CANADA. (*Continued.*)

		Miles.
Columbia, west of Yellowhead, 122.00 miles; and east of Prince Rupert, 117.00 miles; total	480.00	
Hudson Bay—Between The Pas, Man., and Port Nelson	100.00	
Intercolonial—Georges river, N. S., to Sydney mines	8.80	
Interprovincial & James Bay Ry. (Can. Pac.)—Lumsden's Mills, Que., north	10.00	
Kettle Valley—In British Columbia	80.00	
National Transcontinental Railway (Grand Trunk Pacific)—In province of Quebec, 88.26 miles; Manitoba, 2.22 miles; total	90.48	
Pacific Great Eastern—Between North Vancouver, B. C., and Dundrave, 4.50 miles; between Newport, B. C., and Cheakamus, 13.50 miles; total	18.00	
Quebec Central—St. Sabine, Dorchester county, to St. Camille, Bellechase county	5.00	
Reid Newfoundland Co.—In Newfoundland, Trepassey branch, Biscay Bay to Trepassey, 5.00 miles; Carbonear to Bay-de-Verde, 53.00 miles; Goobies to Black River, 15.00 miles; extension Heart's Content branch to Heart's Content, 1.00 mile; total	74.00	
St. John & Quebec—Between Centerville, N. B., and Gagetown	90.00	
Sydney & Louisburg—Waterford Lake, N. S., to Victoria Mines, 1.00 mile; Morien Junction to Morien Village, 2.00 miles; total	3.00	
Temiskaming & Northern Ontario—Porquis Junction, Ont., to Iroquois Falls	7.25	
Vancouver, Victoria & Eastern (Gt. Nor.)—Between Kilgard, B. C., and Sumas Landing	5.05	3,012.96
Second Track		
Canadian Pacific—Farnham, Que., to St. Johns, 12.70 miles; Agincourt, Ont., to Leaside Jct., 6.20 miles; Islington, Ont., to Guelph Jct., 29.20 miles; between Azilda, Ont., and Cartier, 9.50 miles; between Nemegos, Ont., and Devon, 12.40 miles; between Esper, Ont., and Shumka, 16.90 miles; between Tarpon, Ont., and Mobert, 11.50 miles; between Navilus, Ont., and Port Arthur, 1.60 miles; between Selim, Ont., and Paysiplate, 7.00 miles; between Gravel, Ont., and Dublin, 11.00 miles; Bergen, Man., northeast, 20.00 miles; between Kemnay, Man., and Virden, 35.00 miles; between Whitewood, Sask., and Grenfell, 8.00 miles; between Indian Head, Sask., and Regina, 21.60 miles; between Regina, Sask., and Pasqua, 12.00 miles; between Caron, Sask., and Java, 66.70 miles; between Ruby Creek, B. C., and Hammond, 59.00 miles; total	340.30	
Toronto, Hamilton & Buffalo—Welland, Ont., to Fenwick	5.91	
Vancouver, Victoria & Eastern (Great Northern)—Ardley, B. C., to Still Creek	7.12	353.33
Total of all track		3,366.29
MEXICO		
First Track		
National Railways of Mexico—Kilo 90 west of Durango, Durango, to Llano Grande, 7,000 miles; Kilo 124 south of Penjamo, Michoacan, to Ajuno, 7.00 miles; Canitas, Zacatecas, west towards Durango, 4.00 miles; Kilo 53 east of Rives, Veracruz, to San Andres Tuxtla, 12.00 miles; total	30.00	
San Diego & Arizona—Ville Redondo, Lower California, to Dupes	8.20	38.20
Total of all track		38.20

AN ENGLISH SCHEME TO QUICKEN SUBWAY TRAIN SERVICE.—On December 8 the Central London introduced a new idea to quicken the service on its subway trains during the busy hours. In the future, from about 8 o'clock to 10 in the morning, and from 4 in the afternoon until about 7, one station stop will be omitted by all trains. There are but three stations at which the stops will be omitted. Each train will successively omit but one stop on its trip. Thus the first train will omit stop *A*, the second stop *B*, and the third stop *C*, and so on. It is expected that the time saved will amount to one minute for each round trip. There will be no other curtailment of service excepting that for the three stations, and even then each of these will lose but one of every three trains.

THE POSTAL SERVICE OF CHINA.—The report of the Chinese Postal administration for 1912, recently issued, shows that steady and gratifying progress has been made. The striking feature of the year is, perhaps, the enormous development of the newspaper business. This is largely due, of course, to the overthrow of the Manchu dynasty. At the present time the courier lines are about 108,300 miles long; the native boat lines about 9,000 miles; the steamer lines, 9,700 miles, and the railway lines 6,000. The native postal hongs, or agencies, still carry on operations, a thing which is significant of the tenacity of institutions in China. Nevertheless, their activities are being greatly curtailed and in all probability will disappear before very long. One of the longest courier lines is 3,677 miles long, extending from the Eastern railway base to the extreme western boundary of the republic.

