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THE

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OLD SERIES, NO. 129. NEW SERIES, NO. 47. TORONTO, CANADA, JANUARY, 1902. 10 CENTS A COPY. $1 A YEAR.

RAILWAY DEVELOPMENT.

Projected Lines, Surveys, Construction, Betterments, Etc.

Alaska.—It is reported that final surveys for the Nome-Council City Ry. of Alaska, covering part of the projected Alaska-Siberia railway scheme, have been completed, and that construction work will be started in the spring. The length of this piece of line is 96 miles; it follows an easy grade, not exceeding 5% at any point, and the highest elevation is 800 ft. The surveys were made from Nome, following the shore line to the mouth of Solomon river, a distance of 36 miles, thence up the river to its source, surveying from across the divide to what are known as the Casa de Paga waters, thence down the Paga to where it empties in the Neukluk, and along the latter river to Council City.

Another proposed line is one from Valdez or Swanport, to the Kinicott group of copper mines, some 130 miles, at an estimated cost of $15,000 a mile.

A bill has been introduced in the U.S. Congress bonusing a proposed railway from Cook's inlet to Behring strait, 850 miles. The Trans-Alaska Ry. Co., which is mentioned, will be given a right of way 100 ft. on each side of the track, and each alternate section of land for a distance of 10 miles on each side of the track if the bill passes.

Algoma Central and Hudson's Bay Ry.—A number of members of the Ontario Cabinet paid a visit of inspection over the line as far as Goulais river, about 25 miles, recently, when it was stated that the track had been completed to Bass lake, about 20 miles further. The track is laid with 85 lb. steel. In connection with the Clergue enterprises Hon. J. M. Gibson, Attorney-General, said he learned that there were 29 miles of railway sidings connected with them; 4,000 men were employed, and the pay roll amounted to $750,000 a month. A later report states that the line has been completed to Pangassin, 22 miles beyond Achigan, or 65 miles from Sault Ste. Marie, and that the Josephine branch, 11 miles, had been opened. (Dec., 1901, pg. 353.)

The Bracebridge and Trading Lake Ry. has had a route surveyed to connect the two points, but no contract has been let for its construction. The survey was made by A. Brunel, C.E., Toronto. Starting from the G.T.R., about two-thirds of a mile south of Bracebridge station, the line will run east and north-east to Baysville, on the south branch of the Muskoka river, about 2 miles from the west end of Trading lake, from which point steamers ply to all points of the lake, a distance of not quite 16 miles. There are no villages along the route, but there is a considerable farming population to the south, in Draper and Oakley townships, which will be served by the railway. The general character of the country, from an agricultural point of view, is not prepossessing, being very hilly and rocky, but there are numerous fine valleys of good land and some good farms, and a large portion of the upland is very good with very little surface rock. The grading is generally of an easy character, running about 16,000 cubic yards to the mile. For 4 miles east of Bracebridge it is a white clay, and easy to work; the central portion is mostly side-ditching, with a few rocky spurs, and the eastern 5 or 6 miles is principally sand and gravel with plenty of good ballast. The rock excavation will run about 1,500 cubic yards to the mile. There will be only three or four small trestles, from 50 to 100 ft. each in length. The steepest grades are 2 ft. in 100 or 105 ft. to the mile, mostly in the direction of the heavier traffic towards Bracebridge, and the sharpest curves are 8° or 716 ft. radius. There is a good deal of hardwood timber in the country to be opened up, and in the summer there is considerable tourist traffic. (Nov., 1901, pg. 332.)

JOHN ERHARDT MÜHLFELD,
Superintendent of Machinery and Rolling Stock, Intercolonial Ry.

Brockville, Westport and Sault Ste. Marie Ry.—A locomotive shed 20 by 60 ft. has been completed at Westport, Ont. It is intended to erect a freight shed at Brockville in the spring.

Canada Atlantic Ry.—It is reported that a 2,000,000 bush. annex will be built to the 1,500,000 bush. elevator at Depot Harbor, the present accommodation being insufficient, but the management advise us that nothing definite has been decided.

Chief Engineer Mountain had a conference with the city engineer of Ottawa recently regarding the proposed diversion of Elgin st. and the subway under the C.A.R. tracks in connection with the canal driveway. It is understood that the matter will be further discussed by the C.A.R. Co., the city council and the Ottawa Improvement Commission. (Dec., 1901, pg. 350.)

Canada Western Ry. Co.—N. W. Rowell, solicitor, Toronto, gives notice of application to the Ontario Legislature for an Act to incorporate a Co., under this name, to construct a railway from or near Fort Frances by way of Rat Portage to near the confluence of the Winnipeg and English rivers on the western boundary of Ontario.

Cape Breton Ry. Extension.—We were officially informed, Dec. 12, that work would be pushed on the 30 miles under construction from Port Hawkesbury to St. Peters, during the winter as far as the weather would permit. Five miles of track had been laid to that date. Press reports state that 15 miles of the line have been graded, and that nearly all the culverts are in. The grading is expected to be completed to St. Peters by the end of Jan., and the track laid in the spring. A temporary bridge will be built across the river Inhabitants to carry construction materials, pending the erection of a steel bridge. A contract is reported to have been let for the construction of an additional 50 miles of the line beyond St. Peters, and surveys are being made for carrying the line from Louisburg into Sydney. It is also reported that the Co. has made a connection with Point Tupper and laid out a yard and sidings there. (Dec., 1901, pg. 353.)

The Central Counties Ry. Co. gives notice of application to the Dominion Parliament for an act to extend the time for the completion of the unconstructed portions of its lines and to

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Canadian Excursion Agreement Meeting.

CHAIRMAN, J. H. Walsh, Sherbrooke, Que.
SECRETARY, A. V. Fabian, Passenger Department C.P.R., Montreal.
NEXT MEETING, probably in March, 1902.

Canadian Freight Association.

PRESIDENT, W. Woollatt, Walkerville, Ont.; 1st VICE-PRES., M. T. Donovan, Boston, Mass.; 2nd VICE-PRES., E. Tiffin, Moncton, N.B.; SEC.-TREAS., J. Earls, Toronto.
CLASSIFICATION COMMITTEE.—W. B. Bulling, S. P. Howard, F. J. Watson, J. H. Hanna, J. Hardwell, W. P. Hinton, T. Marshall, C. Howe, C. A. Jaques.
FREIGHT INSPECTION COMMITTEE.—G. Collins, F. Conway, F. F. Backus, J. Hardwell, C. A. Jaques, C. E. Dewey, W. B. Lanigan, W. N. Warburton.
CAR SERVICE COMMITTEE.—J. B. Morford, T. Marshall, M. C. Sturtevant, G. S. Cantlie, W. P. Hinton, J. J. Mossman, E. Fisher, J. F. Chapman.
EXECUTIVE COMMITTEE.—W. B. Bulling, J. Pullen, W. P. Hinton.
OFFICIAL ORGAN.—THE RAILWAY & SHIPPING WORLD, Toronto.

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PRESIDENT, A McAuley, Toronto Jct., Ont.; VICE-PRESIDENT, J. R. Brennan, Ottawa, Ont.; SECRETARY-TREASURER, J. Drinkwater, Winchester, Ont.
EXECUTIVE COMMITTEE.—The above & J. Jelly, Carleton Jct., Ont.; T. Graham, Depot Harbor, Ont.; F. J. Holloway, Toronto Jct., Ont.; N. Delaire, Montreal.
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PRESIDENT, E. H. Keating; VICE-PRESIDENTS, G. H. Duggan, E. Marceau, C. H. Rust; TREASURER, H. Irwin; SECRETARY, C. H. McLeod; LIBRARIAN, E. A. Rhys-Roberts.
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MEETINGS AT 877 Dorchester St., Montreal, every alternate Thursday, 8 p.m.

Canadian Ticket Agents' Association.

PRESIDENT, W. Jackson, Clinton, Ont.: 1st VICE-PRESIDENT, M. McNamara, Walkerton, Ont.; 2nd VICE-PRESIDENT, W. H. C. MacKay, St. John, N.B.; 3rd VICE-PRESIDENT, C. E. Morgan, Hamilton, Ont.; SEC.-TREAS., E. de la Hooke, London, Ont.; AUDITOR, R. J. Craig, Cobourg, Ont.
EXECUTIVE COMMITTEE, W. H. Harper, Chatham, Ont., Chairman; W. Bunton, Peterboro', Ont.; W. F. Egg, Montreal; T. Long, Port Hope, Ont.; C. C. Young, London, Ont.
NEXT ANNUAL MEETING at Washington, D.C., in 1902, probably in Oct.
OFFICIAL ORGAN.—THE RAILWAY & SHIPPING WORLD, Toronto.

Great Lakes and St. Lawrence River Rate Committee.

CHAIRMAN, A. A. Schantz, Detroit, Mich.
SECRETARY, G. C. Wells, Passenger Department, C.P.R., Montreal.
NEXT MEETING, at Sault Ste. Marie, Ont., probably in Feb., 1902.

National Association Marine Engineers of Canada.

PRESIDENT, W. J. Barton, St. John, N.B.; VICE-PRESIDENT, D. McQuade, Collingwood, Ont.; SEC.-TREAS., J. A. Findlay, Toronto; CONDUCTOR, J. A. McArthur, Montreal; DOORKEEPER, N. J. Morrison, St. John, N.B.; AUDITOR, D. L. Foley, Toronto.
NEXT ANNUAL MEETING of the Grand Council in Toronto, Jan. 1902.

Niagara Frontier Summer Rate Committee

CHAIRMAN, T. Henry, Montreal.
SECRETARY, G. C. Wells, Passenger Department, C.P.R., Montreal.
NEXT MEETING, at New York, Jan. 23.

Track Supply Association.

PRESIDENT.—F. E. Came, Montreal.
FIRST VICE-PRESIDENT.—R. J. Davidson, Hillburn, N. Y.
SECOND VICE-PRESIDENT.—A. O. Norton, Coaticook, Que.
HON. SECRETARY-TREASURER.—Acton Burrows, 33 Melinda Street, Toronto.

increase its bonding powers on these sections. The lines authorized to be constructed by the Co.'s act of 1899 were: From Hawkesbury, Ont., to South Indian or Casselman, and from Hawkesbury or Vankleek Hill, easterly to the boundary of Quebec. The bonding powers of the Co. are $15,000 a mile.

Crow's Nest Southern Ry.—The grading on the U.S. section of this line from Jennings, Mont., to Tobacco Plains, at the international boundary, has been completed, and track laying was commenced on Dec. 12. This work was being proceeded with at the rate of about a mile a day, and would be continued to the boundary, after which the progress will be slower. The construction of this section of the line is under the charge of Mr. Callahan, C.E. Between Tobacco Plains and Fernie, B.C., the construction has been very difficult, owing to the nature of the ground, and the determination of the Co. to have a thoroughly well-built road, with the easiest grades and curves possible. Nearly all the grading has been completed, but there is a good deal yet to be done in the way of bridge building and the completion of the cuts, to connect the work done on the grade by the different contractors. The work on the Canadian section is under the charge of Mr. Watkins, C.E., Fernie. The maximum grade on the line under construction is 6%, and the maximum curve is 6°. It is not contemplated to proceed with the construction of the line to Michel for the present. J. M. Starke is the Engineer-in-Chief for the whole line. (Dec., 1901, pg. 353.)

The Cuba Co.—At the annual meeting of the Cuban Central Rys. held recently in London, Eng., J. W. Todd, Chairman, said: "By far the most important new enterprise is the Cuba Co., presided over by Sir Wm. Van Horne, of Canadian Pacific fame, and backed by powerful American and other capitalists. That Co. is making good progress with the construction of a very important line of railway to open up the eastern end of the island, and which system will connect with ours, thus giving railway access from nearly one end of the island to the other, and which will naturally create new regions of commerce."

It is reported that construction is being pushed forward, the grading being nearly all completed, and tracklaying is going on as fast as the bridge building will permit. Sir Wm. Van Horne has recently been inspecting the progress of the work.

The Cumberland Ry. and Coal Co. is reported to have purchased the Price property adjoining the present station at Parrsboro', N.S., and purposes building a brick station, 100 ft. in length, at an early date.

Detroit River Bridge.—Press reports state that the Lake Carriers' Association will oppose any bill in the U.S. Congress for the building of a bridge across the Detroit river. "Our contention," says H. D. Gouldur, "has been for wider, deeper and safer channels to accommodate the largely increased traffic on the lakes, and the same arguments and data which were used to defeat the project before will be brought into service again." The Marine Record points out that other waterways have been spanned by bridges, but suggests that the Detroit river should be tunnelled as is the St. Clair river between Sarnia and Port Huron. (Dec., 1901, pg. 353.)

Durham Switch Line Ry.—Pinkerton and Cooke, solicitors, Toronto, gave notice that application will be made at the next session of the Ontario Legislature for an act incorporating the Durham Switch Line Ry. Co., to construct a line from the G.T.R. in Bentinck township, Grey county, to Wilder's lake in the adjoining township of Egremont. This line is proposed to be constructed by the proprietors of the National Portland Cement Co., from their marl pits to their works.

Edmonton, Yukon and Pacific Ry.—The grading has been completed between Strathcona and Edmonton, Alta. Ties have been distributed along the track, and the bridges were expected to be completed by the end of Dec., so that tracklaying could be gone on with. The line is expected to be open by Jan. 15. Mr. Pace took charge of the work for Mackenzie, Mann & Co. in Nov., replacing M. G. Macfarlane, who has gone on survey work. (Dec., 1901, pg. 354.)

Fraser River Bridge.—The time for sending in tenders to the Department of Lands and Works for B.C., at Victoria, has been extended to Jan. 25, owing to the plans and specifications having been held by the Collector of Customs at Victoria for duty, the claim being for $3,000, or 20% on 2½% of the estimated cost of the bridge. The plans were prepared by J. J. Waddell, at Kansas City, Mo., and it is held that they are therefore liable to duty. An appeal has been made to Ottawa by the Provincial Government to have the plans released. (Dec., 1901, pg. 334.)

Gaspe and Western Ry. Co.—E. A. D. Morgan, solicitor, Montreal, gives notice that at the next session of the Dominion Parliament application will be made for an act to incorporate a company under the above name with power to construct a railway from near the Fraserville, Que., station of the I.C.R., to near Gaspe basin, passing through the coun-

ties of Temiscouata, Bonaventure and Gaspe; to build piers, wharves, elevators and warehouses; to own steamers and other boats and to carry on a general navigation business; to enter into agreement for running powers with any railway situated within three miles from its railway, and to purchase and operate the Baie des Chaleurs Ry., and the Atlantic and Lake Superior Ry. or any portion of them; to construct and operate telegraph and telephone lines, and to generate electricity for the operation of the railway if desired, with numerous other powers.

Grand Forks and Kettle River Ry.—Grading was expected to be completed through to Republic by Christmas. The bridges were all framed ready to be put in place as required, and the tracklaying gang was reported to be making satisfactory progress. The Co.'s first locomotive has been delivered, and the first car load of freight reached Grand Forks, via the C.P.R., consigned to Nelson, Wash. The citizens are being asked to vote $3,500 to the Co. to enable it to acquire a site for a station on the Ruckle addition of Grand Forks. (Dec., 1901, pg. 354.)

Great Northern Ry. of Canada.—Work on the cut off from Garneau Jct. to St. Catherines, which will give a direct route into Quebec, will be commenced as early as possible by E. C. Loss, contractor, and it is expected that it will be completed by July. The new route will be 15 miles shorter than the present one over the Quebec and Lake St. John Ry. from Rivière à Pierre. (Dec., 1901, pg. 354.)

Halifax and South-Western Ry.—Surveys are reported completed for this line from Halifax, N.S., to Barrington Passage, and rough plans have been prepared, showing several possible routes. No arrangement has yet been made between Mackenzie, Mann & Co., and the N.S. Government, in regard to any particular route, and until this is done it is impossible to say what points will be served by the new line. The surveys have been in charge of H. K. Wicksteed, C.E. It is not probable that any construction will be engaged in until after the meeting of the N.S. Legislature, by which body the contract has to be ratified. It is expected that A. Sinclair, C.E., who is now Manager of Construction of the Inverness and Richmond Ry., will be Manager of Construction of the H. and S.W. R. (Dec., 1901, pg. 355.)

The Hudson's Bay and North-West Rys. Co. gives notice that at the next session of the Dominion Parliament it will ask for an amendment of its act extending the time for the commencement and completion of its works, and for additional powers as to the mode of constructing the same. The Co. was incorporated in 1897 as the Hudson's Bay and Yukon Rys. and Navigation Co., C. T. Harvey, S. Caldecott, Hon. S. H. Blake, J. W. Langmuir, R. Kilgour, J. K. Kerr, and James Scott, Toronto, being the incorporators, with power to construct a line from Chesterfield Inlet, on Hudson's bay, to Great Slave lake, and from the Mackenzie river to the Porcupine or Yukon river, and to operate steam ships on Hudson's bay, Great Slave lake, and the Mackenzie, Porcupine and Yukon rivers in connection with its railways. Its name was changed and additional powers conferred in 1899.

Intercolonial Ry.—It was expected that the new freight offices at St. John, N.B., would be ready for occupation by the end of Dec. The renewal of the sheds will be taken in hand in the spring. An air-testing plant for the purpose of testing the air-brakes on cars, so that when the locomotive takes hold there will be no loss of time, as under the present tests, has been installed.

Between St. John and Moncton a good deal of ballasting has been done, about 40 carloads a day being spread. All the sidings have been lengthened, new ones of 2,400 ft. each having been put in at Anagance and Penobsquis, that at Rothsay lengthened to 2,500 ft., and an addition of 1,000 ft. to that at Pollett river. It was reported that this work is going on in view of the possible double-tracking of the line, but we are informed that there is no likelihood of this being done.

