Colonies portugaises).
E. Nollett, Commission permanente du Congrès.
I. G. Ogden, Canadian Pacific Railway.
J. R. Onderdonk, Baltimore and Ohio Railroad (Etats-Unis).
Sir Charles J. Owens, London and South Western Railway (Grande-Bretagne).
C. S. R. Palmer, Western Australia Government Railways.
Frederick Palmer, East Indian Railway (Indes anglaises).
F. Paul-Dubois, Chemin de fer Paris-Orléans (France).
Ramon Peironcely, Chemins de fer de Madrid à Sarragosse et à Alicante (Espagne).

Perouse, Ministère des travaux publics (France).
Ralph Peters, Long Island Railroad (Etats-Unis).
John Pickering, South Australia Government Railways.
Pieron, Chemin de fer du Nord (France).
A. Pilkington, Madras Railway (Indes anglaises).
Robert Pitcairn, Pennslyvania Railroad (Etats-Unis).
A. H. Plant, Southern Railway (Etats-Unis).
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