CHICAGO, MILWAUKEE & ST. PAUL MOUNTAIN LINE ELECTRIFICATION

A decision has just been reached to begin actual construction on the electrification of one engine district of the Chicago, Milwaukee & St. Paul, between Three Forks, Mont., and Deer Lodge, which is part of the project to electrify the line between Harlowton, Mont., and Avery, Idaho, 440 miles across the Belt, Rocky and Bitter Root mountain ranges. This project was announced in the *Railway Age Gazette* of January 10, 1913, and additional details were published in the issue of May 2, 1913. The line between Harlowton and Avery includes four engine districts, with maximum grades of 2 per cent., 1.7 per cent., 1 per cent. and .4 per cent., respectively.

The engine district between Three Forks and Deer Lodge, with the Butte terminals, will be undertaken first, as it includes the maximum grade of 2 per cent. for 20.8 miles ascending the eastern slope of the Rockies. This district is 113 miles long and, with passing tracks, sidings and yard tracks, includes a total of approximately 168 miles of track. It is the present intention to undertake the electrification of an additional engine district each year until the entire line between Harlowton and Avery has been electrified.

It has been decided to adopt the 2,400-volt direct current system of propulsion, utilizing the regenerative electric braking feature, which will take the place of the air brakes on the mountain grades. This is the system which has been applied by the General Electric Company in the electrification of the Butte, Anaconda & Pacific, except that the regenerative electric braking feature is not used on that road, and it is expected that in large measure the details of that installation will be used on the Milwaukee with such modifications as are necessary to meet the conditions imposed by trunk line operation. It is expected to operate this district with twelve 200-ton freight locomotives, four 200-ton through passenger locomotives and two 100-ton local passenger locomotives. The switching will be done with electric locomotives. The locomotives will draw power from an overhead trolley line of the catenary type, reinforced by copper feeders, the return circuit consisting of a bonded track with supplementary return feeders. The trolley will be supplied with power from five sub-stations, located at Morel, Newcomb, Grace, Piedmont and Three Forks. These sub-stations will be connected to the feeding points established by the Great Falls Power Company, which will supply the electrical energy, by a 100,000-volt transmission line along the company's right of way for the entire length of the district. The estimated cost of the complete installation between Three Forks and Deer Lodge is about $1,500,000, exclusive of locomotives, but including all electrical apparatus, material, labor, sub-station buildings, overhead and track construction, and all incidental expense, except the changing of block signals from direct to alternating current.

The terms of the contract for the electrical energy guarantee a load factor of 60 per cent. In order to minimize peak loads it will probably be advisable to combine the duties of train despatcher and power despatcher, for since the train despatcher knows the location of all trains, he may be able to avoid an excessive peak in the energy consumption by delaying a freight train a short time at the foot of an excessive grade until the total load is reasonably low. Undue interruption to service need not follow, but a few minutes' delay to one train might be easily justified in order to prevent an advance in the monthly or yearly power rate. Assuming a minimum daily traffic of 10,000 tons in each direction, the power consumption on the Deer Lodge-Three Forks line is estimated at 47,000 k. w. hr. eastbound, and 47,900 k. w. hr. westbound. This would mean a yearly consumption of 34,600,000 k. w. hr., or practically 38,000,000 k. w. hr., including 10 per cent. excess for switching, starting of trains, etc.

The Great Falls Power Company proposes to deliver energy at seven points between Harlowton and Avery, but these do not in all cases co-incide with the proposed location of sub-stations, and the power company's lines will not serve the full number of

sub-stations required. It will be necessary, therefore, to tie in these feeding points to all of the sub-stations by a continuous transmission line following the right of way, except in cases where distance or excessive curvatures can be saved by cutting across the country. The high potential of 100,000 volts was adopted for the main transmission line on account of the great distance over which power will be carried. The use of the same high potential for the transmission line connecting the sub-stations will make it possible to shift the load without excessive loss. This pole line will be separate from the trolley pole line

The sub-station capacities have been designed to allow locomotives to be started at their full tractive power on the heaviest grades, and to accelerate at the rate of .15 m. p. h. per second. To take care of this demand it is proposed to equip each of the three sub-stations supplying those portions of the line with a gradient of over 1 per cent. with three 1,500-k. w. motor generator sets, one of which will be held as a reserve. Starting a train under the maximum conditions, therefore, requires practically 100 per cent. overload on the two units in operation. As these units will be built to operate at 200 per cent. overload for five minutes, there will be capacity for starting a train of maximum tonnage on the maximum grade immediately at the sub-station without using the reserve unit. The reserve units can be used to replace either one of the two normally in operation, and in extreme emergencies trains can even be operated with the locomotive motors connected in series so that they will demand only one-half the energy normally required with the motors in multiple. The two sub-stations supplying sections of the line with gradients up to 1 per cent. will be equipped with two 1,500-k. w. units. It is assumed that the consumption of current required to start a train will be practically the same on a 1 per cent. grade and on a level track, so that two-unit sub-stations are proposed for all gradients below 1 per cent. In these sub-stations one unit will be operated normally, with the second held as reserve for emergency, such as the disabling of the operating unit or a congestion of trains, which will require them to be operated at short intervals. Each unit in one of these sub-stations is capable of providing the energy required to start a 2,500-ton train on level track, and to operate a second train of equal weight at the full speed of 27 m. p. h., assuming that both trains are immediately adjacent to the sub-station and draw their entire energy from that station.