The new brick power-house at Dorchester, N.B., 122 by 50 ft., has been roofed.

Tenders for alterations and additions to North st. station, Halifax have been invited to be sent in by Jan. 8.

Inverness and Richmond Ry.—The extension from Port Hastings to Point Tupper, 4½ miles, has been completed, and was opened for traffic Dec. 12. W. Mackenzie, who was on the train making the first trip, said the Co. would be prepared to ship 250,000 tons of coal by the close of next season. A temporary dock will be built this winter at Port Hastings, where there is 20 ft. of water, which will be used for coal shipments until permanent docks are built. (Dec., 1901, pg. 355.)

James' Bay Ry.—On Dec. 21 we were informed that grading had been completed on the line from the Canada Atlantic Ry. to Parry Sound, about 5 miles, that track has been laid for 2 miles, and that the remainder of the track would be laid by the end of 1901. (Nov., 1901, pg. 337.)

Kingston and Pembroke Ry.—A steel bridge has been placed over the Madawaska river to replace a wooden structure. The roadbed is to be put in first-class condition, the work to be commenced at Sharbot Lake and pushed towards Kingston, as well as towards Renfrew. (Dec., 1901, pg. 355.)

The Kitamaat, Limited, has been incorporated under the B.C. Companies' Act, with a capital of $300,000, for the purpose of acquiring from C. A. Holland, and G. H. Barnard, the trustees for the Kitamaat Coal and Ry. Syndicate, all the property of the syndicate, in whole or in part, and particularly certain rights to search for coal granted to Jane and John Irving, L. M. Clifford, F. S. and G. H. Barnard, E. V. Bodwell, L. P. Duff, L. Cuppage, J. A. Mara, F. W. Vincent, C. Baxter, H. G. Lawson, and W. J. Taylor; the transfer to trustees from the provisional directors of the charter of the Pacific, Northern and Omineca Ry., and all cash now or in future to come into the hands of the trustee on account of calls: to acquire the rights and properties of any other railway company; to construct, equip or operate any such railways, and to obtain legislative authority, either Provincial or Dominion, in respect to any or all of its undertakings; with numerous other powers.

Klondike Mines Ry. Co.—We are informed that E. C. Hawkins, ex-General Manager of the White Pass and Yukon Ry., and his associates, are negotiating with the provisional directors with a view to entering into an agreement by which the former will construct and operate the railway. The provisional directors procured the charter, secured the right of way, and have made considerable expenditures. A meeting was arranged in Ottawa in the beginning of December to conclude these negotiations, but was postponed owing to Mr. Hawkins' inability to come east then. The plan proposed is to build a railway of 3 ft. gauge, from the water front at Klondike city, adjoining Dawson, thence up Bonanza creek to Grand Forks, and thence to Dominion and other creeks. It is proposed to equip the line with modern steam locomotives and first-class equipment. The country opened up includes considerable areas of placer ground of too low a grade to be operated by hand, and under expensive methods of procuring machinery, fuel and supplies. (Dec., 1901, pg. 355.)

The Magnetawan River Ry. Co. has made an arrangement with the G.T.R. for the construction of the railway authorized by its act. (May, 1901, pg. 156.) The Co. has power to construct 2 miles of line from Burk's Falls, Ont., on the G.T.R., to the head of the navigable waters of the Magnetawan river, and has $10,000 bonus from Ontario, and $6,400 from the Dominion. It is reported that construction will be commenced in the spring, and it is expected that the line will be in operation during the summer. Press reports state that this is the first section of a G.T.R. line to Sault Ste. Marie, and that there is a charter for such a line in existence. In 1881 the Dominion Parliament incorporated the Northern, North-Western and Sault Ste. Marie Ry. to build a line from Gravenhurst, the then terminus of the Northern Ry., to a junction with the C.P.R. at Callander, and giving running powers over that Co.'s line to Whanipiti river, from whence power was given to build a line to Sault Ste. Marie, to bridge the river and make connection with U.S. lines. In 1884 the name of this Co. was altered to the Northern and Pacific Junction Ry. Co., and its powers somewhat amended, but the general route of the lines authorized was not altered. Under these acts the line now operated by the G.T.R. from Gravenhurst to North Bay was constructed, and in 1894 the Ontario Legislature voted $7,500 to the Northern and Pacific Junction Ry. to build this particular 2 miles of line. By an arrangement the G.T.R., which had acquired the right of way from Whanipiti to Sault Ste. Marie, handed over its powers to the C.P.R., which constructed the line from Sudbury to Saulte Ste. Marie, and made the connections with U.S. lines. (Aug., pg. 231.)

The Manitoba and Northwestern Ry. Co. gives notice that it will apply at the next session of the Dominion Parliament for an act authorizing it to construct within seven years the lines authorized by its act, viz., an extension of its main line from Yorkton northwesterly to Prince Albert, Sask.; an extension of the Shell river branch from Russell to the northern or western boundary of Manitoba; a branch from the main line between Portage la Prairie, and Arden, eastward of the Riding Mountains, to the northern or western boundary of the province; and a branch from the main line, between Westbourne and Beautiful Plains, northwesterly in the direction of Lake Dauphin or Duck mountains. The M. and N. W.R. is leased to the C.P.R.

Manitoulin and North Shore Ry.—In connection with the 13 miles from Sudbury to Gertrude Mine, completed in 1900, and in operation, an application for the land grant, voted by the Ontario Legislature last session, has been sent in to the Crown Lands Department, Toronto. The land grant is at the rate of 7,400 acres a mile, and this application is for 96,200 acres, in alternate blocks. It is understood that certain areas west of Sudbury are applied for.

It is reported that the right of way is being cleared between Spanish River and White Fish Bay on Georgian bay, 16 miles.

The surveys being made by Mr. McCormick in the Bruce peninsula, from Meaford to Tobermory, are practically completed. No serious engineering difficulties have been encountered. (Dec., 1901, pg. 355.)

Matane and Gaspe Ry.—L. H. Chouinard, J. E. Gagnon, F. Desrosiers, L. J. Levasseur, G. A. Cote, of Matane; J. B. A. Boudreau, J. H. Brassard, Emile Dube, J. Hamel, N. Dion, M.L.A., of Fraserville; T. Cote, E. Lamontagne, of Cape Chat; Prefontaine Bros., C. A. Gauvreau, M.P., A. Bertrand, of Isle Verte; Z. Lamouette, F. St. Laurent, F. Parent, M. Belanger, of Sandy Bay; A. Harrison, of Matane; A. Leclerc, of the River a la Matre; D. Caron, M.L.A., of Saint Octave de Metis; A. Girard, M.L.A., of Marieville; I. L. Lafleur, Montreal; N. P. Tanguay, Weedon; J. M. Lovell, M.L.A., Coaticook;

X. Kennedy, M.L.A., Douglastown, and N. Rioux, Quebec, are applying to the Quebec Legislature for an act of incorporation under this title to construct a railway from some point near St. Octave de Metis to Gaspe Basin by way of Matane, with connections with the Atlantic, Quebec and Occidental and branches at several places.

Michigan Central Rd.—A contract for grading for a second track between Bismarck and Ridgetown, Ont., 18 miles, was let several months ago, and the work is practically complete, but it is not likely that track will be laid until spring. (Dec., 1901, pg. 355.)

Middleton and Victoria Beach Ry.—Two routes have been surved by D. S. Noble, C.E., between Bridgetown, N.S., which was to have been the original starting point of the line, and Middleton, N.S., the present proposed point of junction with the Dominion Atlantic Ry. One is next to the main Annapolis highway, and the other just south of the Clarence road. The latter route is most generally desired by the residents of the district. One of the routes, it is stated, parallels the D.A.R. from Middleton to Paradise at a distance of only a few rods. L. Whitman, C.E., and W. F. Pickering have been assisting Mr. Noble in making the surveys The Co.'s offices are in Bridgetown. (Dec., 1901, pg. 355.)

Midway and Vernon Ry.—It is reported that J. Coyle, C.E., of Butte, Mont., has made a preliminary survey of a route between these B.C. points. He is reported as saying that the country to be opened up is a good one and that there are no engineering difficulties in the way of its construction as a 1% grade can be obtained. Three survey parties are to be put on, one to work from Midway, another from Vernon, and the third from Carmi, on the west fork of the Kettle river. R. Wood, of Greenwood, B.C., is one of the promoters of the line, and, it is stated, has secured sufficent financial backing in the U.S. to build the line. (June, 1901, pg. 175.)

Montreal-Longueuil Bridge.—H. Hogan, President of the Montreal Bridge Co., gives notice that application will be made to the Dominion Parliament for an act extending the time for the completion of its undertaking. This is the charter in which C. N. Armstrong and Mayor Prefontaine, of Montreal, are interested. In addition to this notice and the one given by Archer & Perron, of Montreal, Madore & Guerin, solicitors, Montreal, give notice that they will apply for an act to incorporate a company under the title of the Montreal and St. Lawrence Bridge Co. to build a bridge between Montreal and Longueuil, to construct railways in connection with it and to connect with existing lines, and also to establish a Union station in Montreal. Press reports say that Mayor Prefontaine has been negotiating with M. Connolly with a view of forming a company with a capital of $6,000,000 to build the bridge. (Dec., 1901, pg. 357.)

Morden and North-Western Ry.—Munson and Allan, solicitors, Winnipeg, give notice of application at the next session of the Manitoba Legislature for an act authorizing the Co. to amalgamate with or to sell or transfer its railway, property, rights, and franchises to the Canadian Northern Ry. Co. The M. and N.W. Ry. was incorporated in 1901 to construct a line from the international boundary, north-westerly through Morden to Miami, Treherne, Carberry to Neepawa, thence westerly or north-westerly to the western boundary of the province, with branches from Morden to the international boundary south of Snowflake; and from Morden to Winnipeg, with a branch therefrom to Carman. (May, 1901, pg. 159.)

Mount Sicker Ry.—The grading for the extension of this line from the crossing of the Esquimalt and Nanaimo Ry., to Osborne Bay, B.C., is completed, all the bridges are finished, and tracklaying is reported to be proceeding. (Dec., 1901, pg. 357.)

New Brunswick Ry. and Coal Co.—The surveys for the continuation of this line from Newcastle, to which point the section under construction will carry it, to Gibson have been completed, and it is reported that tenders are under consideration for its construction. The line will be carried across the Nashwaak river near its mouth, by a steel bridge carried on stone and masonry abutments and piers, then taking a sharp turn to the left, will connect with the track of the Canada Eastern, near Gibson station, over which trains will be run into Fredericton. (Dec., 1901, pg. 357.)

Nepigon Ry. Co.—N. W. Rowell, solicitor, Toronto, gives notice that application will be made to the Ontario Legislature for an act to extend the time allowed for the completion of this Co.'s proposed line from Nepigon, Ont., on the C.P.R., to the shores of Lake Nepigon, and to extend the line from that point by way of the Albany river valley to some point on James bay.

The New York and Ottawa Ry. is reported to have completed the addition to its repair shops at Ottawa.

Nipissing and James' Bay Ry.—Some grading is reported to have been done north of North Bay during the past season, but we are unable to obtain any definite information as to the quantity. (Nov., pg. 1901, 337.)

Nova Scotia Eastern Ry.—An inspection of the proposed routes from Halifax to the Strait of Canso, and between New Glasgow and the two proposed junctions with the main line has been completed by H. Dimkin, C.E., representing the N.S. Government and P. S. Archibald, representing the N.S.E. Ry. Co., and a report has been presented to the Government. No fixed terminal point at the Strait of Canso has been decided on, there being three possible points, and only further surveys will determine which is best. By one of these routes there will probably be a saving of 25 to 30 miles over the I.C.R. between Halifax and the strait. The principal places to be served by the proposed lines include Musquodoboit and St. Mary's river valleys, a large mining population at Isaac's Harbor, Goldsmith and Salmon river; practically all the fishing points in the two counties of Halifax and Guysboro and a large lumber district. The grading will be moderately heavy, but there will not be any heavy bridging—100 ft. will probably be the longest span. The maximum grade will be 1% and the maximum curve will have a radius of 1,000 ft. The total length of the line and branches will be about 200 miles. A conference between a number of the directors and the Provincial Cabinet was held in Halifax, Dec. 9, in reference to the subsidy for the line. (Dec , 1901, pg. 357.)

Pacific Northern and Omineca Ry.—The surveys that have been made under the direction of J. H. Gray, C.E., during the summer in the Kitamaat valley, which were referred to on pg. 355 of our Dec., 1901, issue, are now spoken of by press reports in Pacific coast papers to have been made for the P.N. and O. Ry., and not for the Kitamaat Ry. as formerly. A very favorable location is said to have been established up the Kitamaat valley by way of Laketsi lake basin to the Skeena, near the mouth of Copper river, a distance of 82 miles. Two summits are crossed, the first at an elevation of 675 ft., and the second at 700 ft. The prevailing grade will be 53 ft. to the mile, and for a short distance only there will be a grade of 78 ft. to the mile. It is said there has been actually located and cleared a portion of the grade at the mouth of the Kitamaat. It is stated that construction will be

commenced in the spring. (Dec., 1901, pg. 357.) See The Kitamaat (Ltd.), pg. 3.

Parrsboro and Londonderry Ry.—Press reports say that H. J. Logan, M.P., for Cumberland, N.S., together with some Halifax and Montreal people have been looking over the route proposed for this line. The distance between the two points is about 35 miles, and the line would open up a considerable agricultural and mining country.

Pontiac Pacific Jct. Ry.—The section of the line between Aylmer, Que., and Hull has been completed, and was handed over to the operating department Dec. 2. The Co. has now in operation 78.9 miles from Hull to Waltham. Connection is made with Ottawa via the Interprovincial bridge, a further distance of 1.6 miles. (Dec., 1901, pg. 357.)

Quebec Bridge.—The north abutments, north anchorage pier, and pier on north side of ship channel are completed, and the steel has been delivered for the construction of the two spans between the anchor piers and abutments. The false work for these was in course of erection early in Dec. No definite plan has been as yet adopted for connecting the railways on either side of the St. Lawrence with the bridge. (Dec., 1901, pg. 358.)

The Quebec Southern Ry. expects to have its line connected with Nicolet early in the spring, and to the Chaudiere, where connection will be made with the Quebec bridge, by the end of 1902.

South Shore Ry.—It is reported that at the last meeting of the directors it was decided to extend the line from St. Lambert, Que., to Caughnawaga, where connection would be made with the Rutland Rd. About 5,000 tons of steel rails have been landed at Sorel for relaying the track. (Dec., 1901, pg. 358.)

Straits of Canso Bridge.—A staff of engineers, under the charge of H. Donkin, C.E., is engaged at Port Hastings, N.S., making a survey in connection with the proposed bridge. Montrealers are reported to be behind the scheme. (Dec., 1901, pg. 368.)

Temiscamingue Ry.—W. B. Russell, C.E., has located 40 miles of this road proposed to be constructed by the Ontario Government, and is proceeding northerly. It was reported that at the close of navigation on the lake there was 10,000 tons of freight and settlers' effects awaiting shipment to Liskeard and other points in the new country. (Dec., 1901, pg. 359.)

Thunder Bay, Nepigon and St. Joe Ry.—D. F. Burk is in communication with the Dominion Government with reference to the granting of a subsidy for this line. A slight start at grading has been made, but real construction work will not be commenced until the spring. (Dec., 1901, pg. 359.)

Tilsonburg, Lake Erie and Pacific Ry.—It was originally intended to run for about 1,800 ft. on the G.T.R. tracks at Tilsonburg, and then under the Michigan Central Rd. for the purpose of laying track, but this was found to be impracticable, and an additional 1¼ miles of track has had to be constructed. On this there will be 2,400 ft. of an 8 to 12 ft. cut. As the season is late work on this is slow, but it is expected to complete it by the middle of Feb. The track laying is delayed in consequence of this extra work. (Dec., 1901, pg. 359.)

Vancouver, Victoria and Eastern Ry. and Navigation Co.—The question of this Co.'s charter has been called in question not only in the B.C. courts, but before the Railway Committee of the Privy Council at Ottawa. The Co. has both B.C. and Dominion charters, and the B.C. courts have granted an injunction restraining the Co. from proceeding with the further construction of the portion of the line under contract between Cascade and Carson, B.C., and certain spur lines. The injunction extends to Jan. 8, by which time some further action will have been taken. The V.V. and E. Ry. and Nav. Co. came before the Railway Committee of the Privy Council to secure its approval of the construction of a branch 6 miles in length to Grand Forks, B.C. Objection was then taken that there was no main line and, therefore, it could not be approved of, but when the matter again came before the Committee, Dec. 20, the C.P.R. and the Grand Forks and Republic Ry. Co. appeared in opposition, and took the ground that the charter of the Co. had lapsed owing to its having failed to commence work within the specified period of two years. In view of the injunction the hearing of the application was, on the request of W. H. Moore, solicitor for Mackenzie, Mann & Co., adjourned.

It is reported that track laying has been commenced from the Marcus, Wash., end, and that construction would be pushed through to Princeton, without waiting for any further legislation. It was proposed to construct a spur into Grand Forks from Carson, a distance of 6 miles, and a recent report stated that the towns of Grand Forks and Columbia were each to be asked to vote the Co. $7,500 to acquire the right of way leading to the station site, the Co. to accept debentures at 90 in lieu of cash. This proposition evidently led up to the injunction. The survey parties on the route between Molson, on the International boundary, and Princeton, have given up work for the winter. (Dec., 1901, pg. 359.)

Vancouver, Westminster and Yukon Ry.—The citizens of New Westminster, B.C., have by a majority of 420 adopted the railway aid by-law, giving this Co. four city lots for a station, a right of way along the waterfront, and for a lease of water frontage for wharf accommodation on very low terms, with exemption from taxation and permission to carry passengers across the Fraser river by ferry pending the construction of a bridge. The Co. asks the city of Vancouver to give 100 acres on the west side of False creek flats, where it proposes to establish yards, sheds and other terminal necessities; and it purposes to put a swing in the bridge to be built across False creek on the line to New Westminster. (Dec., 1901, pg. 359.)

Victoria Terminal Ry. and Ferry Co.—Work is reported to be progressing on the extension of the Victoria and Sidney Ry. into the proposed terminal station at Victoria, B.C., and to the connection with the Esquimalt and Nanaimo Ry. Construction has also been commenced on the mainland, where the line will be about 20 miles in length, practically a dead level, and with few curves. The line starting from Cloverdale will pass down the Delta, and approaching the coast will swing toward Ladner's Landing, passing it in the rear, but near enough to build a station in the town, then parallel to the river down to Canoe pass, which will be crossed by a bridge to Waltham where the terminus will be constructed near the cannery. The barge Georgian has been strengthened and fitted for use as a ferry to carry 12 loaded cars, pending the construction of a permanent vessel. (Dec., 1901, pg. 359.)

Yukon Ry.—Press reports state that McLean Bros., Vancouver, B.C., have announced that they have perfected arrangements for building a line to the Yukon through the northwestern portion of the Province, thus providing an all-Canadian route to the gold regions. No information is given as to the route proposed to be followed.

It is proposed to send a number of Canadian locomotive firemen to Norway to teach the enginemen on the railways there the best method of firing Nova Scotia coal, which is now being exported there from Sydney, N.S.

Canadian Northern Ry. Construction.

The work of filling in the yards at the terminal at Port Arthur has been suspended until spring, but work on the elevator and other works is being pushed. A rearrangement of the office space at the station has been made by which Supt. Gorrie will move to the first floor, leaving the ground floor for the local operating staff. The roundhouse is now fitted for 12 locomotives, the additional five stalls having been completed. Two miles of siding have been laid out which are expected to be sufficient to accommodate the winter business.

Ballasting is going on along the line towards Fort Frances, and tanks and station buildings have been completed to the 21st siding. At Atikokan, 139 miles west of Port Arthur, the first divisional point, a 10-stall roundhouse has been built. The second divisional point will be at Rainy river.

Since the beginning of Dec. tracklaying has been proceeding east from Fort Frances, as well as west from the Port Arthur end, and the tracks were expected to meet by Dec. 30. At the Fort Frances end H. Mann's tracklaying machine was used and the engineers report that it has been doing good work. R. McCallum, of the Ontario Department of Public Works, recently inspected 106 miles of the line, and reports the road-bed to be an excellent one, the grade varying from 6 ins. to 1 ft. in 100 ft., while the curves are also very slight. In the Rainy river valley there is a straight run of 18 miles in one instance. In some localities the road has been a very expensive one to construct.

The telegraph line along the track from Fort Frances, Ont., to Winnipeg, Man., has been completed.

We were officially informed, Dec. 14, that the press reports crediting the C.N.R. with being about to extend its line from War Road, Minn., through Rosseau and Kitson counties, Minn., were merely rumors and without foundation. The Co. is not doing any work of any kind in that direction.

The Carman branch is to be extended through to Somerset, Man., next season, where a connection will be made with the old Northern Pacific branch line from Morris to Brandon. The present length of the Carman branch is 52.5 miles. It is reported that some difficulty has arisen between the Co. and the town of Carman respecting the location of the station, and that W. Simpson and E. L. B. McLeod have applied for an injunction to restrain the Co. from proceeding further with construction.

The management disclaims any intention of building a branch from Neepawa, Man., through the Riding Mountain district next summer, as reported in the daily press. Press reports state that surveyors have been at work in the vicinity of Neepawa in connection with a C.N.R. extension, probably from the main line to Neepawa. See Morden & Northwestern Ry., pg. 4.

No track was laid during 1901 beyond Erwood, Sask., the terminus for 1900, but a beginning will, it is said, be made in the spring as there are 25 miles of the grade ready, and some additional mileage partially graded. The line is located as far as Prince Albert, 180 miles from Erwood.

J. R. Armstrong, C.E., who has completed a general survey of the route of the extension of the line from Prince Albert to Edmonton, states that it will cross the north branch of the Saskatchewan river within the limits of Prince Albert. For 15 or 20 miles from the town the country is hilly and will be somewhat difficult to build through, and the balance of the country is bluffy, but presents no special features of difficulty. Mr. Armstrong, with W. F. C. Parsons, C.E., is now engaged in staking out the right of way ready for the commencement of construction in the spring.

A statement is reported to have been made on the authority of Mr. Pace, of the Co.'s staff, that the Co. intends to construct 350 miles of line next year between the present track end at Erwood and Edmonton, the work being carried on from both ends. The distance between these two points is about 610 miles.

The information available in Victoria and Vancouver, B.C., in regard to the statements given out in Montreal respecting the extension of the C.N.R. to the Pacific Coast and referred to in our Dec. issue, pg. 37, does not confirm the reports that an arrangement had been concluded between Mackenzie, Mann & Co., the B.C. Government and the Dominion Government. The Victoria Times says the matter has not even been considered by the Dominion Government; the Victoria Colonist awaits "further information on the subject," and bespeaks the sympathy of the people with the Commissioner of Lands and Works, Mr. Wells, in the negotiations he is now conducting, while the Vancouver World states that Mackenzie, Mann & Co, have wired that Mr. Wells has promised to submit legislation to provide a provincial subsidy of $4,000 a mile for the proposed roads, at the session of the Local House in Jan.—only this and nothing more.

F. F. Backus, General Passenger and Ticket Agent, T.H. & B. Ry., writes: "I think THE RAILWAY AND SHIPPING WORLD is doing a good work in Canada. The paper is certainly a valuable one to those who wish to keep in touch with railway matters in the Dominion."

It is reported that the employes of the G.T.R. desire to have the present monthly pay abolished and a fortnightly system established in its place, and that apetition to this effect is to be forwarded to the management.

C.P.R. Betterments, Construction, Etc.

The Maine Route.—Press reports say that the Co. has surveyed a route from Mattawamkeag to Princeton, Me.; and that it will build between these points to secure its own through line to the Maritime Provinces. At present the Co.'s trains run over the Maine Central Rd., between Mattawamkeag and Vanceboro, Me. We are not inclined to credit the report, as the line to Princeton would not connect direct with any other C.P.R. line, but would connect with the Washington County Rd., over which connection could be made with the C.P.R. branch line at St. Stephen, N.B. This, however, would not give a direct route to St. John, unless the C.P.R. secured the Shore Line Ry. of N.B.

Since the above was put in type we have been informed by an officer of the C.P.R. that the press reports referred to are unfounded.

Montreal - Toronto Track. — During the summer a small improvement has been made on the track between Maberly, 155 miles west of Montreal, and Sharbot Lake, Ont., 165.3 miles west of Montreal, by which three or four curves of 4° each have been done away with and the track straightened. The curves all were within about a mile, and two miles west of Maberly. About ⅞ mile of straight track was laid to cut out the curves, but the grade has not been altered, and the length of the line has been shortened by only a few feet.

Toronto Freight Sheds.—The freight sheds on Simcoe St., Toronto, have been rearranged and additional track has been laid to suit the new plan. Formerly one shed was used for inward and outward freight and the second for storage. The storage shed has been done away with, and it will be used for outward freight, the other being used for inward freight. This arrangement will enable freight to be much more quickly handled than has hitherto been the case.

Fort William Terminals.—The General Superintendent of the Western division is reported to have notified the Mayor of Fort William that the Co. will expend about $400,000 on its terminals there, including a large grain cleaning elevator and a large coal dock with up-to-date coal-handling appliances. (Dec., 1901, pg. 361.)

Turtle River District.—Press reports state that the trial line from Ignace to Turtle River district, Ont., is not a success, owing to unsatisfactory grades, and another will be run. The Co. is said to be anxious to get a good line into the district, which contains a large quantity of good pine as well as tamarack and jack pine.

Lake Manitou District.—A recent press report from Winnipeg stated that the Co. was considering a proposition to build a spur line into the mining district, near Lake Manitou, south of Wabigoon. We have not been able to obtain any official confirmation of this.

Branch to Lac Seul.—According to the Industrial Review of Fort William, Ont., the suggested route for the proposed branch from Dinorwic to Lake Minnitakie traverses a mineral region before reaching the timber regions, and if it is desired to reach the navigable waters of Lac Seul, a route further west through the clay belt of the Wabigoon river valley, could be chosen. Lac Seul is only 26 miles from Oxdrift station in a direct line, while the distance from Dinorwic to lake Minnitakie is 16 miles. A line to Lac Seul would open up a magnificent stretch of navigation and make accessible a district of which very little is known. (Dec., 1901, pg. 361.)

Winnipeg Bridge.—The piers were completed in Nov., and the erection of the steel

superstructure was commenced on Dec. 1. It is expected that the whole structure will be completed early in Jan. (Dec., 1901, pg. 361.)

Manitoba & N.W.T. Bridges, Etc.—During the past season considerable bridge work has been done by the Co. in Manitoba and the Territories. On the Manitoba Southwestern Colonization Ry. a trestle, 3,000 ft. long, has been built across the Souris valley at Treesbank, which will be completed next season by a steel bridge, 300 ft. long, across the Souris river to replace the wooden structure already there, and to the approaches of which the trestle work was constructed. The filling for the trestle has been completed. Another heavy piece of work on the Southwestern branch has been completed, in the filling in of two grades, near Treherne, with stone arch culverts by which a big reduction has been effected in two heavy grades and one of the heaviest eastbound grades on the line has been completely wiped out. At Calgary work has been completed on stone abutments for steel bridges across the Elbow river and a second crossing of the Bow river. Besides these large works a great number of smaller bridges and culverts have been replaced with others of a more substantial character, and the roadbed generally has been greatly improved, especially in the matter of grades.

Winnipeg Beach Branch.—We are informed that tracklaying on the extension from Selkirk to Winnipeg beach will be proceeded with in the spring. (Dec., 1901, pg. 361.)

Manitoba & Northwestern Ry.—See pg. 4.

Glenboro to Lauder, Man.—Press reports say that the Co. is surveying a line between these these two points, which would cross the Northern Pacific Morris-Brandon branch, and also its extension from Departure to Hartney.

Battleford District.—It is stated that the district from Saskatoon westward will be the next one to which the C.P.R. will direct immigration. The Battleford Herald gives currency to a rumor that a line will be built to Henrietta, presumably from Saskatoon, and that light draft steamers will be put on the North Saskatchewan river to convey settlers to points as far west as Fort Pitt.

Banff Hotel.—It is said that the addition to this building will be 250 by 100 ft., an exact counterpart of the present house, five stories high, with 80 rooms, that it will be an entirely separate house, to guard against fire, and that all the bedrooms will have baths attached and water laid from one of the hot springs in the vicinity.

Crow's Nest Pass Ry.—Headings have been joined in the 900 ft. tunnel at the loop, 216.7 miles west of Dunmore Jct., which is being constructed to cut off half a mile of detour and four high trestles. The alignment of the tunnel is a 10° curve compounding with an 11° curve. The levels and alignment were exact. When completed the tunnel will form a great betterment to the line. The method of driving the tunnel was described in our July issue, pg. 211. C. E. Coutlee is the engineer in charge of the work. The tunnel is 4,500 ft. above the sea level.

Kootenay River Bridge.—Plans have been prepared for a masonry and steel bridge crossing the Kootenay river about 4 miles west of Nelson, B.C., to replace the original wooden structure on the Columbia and Kootenay Ry. The new bridge will consist of 1 span thro' truss 150 ft., and 3 spans of half thro' girders 80 ft. each, on heavy masonry piers, made wider than usual with strong cutwaters to resist the very rapid current at flood and mass of driftwood and ice. It will be built on a site slightly above the old bridge to conform to an improvement in the alignment and grades on either approach. It has not been decided when work will be commenced.

Robson Bridge.—The erection of the false work was commenced in Aug., from the east end, and by the end of Nov. all the spans had been got into position and the general work of riveting them together was proceeded with during Dec. The approaches were built during the winter of 1900-1901, so that when the bridge proper was completed, which was expected to be by the end of Dec., there would be no delay in operating the line across the river. It was reported at the beginning of Dec. that one cut leading to the western approach had to be completed. The completion of this and the bridge will enable the Co. to run through trains from Nelson to Rossland, and the Boundary country. (Dec., 1901, pg. 362.)

Columbia and Western Ry.—Grading of an extension of 2,000 ft. is reported to have been completed on the Knob Hill spur, which has now been extended with a switchback to the mouth of the Knob Hill tunnel. Track will be laid at once.

Work has been commenced at Hartford Junction, on the Phœnix branch. This consists of a loop of about 1,500 ft. in length for the purpose of doing away with the switchback put in two years ago. The right-of-way has been cut out and grading is expected to be completed early in Jan. Tierney and McPhail are the contractors.

New Westminster to Vancouver.—The Co. will apply at the next session of the Dominion Parliament for an act extending the time within which it may commence and complete the construction of a branch line from New Westminster to Vancouver.

Vancouver Hotel.—It is stated that the extension to be built will be 115 by 104 ft., six stories high, and that when the extension is completed the present structure will be rebuilt.

Vancouver & Lulu Island Ry.—Grading has been completed through to Steveston, and track has been laid from Vancouver to the north arm of the Fraser river, 6½ miles, where a large bridge is being erected by Campbell & Ironsides. The bridge will consist of 4 spans of 80 ft. each, 1 of 100 ft., and a steel swing of 150 ft., which will be erected in Vancouver and towed down the river, or taken by train to be placed in position. This work is expected to be completed early in Feb. The bridge at False creek will be finished early in Jan., and as soon as this is done the line will be ballasted to the north arm, and when the bridge at this point is completed the track will be laid straight through to Steveston. It is expected that the line will be in operation in the spring. (Dec., 1901, pg. 362.)

C.P.R. SUBSIDIARY LINES.

Duluth, South Shore and Atlantic Ry.—It is said that an up-to-date station will be built this year at Houghton, Mich., 80 x 30 ft., of stone and brick, one story high, costing about $15,000, and closely resembling the Sault Ste. Marie, Mich., station.

The Hancock and Calumet Rd. has been changed from narrow to standard gauge.

Minneapolis, St. Paul and Sault Ste. Marie Ry.—The two extensions which this Co. commenced last spring have been completed, and one—the Missouri river line, from Wishek to Pollock, N.D., four miles from the Missouri river—is being operated and is proving a good source of revenue. Large qnantities of merchandise are being shipped to all points along the line, and trainloads of wheat and live stock are being shipped out. Towns along the line are experiencing a rapid growth; elevators have been constructed at numerous points, and banks and business blocks are springing up in every town. The Polk county extension, from St. Croix Falls to Frederic, on Coon lake, has been completed a few days ago, and will soon be in operation. This line pierces a magnificent hardwood territory, and should be a reveuue producer from the start. Fifteen million feet of hardwood were cut adjacent to the road last season, and a sawmill, which will employ 300 men, is being constructed at Frederic. As soon as this mill is completed, it will begin sawing, and its product will find an outlet over the new line. New towns are springing up and the territory is being rapidly settled.—Railway World.

The C.P.R. Terminals at Nelson, B.C.

During the past year Nelson was made the divisional headquarters for the Kootenay section. On account of this and the rapid growth of the city, increased terminal facilities were necessary, and to provide for this, it was found necessary to abandon the old freight and passenger stations, and to reconstruct the entire yard. The freight yard consists of a double gridiron of eleven 40 car length tracks. The ends of the ladder tracks are connected by two cross-overs with the main track and the second tracks, which extend 1,500 ft. from each end of the gridiron, provide switching tracks or a double track through the yard a mile in length. A coach track, having a capacity of 10 coaches, is located on the opposite side of the main track. Hydrants are located along this track for coach cleaning purposes. The car repair yard is located between the engine house and the gridiron.

The passenger station is located at the foot of Baker st., which is the main thoroughfare of the city, and is the terminus of the electric street railway. The building is an imposing two story, frame structure, 102 by 32 ft., is surrounded by a platform roof, and is provided with a platform 400 by 18 ft. The first floor contains a general waiting room and women's waiting room, which are connected by means of an 8 ft. corridor, is located between the ticket office and the lavatories for the respective waiting rooms, a baggage room and an express room. The second floor is occupied by the Superintendent and staff. The interior finish of the building is natural Douglas fir. It is heated by steam from the central steam plant located at the engine house.

The freight shed is located 150 ft. south of and parallel with the passenger station. This building is 240 by 40 ft., the east 30 ft., of which is the office of the freight agent and staff, the west 60 ft., is bonded warehouse. Two tracks lead to the rear of the shed, and between them is an 8 ft. island transfer platform. Two team tracks are located in the space between the freight shed tracks and the main track. Track scales are located on the north side of the yard between the gridiron and the tracks leading to the wharves.

An 8 stall locomotive house is situated on the north side of the yard, which is provided with a 70 ft. through steel turn-table, and has a boiler room in which the steam is generated for the heating of all of the terminal buildings. Under the inbound locomotive house track is located a masonary ash-pit, alongside which is a depressed track. On the north side of this locomotive house track is located an elevated coal track, from which coal is shovelled or dumped into bins, and from which coal is run through chutes into the engine tenders. Adjoining the coal bins on this elevated track is a sand house, where wet sand is received and dried and placed into a hopper and delivered by means of a spout into the sand boxes of the locomotives.

The wharves and tracks approaching them form the north-east portion of these terminals, and consist first, of a passenger wharf, where

transfer is made direct from the steamers on the Kootenay lake to the passenger trains, and second, of a three track transfer wharf, which is the terminal of the car ferry between Nelson and Kootenay Landing.