Each motor generator sub-station unit will comprise a 60-cycle synchronous motor direct connected to two 750-k. w. 1,200-volt direct current generators connected in series for 2,400 volts. The motor generator set will be fed from three single-phase, step-down transformers, reducing from the transmission potential of 100,000 volts to 2,300 volts at the terminals of the synchronous motor. Each set will be equipped with exciters, making the unit complete in itself. The sub-station buildings will be of brick on concrete foundations, with a concrete roof supported on steel girders. The transformers will be of the self oil-cooled type and will be placed in a separate transformer room, served by tracks to facilitate installation and repairs. The sub-stations will be of the so-called indoor type in order to insure the best results in operation.

The trolley construction will be the single pole bracket type wherever possible, as it offers less obstruction to the view and is less expensive. All poles will be of wood and will be guyed on curves. Where two or more tracks are to be spanned it will be necessary to resort to span construction, using wooden poles where the number of tracks does not exceed four, and steel poles for longer spans. The trolley wire will be located a minimum distance of 24 ft. above the rail. The corresponding clearance is 22 ft. on the Butte, Anaconda & Pacific, but on account of the miscellaneous character of rolling stock handled by the Milwaukee it was thought best to increase this by 2 ft. as a safety precaution. The trolley wire will be of copper of 4/0 cross section suspended from a steel catenary cable. The steel catenary will be supported by bracket arms from single poles except on the sharper curves, where poles will be set on both sides of the track and the trolley catenary suspended from a cross catenary. The trolley will be supplemented by a copper line wire in order to reduce the energy lost in the 2,400-volt conducting circuit.

The track rails will be bonded to form a return circuit, the type of bond not being definitely decided on. In addition to the rail bonding 4/0 track return line will be included, at least on the more severe grades. In addition to the economy effected in current consumption this return line has the advantage that it can be placed on the tops of the trolley poles and made to serve as a lightning arrester, also that it will span any open track section, eliminating the danger to trackmen.

The freight locomotives are designed to haul a trailing load of 2,500 tons on a 1 per cent. grade at a speed of 15 miles per hour. It is proposed to operate through freight trains with a maximum tonnage of 2,500 tons, using one locomotive on grades up to 1 per cent., and two locomotives between 1 per cent. and 2 per cent. The speed with which two locomotives can pull the maximum tonnage trains on a 2 per cent. grade will be approximately 15 miles per hour. These locomotives will weigh approximately 400,000 lb., with all of the weight on the drivers. Each locomotive will be handled by a single operator, but for convenience in shopping and making repairs, the locomotive can be divided into two 100-ton units which, if desirable, can be equipped with draft rigging and operated independently in switching service. The running gear is composed of four four-axle trucks articulated. Each axle is driven by a 2,400-volt direct current motor connected to it by twin gearing. Two superstructures rest upon the running gear and serve as housings for the air compressor and control apparatus. Each locomotive will be equipped with two air compressors of 150 cu. ft. piston displacement. The current will be collected from the overhead trolley by a roller pantograph collector.

The through passenger locomotives are to be designed to pull a 10-car passenger train weighing 1,000 tons with a speed of 24 miles per hour on a 2 per cent. grade. The locomotives will weigh 200 tons, all of which is on the drivers.

A separate type of electric locomotive for local passenger trains will be designed which will haul a 300-ton train at a maximum speed of 42 miles an hour on level track. This locomotive will probably have double end control to eliminate the necessity for turning.

All the locomotives will be provided with controlling apparatus, permitting the motors to be reversed on down grades so as to operate as generators, thus providing for regenerative electric braking. This feature will relieve the brake shoes and wheels entirely, as the air brakes will only be needed in case of emergency. The regenerative action returns to the power line from 25 per cent. to 50 per cent. of the energy required in up-grade movement, resulting in a considerable reduction in the power bill.

The method of heating passenger trains with electric operation has not been definitely decided on, although the proposed through passenger locomotive design leaves a limited amount of space available in the locomotive for a steam boiler heated by oil with a capacity sufficient to provide 150 lb. of steam per car for a 10-car train for 12 consecutive hours. If the double end control of local passenger locomotives is adopted, individual car heaters will have to be used, although it is possible that single end control may be substituted and the cab space thus made available will be used for an oil-fired heater.

SOUTH AFRICAN RAILWAY ELECTRIFICATION.—In a recent number of the *South African Railway Magazine,* Mr. Robbins, electrical engineer to the Borough of Durban, discusses railway electrification of the South African railway system. He pays particular attention to the trunk line between Johannesburg and Durban, and believes that the project is quite feasible, for there is cheap current available at both ends and a third generating station might well be established midway on the Natal coal fields.