Water for these terminals is supplied from the city water system, and provides two double nozzle fire hydrants, two stand pipes for delivering water to locomotives, one at the engine house ash-pit and the other on the main track. Electric light, supplied by the city electric company, is furnished in and about all of the buildings, and two arc lights for the yard.

The leading feature in connection with the arrangement of these terminals is that when switching crews are working, either at the east or west end of the yard, at the freight or passenger wharves, or in the freight delivery yard, that their work at either one of these points does not interfere with the operation of the main line, nor with the operation of either of the other three switching districts, and provides a simple, economical and systematic yard for car distribution and storage.

A. W. Campbell, Deputy Minister of Public Works for Ontario, was at Fort Frances when the first train came in from Winnipeg. He says its advent was a great event in the lives of the settlers, some of whom had gone there a generation ago on faith that a railway would soon follow them. They trooped down to the station by the score, and, accustomed for years to awaiting the arrival of the boat, Mr. Campbell tells without a smile on his face how they stood with outstretched arms instinctively waiting to catch the tow-line, and amazed that the contrivance did not drift away from the snubbing-post.

The recent announcement that articles of incorporation of the Grand Trunk Western Ry. Co. had been filed at Sacramento gave rise to a good deal of speculation in the daily press, it being stated that the Co. was reaching out for a Pacific terminus in California. There is nothing in these rumors, and it is officially stated that the only reason for this step being taken is that the Co. has an office at Los Angeles, Cal., and is consequently required to file articles.

An order has been issued by the G.T.R. officials at Portland, Me., that none but Portlanders will in future be employed in clerical capacities in the Co.'s offices there. The residents have been protesting against Canadians being brought in to fill vacancies.

Grand Trunk Ry. Betterments, Etc.

The Montreal General Offices will not be ready for occupancy until spring, owing principally to delays in procuring material for the interior ornamental work. The following provisional location of the offices has been made : –

Ground Floor –General Auditor, express money order department, Manager's office, Canadian Express Co., and Paymaster and staffs.

First Floor –Treasurer, Divisional Freight Agent, freight claims and part of the staff of the General Auditor.

Second Floor – Second Vice-President and General Manager, board room, Solicitor, Freight Traffic Manager, General Freight Agent, Passenger Traffic Manager, General Passenger Agent and Comptroller.

Third Floor—Chief Engineer, Car Accountant, General Superintendent, Car Service Agent, telegraph and telephone.

Fourth Floor—General Purchasing Agent, Insurance and Provident Society, Chief Medical Officer, stationery department, Express Auditor, assembly room.

Basement—Canadian Express Co., post office department, ventilating apparatus, and general storage accommodation.

Montreal Elevator. –We are officially informed that the rumor to the effect that the Co. proposed to erect an elevator at Windmill point or some other convenient place in Montreal harbor, as mentioned in our last issue, is without foundation.

Middle Division Yards.—The proposed improvements of the yards at Bathurst st. and the Don, Toronto, have not yet taken definite shape. The Co. will have to reconstruct its yards at both places very soon, but no plans have been adopted. No further privileges for yard space in the Bathurst yards will be granted to merchants and shippers, until it is decided just how the tracks in the reconstructed yard will be laid.

The reconstruction of the yard at Sarnia has been completed, and that at Stuart street, Hamilton, has been finished with the exception of the engine house tracks.

Stratford Tender Shop.—Recent press reports state that the management is considering the building of a tender shop at Stratford, to be 220 by 120 ft., costing about $50,000. On Dec. 11 we were advised that no decision had been arrived at.

Point Edward Elevator. –To replace the elevator recently burned there is being constructed a new elevator of a total capacity of 1,500,000 bush. It will consist of a work house with square bins having a capacity of 500,000 bush., built entirely of steel, and will have steel storage tanks in the rear with a capacity of 1,000,000 bushels. The tanks will be connected with the workhouse by a complete system of belt conveyers. The workhouse will have two marine legs located in movable towers, and 4 shipping legs. The entire machinery will be operated by electricity. The elevator will be absolutely fireproof, no wood whatever will be used in its construction.

Southern Division.—During the past fiscal year the following expenditures were made on this division, the Wabash Rd. paying its proportion on a wheelage basis :—

Stations, buildings, etc.	$ 45,151 64
Additions to shops, roundhouses, etc.	7,225 80
Wood, water and coal stations, new and rebuilt	2,316 49
Iron bridges repaired, renewed and strengthened	41,902 91
Interlockers erected	9,411 96
Block signal system	1,700 08
	$107,708 88

Detroit Grade Crossings. – Press reports say that an agreement has been reached between the city of Detroit and the Michigan Central, Grand Trunk, and Lake Shore and Michigan Southern railways, for the separation of the grades at 19 streets in that city during the next five years. The estimated expense of this improvement is $1,000,000, and is to be borne exclusively by the railway companies, which agree to spend $200,000 each year until the work is completed. The damage to adjacent property is taken care of by the city. On Dec. 23, we were advised by a G.T.R. officer that the matter was in negotiation between the various interests, and that a definite decision as to the plan to be adopted had not been arrived at.

G. T.-Western Ry.—The double tracking between Port Huron and Durand, Mich., 82.45 miles, including 10½ miles of new single track line near Flint, to avoid heavy grades, is completed, and is being used by east-bound freight trains. The track is practically all laid and surfaced from Grangers, mileage 224.44 west of Port Huron, for 10 miles to Studebaker. From Ainsworth, mileage 290.12, to Thornton Jct., mileage 310.10, or 19.98 miles, the work is completed except the railway crossings at Maynard and Griffith, which had not been delivered Dec. 16. The double tracking is to be extended over the whole division to Chicago, 335 miles. (Dec., 1901, pg. 362.)

Central Vermont Ry.—During the past fiscal year 18.4 miles of new 80-lb. steel rail has been laid between Essex Jct. and North Duxbury on the main line; and the 72 and 75-lb. steel rail taken up has been relaid between Yantic and Orcutts on the Southern division. The roadway generally has been well maintained, and the track between White River Jct. and South Royalton (18.3 miles) has been retied and ballasted with gravel. Wherever new ties are laid in rebuilding and ballasting the track, the number of ties per mile is increased by 300. New steel bridges, replacing old wooden structures, have been put in at 24 points. A new steel bridge has been built over the White river at Hartford. This was the lightest bridge remaining on the line between St. John's and Windsor, and practically completes the extensive expenditures for bridge renewals, which have been made for that portion of the line during the past few years. The completion of this bridge will enable the Co. to operate heavy modern freight locomotives of large capacity through between St. John's and White River Jct.

RAILWAY APPOINTMENTS, ETC.

Algoma Central and Hudson's Bay Ry.—J. Bourke has been appointed Auditor of Freight and Passenger receipts, with office at Sault Ste. Marie, Ont., vice W. O. Smith resigned.

Canadian Pacific.—On Feb. 12, 1900, the directors passed a by-law providing that at the first meeting of the board after each election they should elect from their number a Chairman of the Board, a President and a Vice-President for the ensuing year. The by-law also provides that the board may appoint two or more vice-presidents to be called 2nd vice-president, 3rd vice-president and so on, no one of whom need necessarily be a member of the board of directors. The office of Vice-President has not been filled, and the President, Sir Thos. Shaughnessy, states that it will not be filled.

In April, 1900, D. McNicol, who up to that time had been Assistant General Manager, was appointed 2nd Vice-President and General Manager. He has charge of the operation of the road.

On Dec. 9, 1901, the 3rd and 4th vice-presidencies were filled by the appointment of I. G. Ogden, Comptroller of the Co., to be 3rd Vice-President in charge of the financial and accounting department; and by the appointment of G. M. Bosworth, Freight Traffic Manager, to be 4th Vice-President in charge of the traffic department, including both freight and passenger traffic.

In an interview Sir Thos. Shaughnessy said: "We are getting a very large establishment with a great variety of interests, and the idea is to have officers holding the position of Vice-President and heads of departments report to and advise with the President."

The Fredericton branch of the Atlantic division has, since Dec. 1, 1901, been operated under W. K. Thompson, Superintendent at Brownsville Jct., Me., instead of under D. W. Newcombe, Superintendent at Woodstock, N.B., as formerly.

G. E. Graham, who has been appointed Supervisor of Weighing, with office at Montreal, has general supervision of weighing of all car load freight on Co.'s track scales, also weighing all freight in freight sheds. He does not now act as station inspector.

F. J. Macoun, who was recently appointed town ticket agent at Walkerton, Ont., to succeed W. G. Stovel, deceased, decided not to take the position, but to remain as accountant of the Bank of Commerce at Walkerton. T. E. Attwood has therefore been appointed.

T. Hay, heretofore Superintendent at North Bay, has been appointed Superintendent of the portion of the Lake Superior division between White river and Cartier, including Cartier terminals, with office at Chapleau.

C. Murphy, heretofore Superintendent at Chapleau, has been appointed Superintendent of the portion of the Lake Superior division east of Cartier, including Soo branch and Chalk river terminals, with office at North Bay.

The following paragraph appeared in our last issue in error, under the head of Minneapolis, St. Paul and Sault Ste. Marie Ry., instead of under the C.P.R.:—"H. J. Cambie continues as Engineer-in-Charge of the Pacific division, reporting directly to and representing the General Superintendent in all matters affecting the engineering department of the division."

W. Stitt, heretofore Assistant General Passenger Agent of the Western division at Winnipeg, has been appointed General Passenger Agent Canadian-Australian R.M.S. line, and C.P.R. Co., at Sydney, New South Wales.

G. D. Robinson, heretofore Export Clerk at St. John, N.B., has been appointed Travelling Freight Agent for New Brunswick, east of St. John; Nova Scotia, and Newfoundland, succeeding D. Sutherland, appointed General Freight Agent, Newfoundland Ry.

Central Vermont Ry.—J. Alex. Hutchison, Chief Surgeon of the G.T.R., has also been appointed Chief Surgeon of the C.V.R., with office at St. Albans, Vt.

Grand Trunk.—C. M. Hays has been appointed 2nd Vice-President and General Manager, succeeding G. B. Reeve.

Walter Lindley, having resigned his position as Secretary, has been succeeded by the Assistant Secretary, H. H. Norman; H. Dear succeeding Mr. Norman as Assistant Secretary.

W. H. Bullen has been appointed Pacific Coast Agent with headquarters in the California Bank building, Los Angeles, Cal., succeeding W. F. Botsford, resigned. Mr. Bullen is primarily appointed in connection with freight traffic, and has no special duties in connection with the passenger department.

S. T. Baldwin, Travelling Freight Agent, having resigned to join the service of the Delaware and Hudson Canal Co. at Philadelphia, has been succeeded by F. J. Henstridge, formerly Contracting Agent of the G.T.R. in Montreal. R. C. Manson, Assistant Rate Clerk in the general freight department, has been appointed Contracting Freight Agent for Montreal.

C. N. Cummer has been appointed Chief Dispatcher on the main line, Port Huron to Battle Creek, Mich., with office at Battle Creek, vice W. B. Allan, resigned. G. W. Gillespie has been appointed Chief Dispatcher, C.S. & M., Durand to West Bay City, with office at Durand, Mich.

Kingston and Pembroke Ry.—Following is the official list up to date: President, H. M. Folger; Vice-President and General Manager, C. W. Spencer; Secretary-Treasurer, J. Whitebread, who is also acting as Auditor; General Freight and Passenger Agent, F. Conway; General Superintendent, F. A. Folger, Jr.; Chief Engineer, T. W. Nash; Supt. of Motive Power, F. Clark; Car Accountant, B. H. Campbell; Roadmaster, W. Erwin.

Lake Erie and Detroit River Ry.—T. Marshall, heretofore Assistant General Freight and Passenger Agent, has been appointed General Freight and Passenger Agent, with office at Walkerville, Ont.

O. McKay, heretofore Engineer, has been appointed Chief Engineer, with office at Walkerville, Ont.

Midland Ry. of Nova Scotia. The following are the officers:—President, W. Strachan, Montreal; Vice-President, A. Putnam, Halifax, N.S.; Secretary, A. M. Wovenden, Montreal; General Manager, H. V. Harris, Truro, N.S.

Newfoundland Ry.—H. A. Morine, heretofore Freight and Passenger Agent, has been appointed General Freight and Ticket Agent, with office at St. John's, Nfld.

Douglas Sutherland, heretofore Travelling Freight Agent for the C.P.R. at St. John, N.B., has been appointed General Freight Agent of the Newfoundland Ry., with office at St. John's Nfld.

Quebec Southern and South Shore Rys.—The Quebec Southern Ry. Co., has assumed the control and management of the East Richelieu Valley and the United Counties Rys. The Co. is now operating 156 miles, and it is expected that at an early date the necessary legal power will be granted the Q.S.R. Co. to use its name only and to drop the name of the South Shore Ry. Co.

H. A. Hodge has resigned his position as Traffic Manager of the Rutland Rd., to devote his whole time to his duties as President of the Quebec Southern and South Shore lines, with office at Montreal.

A. H. Harris has been appointed Traffic Manager of the Quebec Southern and South Shore lines, with office at Montreal.

F. D. White has been appointed Secretary-Treasurer of the South Shore Ry., with office at Rutland, Vt.

G. W. Bartlett has been appointed General Superintendent of the Quebec Southern and South Shore lines, with office at Sorel, Que., reporting to the President.

Rutland Rd.—H. A. Hodge having resigned to devote his whole time to his duties as President of the Quebec Southern Ry., the following appointments have been made:—

G. Cassidy, General Freight Agent, has been made Freight Traffic Manager and will have jurisdiction over all the traffic of the Rutland system.

F. Owen, heretofore General Freight Agent of the Rutland Transit Co., has been made Assistant Freight Traffic Manager and will have direct charge of lake and rail traffic.

F. T. Goodman, heretofore of the New York Central Rd. at Troy, has been appointed General Freight Agent, with exclusive control of rail traffic.

C. B. Hibbard, General Passenger Agent, has been appointed Passenger Traffic Manager.

Temiscouata Ry.—As some changes have recently been made we give the official list up to date as follows:—President, F. Grundy; General Manager and Secretary, D. B. Lindsay; Superintendent and Engineer, G. G. Grundy; Car Accountant, F. J. Boudreau; Foreman Loco. and Car Repairs, W. J. Walsh; Trackmaster, W. E. McEwen. The address of F. Grundy is Sherbrooke, Que., the other officials are at Riviere du Loup, Que.

Wabash Rd.—W. P. Sargent, New England Freight Agent, Boston, Mass., has, subject to the supervision of H. B. McClellan, General Eastern Agent at New York, jurisdiction over freight from Quebec, New Brunswick and Nova Scotia. J. J. Mossman, Divisional Freight Agent at Buffalo, N.Y., has jurisdiction over freight from Ontario east of the St. Clair river.

The Halifax, N.S., Board of Trade on Dec. 5, passed a resolution favoring the transfer of the management of the Intercolonial Ry to the C.P.R. Co., providing that such arrangements could be made with that Co. as would, while retaining Government ownership of the road, promote local traffic and lead to the development of Canada in export and import business through the ports of Quebec, St. John, N.B., Halifax and Sydney, N.S. The resolution has been freely discussed in the press, and by boards of trade, but without meeting with much support.

Mainly About People.

R. G. Reid, Jr., of the Reid Newfoundland Co. (Ltd.), has been visiting Great Britain.

J. J. McLeod, M.L.A., a prominent shipbuilder at Black River, N.B., died there Nov. 26, aged 76.

S. C. Malcolmson, one of the oldest captains on the great lakes, died in Hamilton, Ont., Dec. 10, aged 58.

The Duchess of Albany recently paid a visit to Lord and Lady Mount Stephen at Brocket Hall, Hertfordshire, Eng.

G. H. Webster, General Tie Agent of the C.P.R., at Montreal, is convalescing after a severe attack of pneumonia.

S. A. Fraser, Works Manager of the Nova Scotia Steel and Coal Co., at New Glasgow, N.S., died recently, aged 44.

F. W. Blaiklock, father of M. S. Blaiklock, C.E., Resident Engineer, G.T.R., Montreal, died in Montreal, Nov. 26, aged 81.

A. C. Henry, General Purchasing Agent of the C.P.R., has been spending some time at Mt. Clemens, Mich., for treatment for rheumatism.

Hon. W. Harty, President of the Canadian Locomotive Co., has given $1,000 towards a new convocation hall at Queen's University, Kingston, Ont.

G. R. Joughins, formerly Mechanical Supt. of the Intercolonial Ry., sailed from New York, Dec. 4, for England, intending to return in a few weeks.

Lyman Dwight, Superintendent of the G. N.W. Telegraph Co. at Winnipeg, is spending the winter at San Antonio, Texas, accompanied by his wife.

Miss M. S. Pope, daughter of E. Pope, manager in Quebec of the G.N.W. Telegraph Co., was married there Nov. 27, to Rev. W. Barton, of Shawenegan, Que.

T. Hay, Division Superintendent C.P.R., was entertained at supper at North Bay, Ont., Dec. 12, by the townspeople, on the occasion of his removal to Chapleau.

The summer residence of R. B. Angus, a director of the C.P.R., on the shore of the lake of Two Mountains, near Montreal, was completely destroyed by fire recently.

Jas. Ross, of Montreal, has been appointed Managing Director of the Dominion Iron and Steel Co., Sydney, N.S. He is also Managing Director of the Dominion Coal Co.

W. McMillan, Chairman of the board of directors of the American Car and Foundry Co., who died recently at St. Louis, Mo., was born at Hamilton, Ont., Dec. 20, 1841.

Mrs. Crawford, wife of J. D. Crawford, manager of the Muskoka Navigation Co.'s Royal Muskoka hotel, died suddenly at Stroudsburg, Pa., Nov. 28, of paralysis.

Sir C. Rivers Wilson, President of the G.T. R., is one of the promoters of a company to build a large steel office building in London, Eng., at an estimated cost of $10,000,000.

R. G. Reid, of the Reid Newfoundland Co., went to Montreal from Newfoundland for Christmas. Sir Thos. G. Shaughnessy's private car, Manitoba, met him at Sydney, N.S.

Miss Amy Hawson, second daughter of T. B. Hawson, ex-Auditor of the G.T. Ry. system, now residing in Chicago, Ill., will be married shortly to L. W. Liberman of that city.

Sir C. Rivers Wilson, President of the G. T.R., presided at a lecture given in London, Eng., recently by J. W. Bengough, of Toronto, on "Facts and Fancies about Canada."

Thos. Earle, M.P., Victoria, B.C., who was largely interested in the Seattle and International Ry., has assigned, the cause alleged being financial difficulties connected with the railway.

F. H. Clergue, President of the Algoma Central and Hudson's Bay Ry., has subscribed $5,000 and the stone required to erect an addition to the Sault Ste. Marie General Hospital.

H. Foster Chaffee, Western Passenger Agent of the R. & O.N. Co., and Mrs. Chaffee left Toronto, Dec. 1, for Pasadena, Cal., intending to return via the U.P. and C.& N.W. lines early in Jan.

The McAdamite Metal Co. of Canada has been incorporated with a capital stock of $800,000. E. G. Evans, Superintendent of the Central Ry. of New Brunswick, is one of the incorporators.

R. W. Dunsmuir, son of Hon. James Dunsmuir, Premier of British Columbia and President of the Esquimalt and Nanaimo Ry., was married in San Francisco, Cal., recently, to Miss Maud Shoobert.

I. Boomer, Chief Train Despatcher on the Sydney and Louisburg Ry., at Sydney, N.S., was married recently to Miss Marion McKenzie, daughter of the Mechanical Foreman of the I.C.R., at Sydney.

During the absence in California of F. G. Walsh, local manager of the Bell Telephone Co. at Winnipeg, on account of ill health, his duties are being performed by his chief clerk, J. R. Richardson.

T. Kains, ex-Surveyor General of B.C., and one of the engineers who was engaged on the Government surveys for the western portion of the C.P.R., died at Victoria, B.C., Nov. 25, after a year's illness from paralysis.

Sir Wm. Van Horne arrived in Montreal Dec. 25, from Cuba, where he had been inspecting work on the Cuba Ry. Sir Wm. says the work is progressing satisfactorily, and it is exected that the line will be completed by June, 1902.

Major E. L. Bond, President of of the Phillipsburg Ry. and Quarry Co., and the Montreal representative of a number of European marine insurance companies, was burned to death by a fire at his summer residence, at Phillipsburg, Que., Dec. 3.

J. W. McRae, of Ottawa, at one time President of the Ottawa Electric Street Ry., and recently President of the Canadian Railway Accident Insurance Co., died recently from wounds inflicted by the accidental discharge of a revolver, which he was cleaning.

It is reported that Lord Strathcona and Lord Mount Stephen between them hold $30,000,000 of stock in the Great Northern Ry., U.S. Lord Strathcona is said to have $750,000 of stock in the C.P.R., from which Lord Mount Stephen sold out some time since.

G. B. Reeve, who recently resigned his position as 2nd Vice-President and General Manager of the G.T.R., left Montreal Dec. 24, in company with Mrs. Reeve, to reside at La Pomelo ranch, La Mirada, Cal. An illustrated description of the ranch appeared in our issue of Sept., 1900.

C. M. Hays, who has been appointed 2nd Vice-President and General Manager of the G.T.R., arrived in New York Dec. 23 from England, accompanied by his two youngest daughters, and went to St. Louis, Mo., to spend a few days with Mrs. Hays and the rest of his family. He is expected in Montreal early in Jan. to assume his new duties.

Jno. Foy, Manager of the Niagara Navigation Co., is seriously ill with uræmia. He had been in rather poor health for some months, but was at his office Dec. 18. The next morning he became unconscious, remaining so for three days, but rallied, and as this is written on Dec. 26, the attending doctors report considerable improvement. His recovery is earnestly hoped for by hosts of friends.

A. G. Creelman, of the Imperial Bank, Ottawa, brother of the Chief Solicitor to the C.P.R., and Miss A. E. Blair, third daughter of the Minister of Railways, went through the ice on the Ottawa river on Dec. 6, while skating. Both were carried under the ice, and H. A. Harper went to their assistance. After

a long struggle Mr. Creelman was rescued in an exhausted condition, but Miss Blair and Mr. Harper were drowned.

H. H. Norman, who has been appointed Secretary of the G.T.R. in London, Eng., went to that Co. from the Manchester, Sheffield and Lincolnshire Ry., now the Great Central Ry. of England, and received his early training under the late Sir Edward Watkin, at one time associated with the G.T.R. For some years Mr. Norman was chief accountant to the G.T.R.

R. P. Perry, C.P.R. ticket agent at Bracebridge, Ont., and wife attended the recent annual meeting of the Canadian Ticket Agents' Association at Montreal, but their names were omitted from the list published in our last issue, the names of S. O. Perry, Wabash Rd. ticket agent at St. Thomas, Ont., and wife being inserted instead. The latter did not attend the meeting.

W. Stitt, recently appointed General Agent for the C.P.R. in Australia, was presented by his railway friends in Winnipeg with a set of solid silver tableware, a gold watch and chain, a set of gold cuff links, and a travelling case, and by the members of the grain exchange with a purse of gold. The railway officials also presented Mrs. Stitt with a travelling case. Mr. and Mrs. Stitt and family left Winnipeg Dec. 9 and were expected to arrive at Sydney, N.S.W., early in Jan.

G. M. Lang, who has been appointed Resident Engineer of the C.P.R. at Moose Jaw., Assa., was born at Ottawa, Ont., Aug. 16, 1859, and entered railway service as masonry inspector, Western division C.P.R., at Winnipeg, July, 1899, since which his record has been: Nov., 1899, to July, 1900, draughtsman, divisional engineer's office, same road, Winnipeg; July, 1900, to Nov., 1901, Asst. Engineer, same road, Medicine Hat, Assa.

G. H. Richardson, who has been appointed Resident Engineer of the C.P.R. at Cranbrook, B.C., was born in Toronto, and entered railway service on the C.P.R. engineering staff in 1886, since which he has been consecutively to 1892 on surveys and construction of lines in Ontario; 1892 to 1899, on surveys and construction branch lines, Pacific division, same road, and Crow's Nest Pass Ry.; 1900 to Nov., 1901, Asst. Engineer at Cranbrook.

Among the principal guests at the annual dinner of the Province of Quebec Association for the Protection of Fish and Game, at Montreal, Dec. 5, were W. E. Davis, Passenger Traffic Manager of the G.T.R., and C. E. E. Ussher, General Passenger Agent of the C. P.R. eastern lines. Reference was made to good done by the railway interests in connection with the work of the association. During the year Mr. Davis secured 20 new members, nearly all of whom were railway men.

Isaac Governeur Ogden, who has been appointed 3rd Vice-President of the C.P.R., was born at New York Oct. 10, 1844, and entered railway service Mar., 1871, since which he has been consecutively: Mar., 1871 to 1876, Paymaster and Accountant Chicago and Pacific Ry.; 1876 to Mar., 1881, Auditor same road under Receiver; Mar., 1881, to July, 1883, Auditor Western division C.P.R. at Winnipeg; July, 1883, to June, 1887, Auditor same road at Montreal; June, 1887, to Dec., 1901, Comptroller, same road.

H. B. Curtis, who has been appointed General Superintendent of the Newfoundland Express Co., was born at Adrian, Seneca county, Ohio, Mar. 21, 1848, and entered express service Mar. 15, 1869, as clerk in the office of E. M. Matthews, Superintendent U.S. Express Co. at Cleveland, Ohio, with which Co. he remained until July, 1886, when he resigned. He again entered express service Aug. 10, 1888, as chief clerk, to S. T. Stewart, Superintendent Dominion Express Co., Montreal, remaining there until appointed to his present position, Nov. 11, 1901.

W. R. Baker, Assistant to the 2nd Vice-President of the C.P.R., who had charge of the Co.'s train on which the Duke and Duchess of Cornwall travelled while in Canada, has received a silver jardiniere, with ebony base, bearing the Royal arms and the inscription: "To W. R. Baker, Esq., from the Duke and Duchess of Cornwall, in remembrance of their journey across Canada by the Canadian Pacific Railway, 1901." The members of the suite sent him a silver cigarette box, with facsimiles of their signatures engraved on the cover and the inscription: "To our friend, W. R. Baker, in remembrance of many happy days spent on the C.P.R. in Sept. and Oct., 1901."

Jas. Mooney, who retired on account of ill-health from the office of Superintendent and General Freight Agent, etc., of the Brockville, Westport and Sault Ste. Marie Ry., Mar., 1901, but remained with the Co. as General Passenger Agent, died in Brockville, Dec. 23. He entered railway service in 1858, and was Contracting Freight Agent for the Ottawa and Prescott Ry. until 1864. Between 1864 and 1888 he was engaged in the Southern States superintending railway construction, and on his return to Canada was appointed Superintendent, General Freight Agent, Treasurer and Purchasing Agent of the B.W. and S.S.M. Ry., and in 1894 was also appointed Receiver.

Owen McKay, who has been appointed Chief Engineer of the Lake Erie and Detroit River Ry., was born in the township of Ross, Renfrew county, Ont., Mar. 13, 1848. After being engaged in teaching in the public schools for 12 years, he took a course in civil engineering in the School of Practical Science, Toronto, and became a land surveyor for Ontario in 1887. In the same year he joined the late Jos. de Gurse, and was engaged in survey work on the Lake Erie and Detroit River Ry. Remained with him in his local practice and as Assistant Engineer of the railway until his death, March, 1898, succeeding him as Engineer.

G. W. Bartlett, who has been appointed General Supt. of the Quebec Southern and South Shore Rys., was born in Portsmouth, N.H., and entered railway service in 1877 on the Chicago, Burlington and Quincey Rd.; since which his record has been as follows:—Civil Engineer Buffalo division, Erie Rd.; Roadmaster Delaware division, same road; Supt. Rochester division, same road; Supt. 3rd and 4th divisions New York, Philadelphia and Ohio Rd., at Galion, Ohio; General Supt. Buffalo, Rochester and Pittsburg Ry. up to 1892; Manager Centralia Rd., now part of the Illinois Southern, at Sparta, Ill.; Division Engineer New York Central Rd., from New York to Albany, including the Putnam and Harlem divisions, at New York; and Division Supt. Dunkirk, Allegheny Valley and Pittsburg division, same road.

G. M. Bosworth, who has been appointed 4th Vice-President of the C.P.R., was born at Ogdensburg, N.Y., Jan. 27, 1858, and entered railway service May 1, 1875, as office boy with the Ogdensburg and Lake Champlain Ry. at Ogdensburg, N.Y., since which he has been consecutively to Feb. 21, 1881, clerk local freight office, audit office, and general freight office same road; Feb. 21, 1881, to Aug. 1, 1881, General Freight Agent same road; Aug. 1, 1881, to May 1, 1882, Travelling Freight Agent National Despatch line at Chicago; May 1, 1882, to Jan. 1, 1884, Asst. General Freight Agent C.P.R., Ontario and Quebec lines; Jan. 1, 1884, to April 15, 1885, General Freight Agent, Ontario and Quebec lines same road; April 15, 1885, to Jan. 1, 1896, Asst. Freight Traffic Manager, lines east of Fort William same road; Jan. 1, 1896, to Dec. 1, 1901, Freight Traffic Manager, all lines same road.

E. V. Bodwell, K.C., a partner in the firm of Bodwell & Duff, Victoria, B.C., acting for the Vancouver, Victoria and Eastern Ry. and Navigation Co., and the Victoria Terminal Ry. and Ferry Co., is a candidate for the vacant seat in Victoria for the B.C. Legislature. He is in favor of giving aid to trunk railways, including the Coast to Kootenay Ry., the Island Ry., the Kamloops and Atlin Ry. from Ashcroft to Cariboo, and the British Columbia section of the Canadian Northern Ry. Having done this he would urge the Dominion Government to extend similar aid. It is said that he has given up all briefs incompatible with his position as a candidate, and that if elected he will inaugurate a pro-Great Northern policy as opposed to the C.P.R.

J. E. Muhlfeld, whose portrait appears on the first page of this issue, was born at Peru, Ind., Sept. 18, 1872, and entered railway service Dec., 1892, since which he has been consecutively to July, 1894, machinery apprentice Wabash Rd., at Fort Wayne, Ind.; July to Nov., 1894, locomotive foreman, and Nov., 1894, to Nov., 1895, roundhouse foreman same road, at Peru, Ind.; Nov., 1895, to Feb., 1898, general foreman Danville shops same road; Feb., 1898, to Feb., 1899, general foreman locomotive and car department Buffalo division, same road at St. Thomas, Ont.; Feb., 1899, to Feb., 1901, master mechanic Western division G.T.R., at Port Huron Mich.; Feb., 1901, to Aug., 1901, master mechanic in charge Montreal works, same road; Aug., 1901, to date, superintendent of machinery and rolling stock, Intercolonial Ry.

J. E. Schwitzer, who has been appointed Resident Engineer of the C.P.R. at Winnipeg, Man., was born at Ottawa, Ont., April 19, 1870. During his undergraduate days at McGill College, Montreal, and at intervals of private practise and general survey and engineering work, he was engaged in the following railway works: 1888, rodman on location of the Vaudreuil and Ottawa Ry., and the Lake Temiscaming Colonization Ry.; 1889, Asst. Engineer on construction of the latter line; Aug., 1891, to Feb., 1892, Asst. Engineer on location and construction of the Ottawa and Gatineau Ry.; July, 1893, to Jan., 1894, Asst. Engineer in charge of location and construction Ottawa, Arnprior and Parry Sound Ry.; Feb., 1894, to Dec., 1896, same position, same road; Engineer in charge of Central Counties Ry., from South Indian for Canada Atlantic Ry.; and on surveys, Hull Electric Ry.; July, 1899, to Nov., 1900, Engineer in charge of construction Rat Portage yards, C.P.R.; Nov., 1900, to Nov., 1901, Asst. Engineer in charge of maintenance of way, same road, Winnipeg.

In connection with the precautions being taken in the Province of Quebec against smallpox, the C.P.R. and the G.T.R. have directed that all their employes shall be vaccinated. The G.T.R. circular further requests employes to see that their families are also vaccinated, and desires them to report any case of smallpox within their knowledge to the heads of their departments.

A new schedule of wages, and classification of workmen, together with a new set of rules governing the employes of the I.C.R.'s mechanical department, has been approved by the Minister of Railways, and goes into effect on Jan. 1. By the new schedule the wages paid show an increase of about $30,000 a year over the rates hitherto in force.

The MacPherson Switch & Frog Co., Niagara Falls, N.Y., write: "We take great pleasure in digesting the contents of THE RAILWAY AND SHIPPING WORLD."

January Birthdays.

Many happy returns of the day to

G. M. Bosworth, 4th Vice-President C.P.R. at Montreal, born at Ogdensburg, N.Y., Jan. 27, 1858.

P. W. Brown, Purchasing Agent, Duluth, South Shore and Atlantic Ry., and Mineral Range Ry. at Marquette, Mich., born at Uxbridge, Worcester Co., Mass., Jan. 18, 1845.

N. S. Dunlop, Tax Commissioner C.P.R. at Montreal, born near Almonte, Ont., Jan. 17, 1861.

Sir Sandford Fleming, K.C.M.G , director C.P.R., promoter Pacific Cable, born at Kirkcaldy, Scotland, Jan. 7, 1827.

T. A. Foque, Mechanical Superintendent Minneapolis, St. Paul and Sault Ste. Marie Ry. at Minneapolis, Minn., born at Boston, Mass., Jan. 14, 1866.

J. Pullen, General Freight Agent G.T.R. at Montreal, born at Shepton Mallet, Somersetshire, Eng., Jan. 23, 1863.

E. C. Smith, President Central Vermont Rd. at St. Albans, Vt., born at St. Albans, Vt., Jan. 5, 1854.

J. R. Steele, Freight Claims Auditor C.P.R. at Montreal, Que., born at St. John's, Newfoundland, Jan. 14, 1856.

W. A. Trueman, Director, Secretary and Treasurer Albert Southern Ry. at Albert, N.B., born at Wallace, N.S., Jan. 29, 1849.

F. J. Watson, Division Freight Agent G.T.R. at Montreal, born at Toronto, Jan. 12, 1866.

G. H. Webster, General Tie Agent C.P.R. at Montreal, born at Creemore, Ont., Jan. 31, 1857.

A system of cable conveyers has been installed connecting the Algoma Central & Hudson's Bay Ry. with the lumber area, from which 300 cords of hardwood a day are to be cut for conveyance to Sault Ste. Marie for conversion into charcoal, for one of the Clergue enterprises.

Railway Equipment Notes.

The C.P.R. cars composing the Royal train are being stored at Owen Sound for the winter.

The Newfoundland Ry. will probably be in the market for some mail cars in the near future.

The Cape Breton Ry. Extension Co. has received a locomotive from the New York Central Rd.

The Mount Sicker Ry., Vancouver Island, B.C., has placed an order for another locomotive.

The White Pass & Yukon Ry. equipment will, it is said, be increased by a number of additional locomotives.

The I.C.R. private car No. 109, which was built in anticipation of the recent Royal visit, has been used lately by the Minister of Railways.

The Grand Forks and Kettle River Ry., B.C., has received its first locomotive from the U.S., and is reported to be purchasing other equipment there.

The Klondike Mines Ry., which is referred to in Railway Development department on pg. 3, is likely to be in the market for narrow gauge locomotives and other equipment.

The Canadian Northern and the Northern Pacific Rys. are jointly operating the three sleeping cars, Ogalalla, Klikitat and Nes qually, between Winnipeg and St. Paul, Minn.

The Crow's Nest Southern Ry. is negotiating with the Canadian Locomotive Co. for the construction of several locomotives for its line which will be ready for operation in a short time.

The Toronto, Hamilton and Buffalo Ry. has overhauled a number of its 1st class passenger coaches, abolishing the smoking compartments, and providing accommodation for smokers in the combination cars.

The C.P.R. has equipped locomotive 203, run on the Atlantic division between McAdam Junction and St. John, N.B., with an electric headlight. Ten locomotives on the Pacific division have been similarly equipped.

The Canada Atlantic Ry. Co. was recently reported by the daily press to be about to build two parlor cars for the Montreal-Ottawa service. We were officially informed on Dec. 4 that the Co. was not doing any new work.

The G.T.R. has arranged with the Pullman Co. to place on service on the express trains between Montreal and Toronto 3 new sleeping cars, each containing 12 sections and drawing-room. The interior decorations are very elaborate.

The Canadian Northern Ry. car shops at Winnipeg have been thoroughly equipped, and material has been stocked for car construction. Orders have been placed for cars for May delivery, among them being a number of refrigerator cars. These are to be painted black and white.

The Canadian Northern Ry. has received nearly the whole of the car equipment ordered prior to Sept., 1901, and delivery of the balance, as well as of the 700 box cars, of 60,000 lbs. capacity, ordered since, is being made. The whole are expected to be in by the end of Jan. Of the 16 locomotives ordered, all but one or two have been delivered, and these are expected early this year.

The Canada Foundry Co., Toronto, has ordered from the Canadian Locomotive Co., a four wheeled saddle-tank engine, about 40,000 lbs. in working order, cylinder 12 in. diameter by 16 in. stroke; driving wheels 36 in. diameter; tank capacity 500 imp. gals.; 36 in. radial stay boiler to carry 150 lbs. per square in.; M.C.B. automatic coupler, front and back; steam brake, combined with hand power attachment; coal bunkers at rear of engine.

The Algoma Central and Hudson's Bay Ry. added the following equipment during 1901:— Private car "Michipicoten," 100 pressed steel ore cars 100,000 lbs. capacity, 94 dump cars,

100 flat cars 40,000 lbs. capacity, 4 flat cars 60,000 lbs. capacity, two 60-ton steam shovels. The Co. has built at Sault Ste. Marie 1 snow-plow and 4 cabooses. The car shops there have just been completed and work has been started on 300 flat cars 40 tons, and 50 box cars 40 tons.

The Dominion Customs Department recently released 1,000 box cars on the Canada Atlantic Ry., which were seized two years ago for duty, the customs authorities contending that they were being used for the C.A. Ry.'s traffic between Depot harbor, Ont., and Coteau, Quebec., and not for through international traffic. Only three of the cars were held, the others being allowed to be used pending the decision. The value of the cars was placed at $750,000.

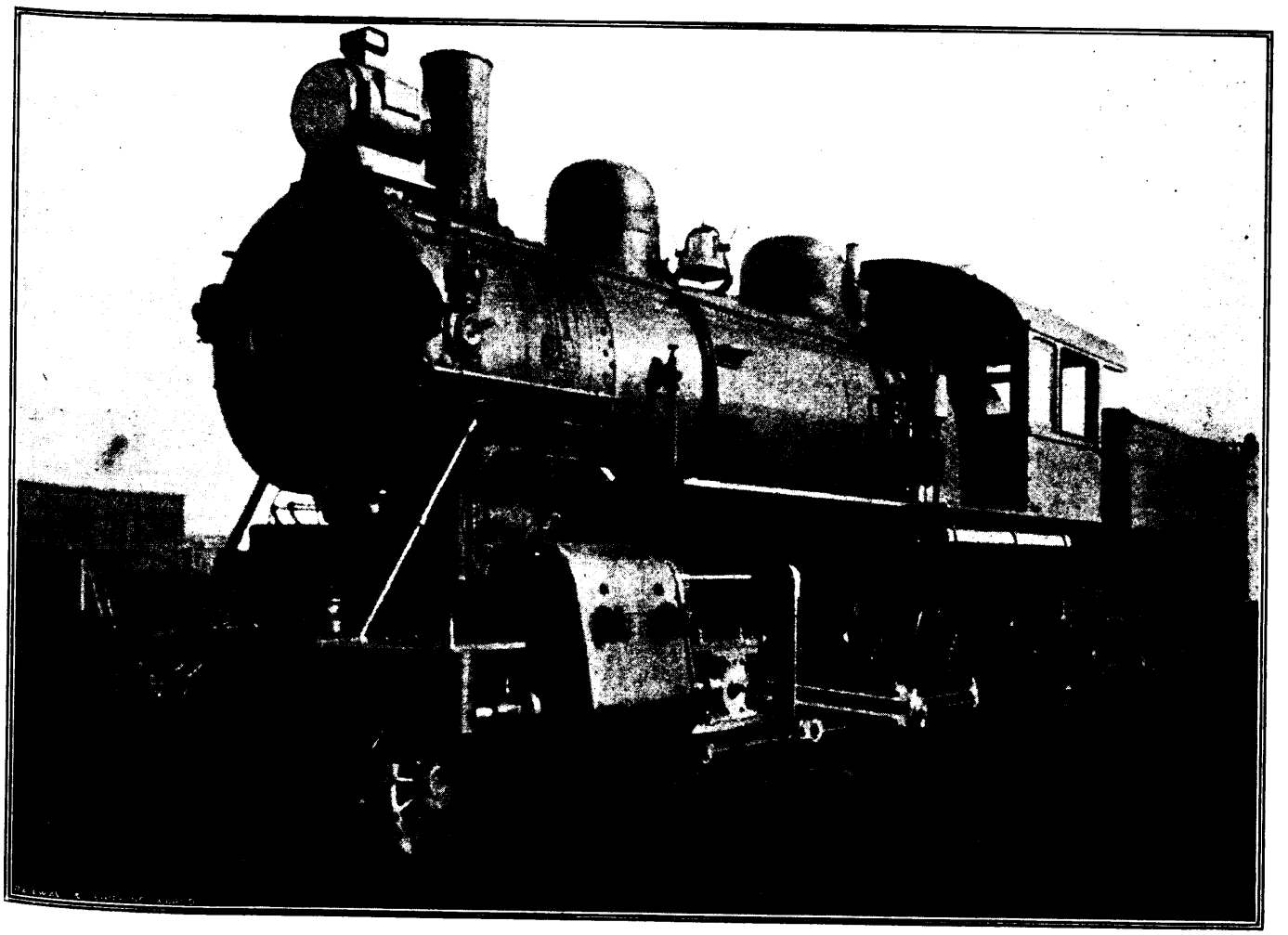
will remove its works to another location and it seems probable that this will be done, and that a much larger plant will be put in operation.

The Midland Ry. of Nova Scotia, which has recently been opened for traffic, has started out with the following equipment:—1 locomotive, 2 first class passenger coaches, 1 combined 1st class passenger and smoking coach, 1 baggage and express car, 2 box cars, 60,000 lbs. capacity, 30 flat cars, 60,000 lbs. capacity. The equipment is provided with automatic couplers and air-brakes. It has not been definitely decided what additional equipment will be provided during the winter, but 2 locomtives will be added and more passenger coaches.

The Michigan Central Rd. has built two

met Hon. Mr. Harty, M. J. Haney, and C. Bermingham, of the Canadian Locomotive Co. It is reported that he made an offer of $500,000 for the works and the contracts in hand for locomotives; that this offer was declined, and that a price of $1,000,000 was put on the property, etc. Mr. Arkell is reported to have stated in Montreal that, failling to secure the Kingston works, the American Locomotive Co. will start works in Montreal, but that if the Kingston works are secured 3,000 men will be employed. We have been unable to obtain any definite information in regard to the matter further than that an officer of the American Locomotive Co. informs us that that Co. does not contemplate the establishment of works in Canada.

The Lake Erie and Detroit River Ry. has



CANADIAN PACIFIC RAILWAY COMPOUND CONSOLIDATION FREIGHT LOCOMOTIVE.

The Central Ontario Ry. has ordered a 10-wheel passenger locomotive, with 3 pairs of coupled wheels, from the Canadian Locomotive Co., to be delivered in May. Gauge, 4 ft. 8½ ins.; fuel, bituminous coal; cylinders, 18 x 24 ins.; driving wheels, 57 ins. diameter; weight of engine in working order, about 115,000 lbs.; brakes, automatic (Westinghouse) for tender and train, and equalizing brakes on drivers; bell, automatic bell ringer; tank capacity, 4,000 gallons; steel frame.

The Canadian Locomotive Co. has had a very satisfactory year's business. It was about the middle of April, 1901, before the Co. began turning out locomotives under the new management, and since that time it has delivered 20 consolidations, 4 compounds, 4 moguls and 2 narrow gauges. It is expected that the output will be considerably increased this year. It has been rumored that the Co.

transfer freight engines at its St. Thomas, Ont., shops, and two more will probably be built there in the near future. Following are the general dimensions:—

Style	6 wheel coupled switch
Total weight of engine alone	131,000 lbs.
Cylinders	19x26 in.
Driving wheel centre	44 in.
Style of boiler	Radial stay, straight
Inside diameter of boiler	65 in.
Pressure carried	180 lbs.
Flues, 2 in	280
Heating surface	1771.4 ft.
Grate area	31.5 ft.

In a recent test of one of the locomotives 45 loaded cars were hauled from Montrose yards to the cantilever bridge at Niagara Falls.

W. J. Arkell, of New York, who is said to be associated with the American Locomotive Co., has been in Kingston, Ont., where he

recently purchased 17 passenger coaches in Chicago. Three of them are palace cars 50 ft. long, three wheel trucks, moderately equipped, with smoking compartment, chandeliers, and patent heaters—seating capacity 48. One is a palace car 60 ft. long, same description—seating capacity 60. Two are 1st class day coaches, 60 ft. long, patent heaters, chandeliers, finished in fine quarter-oak—seating capacity 70. One is a palace car 60 ft. long, solid vestibule, three-wheel trucks—will seat about 70—has not been finished up yet. The Co. has also purchased a combination official and pay car, built by the Pennsylvania Co., 50 ft. long, containing observation end, two upper and two lower sleeping berths, one state room, closet, kitchen, and pay car end, fitted with lighting system and patent heaters.

The unconfirmed report that the C.P.R. was contemplating using electricity as motive

power for its trains in the B.C. mountain sections, recalls the fact that the Baltimore and Ohio Rd. some time ago made an exhaustive inquiry into the feasibility of operating trains over the 17-mile grade in the Alleghanies with electric power. It was found, however, that the expenditure of several millions of dollars would be necessary to put such a system in operation at that point. The track would have to be relaid with 100 lb. rails and electrical locomotives weighing 120 tons would have to be built for the service. Nevertheless, the electrical system of operating might have been introduced on the mountain had the engineers been able to find adequate water supply to drive the dynamos which would manufacture the necessary electricity. No suitable stream could be discovered, and the idea was abandoned for the time being and no evidence of its being revived has been recently observed. To operate the dynamos by steam would be too expensive. In B.C. the C.P.R. has at its disposal abundance of water power.

The Quebec & Lake St. John Ry. has ordered from the Baldwin Locomotive Works 2 mogul freight locomotives, to be delivered by Feb. Following are the general dimensions :—

Cylinder, diameter (high pressure)	20 in.
" stroke	26 in.
" valve	Balanced
Boiler, diameter	64 in.
" thickness of sheets	
" working pressure	200 lbs.
" fuel	
Firebox, material	Steel
" length	108 in.
" width	42 in
" depth (front)	
" " (back)	
" thickness of sheets—sides	5-16 in.
" " " back	5-16 in.
" " " crown	3-8 in.
" " " tube	½ in.
Tubes, material	Iron
" number	abt. 262
" diameter	2 in.
" length	12 ft. 6 in.
Driving wheels, diameter outside	57 in.
" diameter of centre	50 in.
" journals	8 in. x 10 in.
Engine Truck Wheels (front) diameter	30 in.
" " " journals	5 in. x 10 in.
Wheel Base, driving	14 ft. 0 in.
" rigid	14 ft. 0 in.
" total engine	22 ft. 2 in.
" total engine and tender	abt. 52 ft.
Weight on driving wheels	abt. 117,000 lbs.
Tender, diameter of wheels	33 in.
" journals	4¼ in. x 8 in.
" tank capacity	5,000 gals.

The C.P.R. recently received from the American Locomotive Co. eight compound consolidation freight locomotives, one of which is illustrated on page 13. E. A. Williams, Superintendent of Machinery and Rolling Stock, has furnished us with the general dimensions, as follows :—

Total weight in working order	159,500 lbs.
Weight on drivers	140,500 lbs.
" on truck	19,000 lbs.
" of tender, loaded	114,000 lbs.
Total weight of engine and tender	273,500 lbs.
Total wheel base of engine	23 ft. 7 in.
Rigid wheel base	15 ft. 8 in.
Total wheel base, engine and tender	51 ft. 8 in.
Simple or Compound	Compound
System	Schenectady
Cylinders	22 and 35 x 28 in.
Driving wheels, dia. on tread	57 in.
" " centres	Cast steel
" " axle boxes	Cast steel
Driving wheels, axle journals (main)	9 x 11 in.
" " " leading, interm. and trailing	8½ x 11 in.
Engine truck journal	6 x 11 in.
" " wheels, Allan No. 7 steel tired	30 in. dia.
Crank-pin journal (main), nickel steel	6½ x 6 in.
" " main (side rod), nickel steel	7½ x 5 in.
" " intermediate, nickel steel	5½ x 4½ in.
" " front and back	5 x 3½ in.
Engine truck	Swing bolster
Boiler, extended wagon-top with wide fire box over frames	
Working steam pressure	200 lbs.
Diameter of boiler at waist, inside	61 in.
" of tubes, outside	2 in.
Number of tubes	281
Length of tubes	14 ft. 3 in.
" of firebox	9 ft. ½ in.
Width of firebox	5 ft. 5⅜ in.
Depth of firebox	front, 4 ft. 6½ in.; back, 5 ft. 2½ in.
Radial stays (Taylor iron)	1⅛ in. dia.
Stay-bolts (Taylor iron)	1 in. dia.
Boiler material (steel)	½ in., ⅝ in., 11/16 in. and ¾ in.
Heating surface, firebox	134.37 sq. ft.
" " tubes	2,084.17 sq. ft.
" " total	2,218.54 sq. ft.
Grate "	43.64 sq. ft.
" type	Rocking, with dump.
Tender :	
Tank capacity	5,000 impl. gals.
Coal capacity	20,000 lbs.
Tank Material	Steel
Frame	10 in. steel channel
Truck	Common sense bolsters
Axles	Steel, 5½ x 10 in.
Wheels	Cast iron, 33 in. dia.

Four similar compound locomotives have been received by the C.P.R. from the Canadian Locomotive Co. The C.P.R. has placed an order with the American Locomotive Co. for 12 additional similar locomotives for September delivery, and for three 10-wheel passenger locomotives. The latter will be duplicates of the 12 the Co. is building in its Montreal shops, the general dimensions of which

were given in our issue for Sept., 1901, pg. 265. One of these was expected to be completed in the Montreal shops, and the balance to be turned out at the rate of two a month till the order is completed. The order has been increased by 12 more, making 24 in all. The C.P.R. has completed at its Montreal shops the 12 switching locomotives which were described in our issue of Sept., 1901, pg. 265.

The C.P.R. built at its Hochelaga, Perth and Farnham shops during 1901 the following cars :—

245 box cars, 30 tons capacity, 35 ft. long.
55 box cars, 40 tons capacity, 36 ft. 8 in. long.
20 standard vans, 33 ft. long.
28 stock cars, 30 tons capacity, 35 ft. long.
24 flat cars, 30 tons capacity, 35 ft. long.
2 official cars, 70½ ft. long, fitted with electric light.
1 sleeping car, 70½ ft. long, fitted with electric light.
2 standard baggage and express cars.

At the C.P.R. Perth shops an order for 1,200 freight cars is being completed at the rate of 10 a day. At Farnham 20 cabooses are being built. At Hochelaga an order is in hand for 20 1st class passenger coaches, 6 1st class sleeping cars and 2 parlor cars.

The following additional orders have recently been placed in the C.P.R. shops :—At Farnham, 10 standard cabooses, which have already been completed ; at Perth, 50 double deck stock cars, 30 tons ; 50 refrigerator cars for freight service, 30 tons ; 300 coal cars, 40 tons; 200 stock cars, 30 tons ; at Hochelaga, 2 standard wing snow plows.

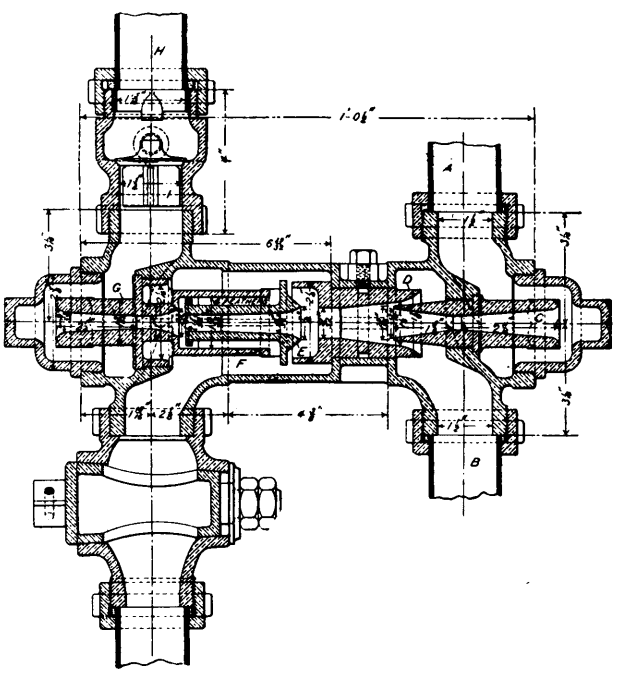
C.P.R. Standard Injector.

The accompanying illustration shows an injector which is made by the C.P.R. at its own shops. It is of the lifting type. Steam is admitted at A, and the water through the suction pipe at B. The steam nozzle C has a rear opening of ¾ inch, tapering to ⅜ inch at the choke. This is screwed into the body. The combining tube D has a wide, flaring opening to its full diameter of 1⅞ inches, and is held in position by a tap bolt passing through the body and tightened from the outside. The sliding nozzle, E, which is just beyond, is held centrally in position by four feathers on the outside of the tube, and has a travel of 3-16 inch before it strikes against the face of the combining tube. This sliding nozzle moves in a shell cast solid in the delivery nozzle and which opens into the overflow chamber, F. The latter opens into the overflow pipe, leading down to the ground in the ordinary manner. The delivery nozzle, G, discharges against the inside of the back cap from which point the feed flows up through the check I, and into the boiler by way of the pipe, H. In working out the details of this injector, great care has been taken to secure the proper taper and flare in all of the nozzles and tubes through which the steam and water are obliged to flow in order to secure a complete commingling of the two. The design also seems to secure the proper condensation of the former, and the greatest velocity of delivery with the minimum of resistance on the part of the apparatus to the flow of liquid through it. —Railway Age.

The L'Assomption Ry., which connects with the C.P.R. at L'Epiphanie, Que., has been closed for the winter as usual.

E. T. Galt and Alberta.

A special correspondent of the Toronto Globe has been contributing a series of interesting articles on the Northwest Territories. In one of them, written from Lethbridge, he says :—"Justice compels me to give first place in any reference to the progress of southern Alberta to the gentleman who has been prominently identified with this great semi-province, practically from its birth, namely, Elliott T. Galt. No man has done more than Mr. Galt in opening up western Canada, and none has shown a more implicit confidence in the future of this particular section of the country. His father, the late Sir Alex. Galt, gave the original impetus here by starting coal mining operations, work which furnished immediately a nucleus for the town of Lethbridge. These mines have developed, until at present they are producing 800 tons daily. Mr. Galt divides his time between Lethbridge and Montreal, but a liberal share of it is spent in the beautiful country with which his name is so closely identified. Besides his mining interests here, he has extensive rail-



CANADIAN PACIFIC RAILWAY STANDARD INJECTOR.

way interests. With the aid of English capital, which he interested, he built the Alberta Ry. and Coal Co.'s road which, although mainly used at first in transporting coal to the U.S. market, has proved also of the greatest service in opening up the country. This road extends to Great Falls, Mont., a distance of 220 miles, though only that portion north of the border remains under Canadian control, and this, it is expected, will in the near future be taken over by the Great Northern Ry. Then Mr. Galt identified himself prominently with a great scheme of irrigation, whereby many hundreds of thousands of acres of land to the south and east of Lethbridge, which had hitherto been considered of comparatively little value, because of the scarcity of water, are being brought within the fruitful zone. This last great enterprise is in itself so vast in its scope and so far-reaching in its effect that I shall deal with it in another letter. It is sufficient to say here that the project appears destined to exercise a vast influence on the settlement of the country, and has, indeed, already been a material factor in the remarkable development of the past year or two. Yet one other important enterprise which Mr. Galt practically shouldered alone was the construction only last year of the St. Mary's River Ry., a narrow-gauge line, running out from the Alberta Ry. and heading for Cardston, the pioneer and principal Mormon settlement, lying just east of the Rockies and north of the boundary. This new line, which received the usual cash subsidy from Ottawa, is 30 miles long. It is at present 17 miles from Cardston, but will no doubt be continued to that town next year. On its way it already touches Stirling, McGrath and Raymond, all flourishing Mormon settlements, the last the youngest, but destined, I should conjecture, to speedily outrank the older towns, when once the great beet sugar factory indicated in the above interview is estalished there. No more useful railway could have been constructed in southern Alberta.

"These are examples of the way in which Mr. Galt, quietly and unostentatiously, has been developing the wealth of this beautiful Province. He is little known in the east, and, save to a few intimate friends, but little better known out here. He cares but little for money, and his enterprises have been by no means always money-making ventures, though the country has benefited greatly from them."

Freight Traffic Matters.

A weekly train carrying perishable freight is now made up at North Bay by the C.P.R. and run to Winnipeg, where a similar train is made up and run to the Pacific coast.

An arrangement is said to have been made by which the C.P.R. may use the I.C.R. terminals at St. John, N.B., for any overflow of business. The Bridge Co. has given a special rate, and the I.C.R. will also give favorable rates to Carleton on any shipments that may have to go there for steamers. Supt. Osborne, of the Atlantic division of the C.P.R., is reported to have said nothing was known of the matter at that end of the line, and that it was unlikely any such arrangement should be made, as the C.P.R. had ample facilities for handling all the freight that would arrive at West St. John this winter.

Two writs, it is reported, have been served on the Victoria, B.C., representative of the White Pass and Yukon Route, each claiming $20,000 from the Co., on the ground that the rates on its railway have not been approved by the Dominion Government as required by law, and asking for the return of all freight and passenger fares paid to the Co. by the Upper Yukon Consolidated Co., and J. Clearihew. It is also contended that the rates charged are exorbitant. Statements have recently been appearing in the daily papers as to rates over the line. One statement made was that the rate for flour was $2.70 per hundred lbs. J. F. Lee, General Traffic Manager, has denied this and states that the maximum distance tariff rate for flour is $1.75 per 100 lbs., and not in any way the actual competitive or proportionate rate demanded or collected. The whole question of freight rates on this line is being considered by the Department of Railways, and probably would have been settled but for the state of Hon. Mr. Blair's health, which has been very poor since his daughter's tragic death. It is understood to be his determination to have such rates fixed as, while giving the Co. all it is justly entitled to under all the circumstances, will be fair to the users of the road.

The Wire and Cable Co. has ordered a 300 h.p. compound engine for its new factory in Montreal.

AN EFFICIENT AND ECONOMICAL LOCOMOTIVE SERVICE FOR FAST HEAVY TONNAGE.

By J. E. Muhlfeld.

During the present period, when the facilities of many railroads are being taxed to their limit to move the tonnage which is naturally forthcoming and dependent upon the railroad service to handle to its destination, to the operating, more than to the traffic department, is assigned the duty of increasing the revenue which must be derived from the handling of a ton of freight per mile of haul.

On systems where the most favorable and modern conditions exist for the train movement, the operating of the line may be termed practically automatic when compared with parallel and competing lines where the track, power, and despatching conditions are not so conducive for the realization of net earnings.

In the one case the track and despatching conditions are the best that advanced ideas and money can devise, and the capacity of the locomotives provided is limited only by the most modern design and the clearance limits. On the other hand, we have the single track line, with its naturally unfavorable road bed, light rail, short sidings, many grades and short degree curves, unfavorable water, and grade stops, more liability for casualty, and a large proportion of obsolete power, from the operating of which, and in competition with the more automatic line, is expected the handling of tonnage at dividend paying figures.

It is on these latter lines, especially, that the people employed in the operating departments must contend with the most severe conditions and the consequent annoying criticism when a failure to accomplish the expected results occurs.

Considering the subject referred to from an operating department standpoint, the first requirement by the transportation of the motive power department is locomotives of such capacity and in such condition as will move the greatest gross tonnage in one train at the fastest rate of speed that the track and despatching conditions will allow with a reasonable degree of safety.

The principal thing that a railway has to do is to get its trains from one terminal to another on time, and to the motive-power men and the operating officers this is the uppermost duty in mind.

While railroads are not operated to save fuel, or to have locomotives that it does not cost much to maintain and run, and although economy has to be considered as secondary to getting trains over the road, at the same time the tractive power required and the limits given within which to acquire this, make it now necessary that locomotives be so constructed that more work will be derived from the use of steam, and the result should be economy.

While the motive-power department people and locomotive builders are keeping abreast of the times as regards the development of power suitable for and which fulfils the requirements of the transportation and traffic departments of railroads, at the same time such advance has not been made with due consideration being given to the combination of an economical with an efficient service. The designs now having reached the clearance limits, it is necessary that a decided change be made at once, to not only provide for a further increase in the boiler capacity to supply the additional tractive power, but also for a service which will be given without the proportionate increase in the cost as the capacity of the power.

During the past few years almost entire attention has been given to the enlarging of boilers and grate areas only for the reason of fulfilling the requirements of the cylinder capacity required to produce the increased tractive power, and the proper consideration has not been given to the obtaining of this increased efficiency at a reduced operating cost.

It is not presumed that the design of locomotive referred to in this paper, or the method proposed for the operation, is without criticism, but the intention is that the special features that have been referred to will receive the due consideration of designers and builders, and that power will be provided which will remain modern for its entire period of service and produce the same efficiency at a more reduced cost than the power that has been built during the past few years.

A discontinuance of the present prosperous conditions of the country and the railways, and the continuance of some of the present wasteful methods of locomotive service, will soon result in increased losses, which would not occur had more consideration been given by the men in the mechanical departments to the attaining of an economical service in connection with an efficient one.

That the motive power department shall be asked to do a large proportion as regards the reduction in cost for operating is but fair, especially when it is considered that the average cost for the fuel alone for the locomotive service amounts to from 14 to 16%, and the cost for the renewals, maintenance and the operation of the power figures from 18 to 25% of the total operating expenses, depending upon the locality and the conditions.

While it is a fact that electro-motive force is in many instances superseding steam power for the handling of suburban passenger traffic, and that it may shortly displace the latter for through passenger service; it will, however, be some time before electrical energy will supplant steam motive force for the handling of heavy tonnage.

Therefore, in preparing the design for a type of tonnage locomotive for to-day, such construction must be adhered to as will not only fulfil the present heavy tonnage requirements, but which will also remain modern for several years to come, and combined in the constructive features must be the design of a boiler and a motion gear which will insure the most conversion into energy, per unit of heat contained in the fuel to be consumed, and which will result in the most econony, both as regards the cost for maintenance and operation.

The features for a modern locomotive may be summed as follows:—A reasonable first cost, maximum capacity for the service, and within the track weight and clearance requirements, capacity to handle the heaviest gross tonnage practicable at the highest permissible speed, economical as regards fuel and water consumption and maintenance for repairs, a construction of the least number of parts, and a capacity to perform continuous mileage without failure.

The modern American types of locomotives fulfil quite satisfactorily all of these requirements, with the exception of the wastefulness in fuel and water consumption; and in the type of locomotive that is submitted, the most careful consideration has been given this subject, while a design has also been adhered to which will embody the other necessary, and which may be, practicable features.

All mechanics interested in locomotive design and construction realize the fact that we have reached almost the limit, and that only by brute force, as regards increasing the steam-making capacity of the present American type of locomotive boiler, with its stoking and feeding appliances, and in maintaining the present clearance limits. A new type of boiler and its attachments must be designed which can be readily adapted to the present arrangement of cylinders, frames, and the carrying and motion gear, and to further increase the capacity and mainly the efficiency, it must be of such design as will convert into work more of the energy now contained in the fuel, and which is being lost to such a serious extent. This efficiency must be increased from two to three fold, and for an almost equivalent weight.

Such a boiler must be of a simple and durable construction to be able to withstand the grief that will result from the high steam pressure, excessive expansion and contraction, persistent forcing, bad water, weather and track conditions, and neglect of attention in the way of boiler repairs, inspections, tests and washing out, which are quite liable to occur during a time when the power is hard run in order to handle a heavy business, and when the weather conditions especially are decidedly severe. Such a boiler must be easily accessible to facilitate repairs and removal of parts, and must be drafted so that even under the most adverse conditions which will result from the use of an inferior quality of fuel during severe atmospheric conditions, the failures to steam, which cause much expense, to say nothing of the delay to train movements, will be reduced to the minimum.

With this recommendation for the design of a boiler which will more nearly fulfil the requirements of locomotive service than the present type, have also been embodied other features which will better meet the general requirements, and which will give results to the company, engineers, firemen and shop men who must do service about them.

The type of locomotive that has been made the subject for this proposition is the most undesirable with which to associate the new features and keep within the overhead clearance requirements of 15 ft. 2 in., from the fact that the driver wheels being 63 inches in diameter over the tires, leaves but little margin for the boiler and its attachments, and for a depth of firebox between the top of the foundation ring and the lowest position of the combustion flues. It will be noted that these features can be more readily applied to some of the other types of locomotives, but which would not be so favorably adapted for the service to be performed.

Referring to the drawings which give the general arrangement only and which are printed separately as an inset opposite page 24.

Fig. 1 shows a left elevation of the locomotive.
Fig. 2 shows a longitudinal section of the locomotive.
Fig. 3 shows a top plan of the locomotive.
Fig. 4 shows a right elevation of the engine.
Fig. 5 shows a front elevation and section through the combustion chamber.
Fig. 6 shows a front end elevation of the engine.
Fig. 7 shows a rear end elevation of the engine.
Fig. 8 shows a cross section through the firebox and stokers.
Fig. 9 shows a rear end elevation of the tender.
Fig. 10 shows a section of the tank on line A.B.
Fig. 11 shows a section of the tank on line Y.Z.
Fig. 12 shows a section of the tank on line C.X.
Fig. 13 shows a cross section of the stokers.
Fig. 14 shows a longitudinal section of the stokers.
Fig. 15 shows a longitudinal section of the combustion chamber.
Fig. 16 shows a section plan of the combustion chamber.
Fig. 17 shows a front elevation of the combustion chamber.
Fig. 18 shows the method for attaching the combustion flues to the flue sheets.

DESCRIPTION AND SPECIFICATIONS.

GENERAL.

Service.—Fast freight.
Type.—Consolidation, cross-compound.
Gauge.—4 feet, 8½ inches.
Kind of Fuel.—Bituminous coal; screenings, run-of-mine, or lump.
Cylinders.—21 in. x 36 in. diameter x 30 in. stroke.
Driver wheels, 63 in. diameter, over tires.
Boiler pressure.—250 lbs., indicated.

WEIGHT.

Weight on driver wheels, with 10 tons of coal,	187,500 lbs.
" on pony truck wheels	18,000 "
" total of engine with coal, water and stokers ready for service	205,500 "
Weight total of tender with 7,564.5 U.S. gallons of water	130,000 "
Weight total of locomotive loaded, in working order	335,500 "

DIMENSIONS.

Wheel base, rigid or driver	17 ft. 3 in.
" " total of engine	26 ft. 3 in.
" " total of tender	16 ft. 6½ in.
" " locomotive	55 ft. 9¾ in.
Length, engine, pilot to friction casting	40 ft. 4 in.
" tender, friction casting to coupler	25 ft. 0 in.
Length, locomotive, pilot to rear coupler	65 ft. 4 in.
Height, centre of boiler above rails	9 ft. 6 in.
" total above rails	15 ft. 2 in.
" top of tender tank above rails	12 ft. 0 in.
Width, cab, over all	10 ft. 0 in.
" coal tank, over hand rail	10 ft. 0 in.
" tender, over all	10 ft. 0 in.

TRANSPORTING CAPACITY.

Tractive power, maximum, in compound gear,	35,070 lbs.
" " " emergency gear,	43,837 "
Adhesive " " with 10 tons of coal,	42,187 "
" " minimum, with no tons of coal,	37,687 "
Hauling capacity in compound gear, on straight, level track, at 10 miles per hour, maximum	6,512 tons.
Speed, maximum economical	45 miles per hour.
Horse-power, maximum indicated, developed at starting	about 1,000.

BOILER AND TANK PROPORTIONS.

Heating surface, firebox, from top of foundation ring, fire surface measurement	141.00 sq. ft.
Heating surface, water, surface measurement	143.00 "
Heating surface, combustion flues, F.S.M.	282.39 "
Heating surface, combustion flues, W.S.M.	300.94 "
Heating surface, front tube sheet, F.S.M.	14.00 "
" " front tube sheet, W.S.M.	14.00 "
" " boiler tubes, F.S.M.	1,824.00 "
" " boiler tubes, W.S.M.	2,075.00 "
" " Total, F.S.M.	2,261.39 "
" " Total, W.S.M.	2,532.94 "
Grate area, equivalent	42.00 "
Draft area, combustion flues, cross sectional	4.82 "
Draft area, boiler tubes	3.72 "
" " smoke stack	3.68 "
Volume, combustion chamber	150.00 cubic ft.
" smokebox	55.66 "
" steam space in boiler, with normal water level	82.34 "
Volume, minimum, for free steam space in water tank	447.5 "
Capacity, boiler, for water at normal level	2,130 U.S. gals.
Capacity, maximum cold water storage in water tank	6,070.5 "
Capacity, maximum hot water storage in water tank	1,494 "
Water level, normal, from top of boiler tubes	6 in.
" " normal, from base of dome	12 in.
Ratio of equivalent grate area to total heating service, F.S.M.	1 to 53.84
Ratio of equivalent grate area to total heating surface, W.S.M.	1 to 60.30
Ratio of equivalent grate area to firebox heating surface, F.S.M.	1 to 2.68
Ratio of equivalent grate area to firebox heating surface, W.S.M.	1 to 2.72
Ratio of firebox to total flue and tube heating surface, F.S.M.	1 to 15.03
Ratio of firebox to total flue and tube heating surface, W.S.M.	1 to 16.59
Ratio of high pressure cylinder volume, in cubic feet, to total heating surface, in square feet, F.S.M.	1 to 376.27
Ratio of high pressure cylinder volume, in cubic feet, to total heating surface in square feet, W.S.M.	1 to 421.45
Ratio, volume of boiler steam to water space	1 to 3.44

BOILER.

Type, straight.	
Pressure, indicated working	250 lbs.
Length, over combustion flue sheets	13 ft. 0 in.
" over boiler tube sheets	23 ft. 6 in.
" front of combustion chamber to rear of smoke box	33 ft. 0 in.
First course, outside diameter	72 in.
Boiler, " outside diameter	72 in.
Dome " outside diameter	36 in.
" depth	24 in.
Combustion chamber, outside diameter	75½ in.
" " length from tube sheet	60⅝ in.
Smokebox, outside diameter, at boiler 45 in., rear	36 in.
" length from tube sheet	45 in.
Firebox, type, wide, long and shallow.	
" length, inside	120 in.
" width, inside	63 in.
" depth, inside, at front and back	42 in.
" water leg width, front	5 in.
" water leg width, rear	5 in.
" water leg width, sides, top	7 in.
" water leg width, bottom	5 in.

Firebox, flat sheets, stayed with 1¼ in. diameter, 12 pitch thread, best iron staybolts spaced 3¾ in. between centers, with tell-tale holes drilled at outside sheet ends.
Firebox, crown sheet, stayed with 1⅛ in. diameter, 12 pitch thread, best iron staybolts, spaced 3¾ inches between centers, secured to 6 in. x 5½ in. x 1½ in. tee steel bars spaced with thimbles to each bolt, 3 in. from the top of crown sheet. Crown sheet bars suspended from tee steel bars riveted to shell sheet, by five 1½ in. diameter clevis stays adjusted for expansion and contraction of firebox sheets. Tell-tale holes drilled at crown sheet end of all staybolts.
Boiler flat sheets, stayed with tee steel bars riveted to sheets and tied with 1½ in. diameter rod stays to boiler shell.
Combustion flues, Material: charcoal, iron.
" " corrugated, center, gauge .500 in., O.D. 24 in., length 12 ft. 10¾ in.
Combustion flues, corrugated, R. and L. gauge .375 in., O.D. 12 in., length 12 ft. 10¾ in
Combustion flues, plain, two top, gauge .250 in., O.D. 5 in., length 12 ft. 10¾ in.
Combustion flues, plain two bottom, gauge .250 in., O.D. 6 in., length 12 ft. 10¾ in.
Combustion flues, minimum water space between, 1¾ in.
" " corrugated, fastened at firebox flue sheet to outside of flanging with ¾ in. best iron rivets, pitch 2½ in., countersunk heads to fire side, and flanging edge calked to flue. Fastened at front tube sheet to inside of flanging in the same manner. See Fig. 18 of drawing.
Combustion flues, plain, fastened at firebox flue sheet and at front tube sheet in the same manner as the corrugated flues, but with ¾ in. rivets, pitch 2 in.
Boiler tubes, Material: cold drawn seamless steel.
" " number 135, gauge .135 in., O.D. 2¼ in., length 24 ft. 0⅛ in.
Boiler tubes, minimum water space between, 1⅛ in.
" " fastened to front and rear tube sheets by roller expanding, copper ferrules and beaded at combustion chamber end only. 31/16 in. centers, minimum spacing, but tubes swaged to give a ¾ in. minimum bridge at combustion chamber tube sheet.
Combustion chamber door and frame, cast iron, with clamp fastenings to door.
Smokebox door and frame, cast iron, with clamp fastenings to door.
Smokebox netting and draft appliances, none.
Smoke stack, cast iron, straight, inside diameter, 26 in., length 32 in.
Smoke stack steam blower, malleable iron, central with stack, with ¾ in. live steam nozzle.
Firebox doors and frames, cast iron, 2-15 in. diameter.
Drop grates, cast iron, two at rear of firebox.
Ash pan, steel plate, with hinged rear cleaning door.

CYLINDERS AND MOTION GEAR.

Type, cross-compound.
Cylinder, high pressure, diameter 21 in., stroke 30 in.
" low pressure, diameter 36 in., stroke 30 in.
Crotch, direct steam and receiver pipes, cast iron, of large capacity for superheating purposes.
Dry pipe, steel tube, 8 in. diameter, with brass connections.
Throttle stand pipe, cast iron, with one-seated balanced throttle valve.
Pistons, high and low pressure, cast steel "Z" pattern center, with fused cast iron ring for the cylinder bearing. Pistons fitted 1-32 in. less than the cylinder bore diameter and without extended piston rods. Each piston to have 3⅜ in. width x ⅜ in. thickness cast iron snap packing rings turned ¼ in. and ¾ in. larger in diameter, respectively, for the high and low pressure cylinders, and fitted and returned to suit the bores.
Piston rods, forged wrought iron, machined, case-hardened, and ground to 4½ in. diameter.
Valve, high pressure, piston, internal admission.
" *low* " D pattern Allan ported, balanced to sixty-seven per cent. of face area.
Valve stems, forged wrought iron, machined, case-hardened and ground to 2½ in. diameter.
Rod packing, metallic, of composition to resist high temperature.
Crossheads, cast steel, alligator pattern, with cast iron shoes containing antimonial lead bearing plugs. Tapered and nut secured fit of rods to crossheads.
Crosshead wrist pin, forged wrought iron, case-hardened, bearing diameter 4½ in., length 3½ in.
Guides, two bar type, forged wrought iron, machined, case-hardened and ground on bearing faces.
Rocker shafts, cast steel, with brass removable bearings to boxes.
Links, lifting type, forged wrought iron, with all bearing parts and connections machined, case-hardened and ground.
Eccentrics and straps, cast iron, with antimonial lead bearing plugs in straps.
Lifting shaft, cast steel, with one central arm for link suspension.
Reverse and Throttle Levers, forged wrought iron, with fine graded adjustment, and all working parts and bearings case-hardened.

RUNNING GEAR.

Frames, Main, cast steel.
" *Front*, cast steel.
Tire, driver wheel, flanged, front and rear.
" driver wheel, blind, main and intermediate.
Wheels, driver, cast steel centers, diameter 56 in., outside tire 63 in.
Wheels, pony truck, cast iron, diameter 32 in., outside tire 38 in.
Wheels, tender, cast iron, diameter 28 in, outside tire 34 in.
Axles, driver, steel, journals 10 in. diameter x 12 in. long.
" pony truck, steel, journals 6½ in. diameter x 12 in. long.
Axles, tender truck, steel, journals 5½ in. diameter x 10 in. long.
Crankpins, main, steel, main road bearing, diameter 7 in., length 6 in.
Crankpins, parallel rod bearing, diameter 8 in., length 5¼ in.
Crankpins, parallel rod, steel bearings, diameter 5¾ in., length 4 in.
Rods, main, steel, I section, solid front end with wedge adjusted sectional antimonial leaded brasses; strap rear end with wedge adjusted sectional antimonial leaded brasses.
Rods, parallel, steel, I section, antimonial leaded solid brasses to crankpins and wrought iron case-hardened bearings to connecting joints.
Springs, driver, straight pattern, under hung, suspended in cradle fulcrumed to top of driver boxes.
Springs, compensating, double coiled.
" pony truck, coiled.
" tender, triple elliptic, self-adjusting for minimum and maximum loads.
Equalizers, cast steel.
Spring Gear Hangers, fulcrums and bearings, forged wrought iron, with all bearing parts case-hardened.
Boxes, driver journal, cast steel, with pressed antimonial leaded brass crown bearings.
Boxes, driver journal cellars, cast iron, with removable plates to inside for packing.
Boxes, driver journal, shoes and wedges, cast iron, with adjustable wedges.
Boxes, pony truck journal, cast iron, with removable antimonial leaded brass crown bearings.
Boxes, pony truck journal, shoes, cast iron, stationary.
Engine and Tender Truck, center and side bearings, cast iron, with chilled bearing faces.
Tender Trucks, structural, arch bar, diamond frame pattern, cast steel bolsters and pedestals, with inside hung metallic brake beams.
Tender frame, channel steel, tied, with diagonal braces and steel body bolsters. All connections riveted.

MISCELLANEOUS EQUIPMENT.

Stokers, three mechanical automatic underfeed, capable of developing the maximum horsépower required from the boiler, without forcing.
Draft, mechanical, developed by two volume blowers (one for relay), operated by direct connected steam turbines; each fan capable to supply from 6,000 to 8,000 cubic feet of air under from 2 to 4 ounces pressure per minute.
Feed water pumps, two (one for relay), vertical duplex pattern, capable of delivering from 1,800 to 3,600 U.S. gallons of feed water at 212° Fahr. temperature against 250 lbs. indicated pressure per hour.
Lagging, magnesia sectional made removable over stayed boiler sheets and applied to all but smokebox sheets of the boiler proper; to cylinders and covers, steam chests, cylinder steam passage walls and to all exposed live and exhaust steam pipes, and to exterior of hot well side and top plates to tender tank.
Jacketing, cold rolled pickled steel, .050 in. gauge, made removable over all stayed boiler sheets and applied over all lagging to boiler, cylinders, steam conduits and tender tank. Jacket bands .125 in. gauge x 4 in. wide.
Locomotive brake, automatic air brake.
Air brake pump, steam cylinder, diameter 9½ in., stroke 11½ in.
Air brake pump, air cylinder, diameter 12 in., stroke 11½ in.
Air main reservoir storage, two 20 in. x 96 in.; volume 60,300 cubic inches.
Train signal equipment, compressed air signal appliances.
Driver brake pressure retainer, automatic, pneumatically operated retaining valve in connection with the engineer's brake valve.
Driver brake equipment, equalized pressure to all driver wheels, adjusted to 75 % of minimum loaded weight on drivers.
Tender foundation brake, equalized pressure to all tender wheels, adjusted to 100% of minimum weight of tender.
Brake shoes, chilled end, cast iron and steel mixture, and flanged.
Couplers, M.C.B. pattern, cast steel, with positive gravity vertical drop knuckle lock and solid shank fulcrumed to steel solid buffer drawhead casting at rear and plain casting at front end.
Lubricator, triple sight-feed for cylinders and air pump.
Safety Valves, three 3 in. muffled pop valves.
Steam heat equipment, automatic pressure reducing valve, with connections to front and rear of locomotive for use in emergency passenger service.
Steam hose couplings, metallic throughout.
Headlamp, 18 in. diameter, round pattern, oil or acetylene gas lamp.
Sanding device, hand operated sanders to front of front driver, with steam jets at rear of rear drivers to clean rail.
Lubrication, positive action grease cups to all crankpin and eccentric strap bearings.
Siphon trimmings for engine oil to top of all pony truck and driver journal bearing boxes, with cotton waste packing to cellars.
Cotton waste packing for car oil to tender journal bearings.
Siphon trimming for engine oil to all journal box shoe and wedge face bearings and to cups for guide, rocker shaft, cross-head, and wrist pin and link motion bearings.

Oil holes, grooves, cups, siphons and swabs arranged as required to lubricate the balance of the motion gear, center and other bearings, with engine oil.

Cylinder oil to lubricate all sliding surfaces exposed to and confined in steam under pressure.

No water service to be connected with any bearings.

Speaking tube, one, from front to rear cab, 1 in. gas pipe, with flexible mouthpieces.

Engine bell, operated with pneumatic ringer.

Steam whistle, single tube, long distance pattern.

Pressure gauges, two diaphragm 500 lbs. capacity gauges, one each located on boiler in front and rear cabs. One each simplex steam heat and duplex air brake equipment diaphragm 160 lbs. capacity gauges located in engineer's cab.

Water level gauges, water gauge glass at rear of boiler for fireman's information, and water gauge glass and three try cocks in engineer's cab.

Draft exciter, a ¾ in. live steam nozzle located in smoke-box centrally with smoke stack, to be used as necessary when blowers are not running.

Loose equipment as required, for train rules, operation of locomotive, and emergency.

OTHER CONSTRUCTION

Cab, front, wood framing and roof with steel stay plates secured to exterior of sides and rear, and steel plate front.

Cab, rear, steel plate throughout.

Running boards on engine and tender, wood, bound with angle iron.

Pilot, steel throughout; framing, flat bar and horizontal angle steel stays, riveted.

Buffer beams, oak, to front of engine and to front and rear of tender frame; bolted to steel buffer plates secured to frames.

Tool equipment and drinking water boxes, wood, located and secured on flat deck to front of tender water tank.

Painting: Engine—Eccentrics, straps and blades painted vermilion; lettering and numbering, aluminum leaf; usual bright work in and outside cab, polished; inside of front cab, material wood; all other parts painted black. Tender—Raised figures of aluminum riveted to proper location on outside of side and rear sheets; unjacketed portion of tank painted with graphite; all other parts painted black. Boiler—Interior painted with a protective coating to prevent corrosion.

In the construction, malleable and steel castings to be substituted for the present practice of brass and iron castings, pressed steel and forged wrought iron, and all cast iron bearing faces to be chilled, wherever practicable. Forged wrought iron, machined, case-hardened and ground to finished size to be used when consistent, in preference to forged or rolled steel for all except axle and crankpin bearings and main and siderods. Brass bearing metal of a suitable formula to be used in place of the so-called anti-friction metals and bronzes. Antimonial lead to be substituted for babbitt metal. All operating mechanism to be concentrated, and the general construction arranged with all the regard consistent to the engineers, firemen, shop and roundhouse men who must operate, build, maintain and handle the power.

THE REQUIREMENTS FOR A PERFECT LOCOMOTIVE STEAM BOILER.

It is a thankless statement when one makes claim of a certain per cent. in saving to result from the use of any so-called improved machines or methods, but in consideration of facts resulting from both practical and theoretical experience, a locomotive construction such as set forth in the foregoing proposition and design, as compared with one of the same haulage capacity of the present almost universal American type, when operated under similar conditions, must necessarily bring more net returns and at no loss of efficiency. The following subjects are, therefore, entered into with the intention of substantiating to a more or less degree, that the features embraced will effect, at least partially, the results which must be forthcoming from locomotive service at an early date.

The requirements for a perfect steam boiler for modern locomotive service are as follows:

1st. A simple construction throughout of iron or steel, and of the best material sanctioned by use; perfect in workmanship, durable in use, and not liable to require early repairs.

2nd. A large factor of safety and a great excess of strength over any legitimate stress; so constructed as not to be liable to be strained by unequal expansion and contraction, and the least possible number of joints exposed to the direct action of the fire.

3rd. Ample disengaging surface, to insure a steady water level and dry steam, and to prevent foaming.

4th. A steam and water capacity sufficient to prevent any fluctuation in pressure or water level.

5th. A constant and thorough circulation of water throughout the boiler, so as to maintain all parts at one temperature.

6th. All parts readily accessible for inspection, test, cleaning and repairs, as this is of the greatest importance as regards safety and economy.

7th. A boiler proportioned to the work to be done, and capable of working to its full-rated capacity, with the highest economy and efficiency.

8th. A disposition of heating surface, to thoroughly absorb the heat.

9th. A combustion chamber so arranged that the combustion of the gases, which is commenced in the furnace, may be completed before they are released to the atmosphere.

10th. Straight tubes, which can be readily cleaned and looked through.

11th. Cheapness of reserve parts so that the cost of maintenance may be low.

12th. Freedom from expansion and contraction.

13th. Economy in space per unit of power generated.

14th. Large and unrestricted draft area.

THE FEATURES OF THE PROPOSED BOILER.

Considering the advantage of the construction and arrangement of the proposed type of boiler as compared with the present almost universal American design, the following are some of the constructive features which have been embodied, and which are essential to bring about results:—

1st. A straight, horizontal, self-contained, multitubular, return-draft, large capacity boiler, combining strength, freedom from defects on account of contraction and expansion of the plates or stays, accessibility for inspection and repairs, and economical as regards cost to build and maintain.

2nd. A largely reduced length of water-joint seams in the furnace, which through the direct contact with the flame and the intense heat, are liable to become defective and leak, resulting in the consequent failure of the boiler to make steam, delays to train service, excessive waste of both water and fuel, and expense for repairs and renewals.

3rd. The corrugated combustion flues leading from the furnace to the combustion chamber, are adapted by the construction and thickness of the metal to facilitate the uniform transfer of heat, and at the same time permit a free expansion and contraction of the boiler. They also possess decided resistance against collapsing, and by sufficient elasticity in the direction of their length, readily accommodate themselves to alterations in dimensions due to change of temperature in the boiler, thus removing all excessive stress from the tube sheets. The three corrugated, as well as the four plain flues, to be riveted to the furnace flue-sheet flanging, with the joints not exposed to the direct action of the fire, reducing the liability for failure or leakage, and presenting opportunity to make substantial repairs when such are necessary.

4th. The boiler or expanded tubes being away from a direct contact with the flame, presenting less liability for these joints to leak and give out at the tube sheet connections as a result of mud burning, corrosion, incrustation, the effect of the chilling of the beads of the tubes through leakage, and the consequent continual working on all of the tubes at this point as in the present type of boiler, which causes entire failure and necessary resetting, increasing the cost for maintenance.

5th. A shallow fire-box, that will be less affected from the contraction and expansion, which causes liability for the rupturing of the side and end sheets, and the breaking of stay-bolts. This depth of fire-box will largely reduce the number of flat sheet stays required, and overcome undue stresses at all the joints in the same.

6th. It will also provide an arrangement of fire-box sheets, which will be located near the fire area, obtaining the greatest advantage of the heat from the action of the flame, giving more intense action for the generation of steam at the location of the greatest heat, without the resulting disadvantage usually forthcoming from shallow fire-boxes on account of the leakage of the boiler tubes expanded into the flue sheet of the ordinary type of locomotive boiler, from the effects of expansion and contraction, by cold air drafts through the fire-door, holes in the fire on the grates, or by a badly-clinkered fire.

7th. A crown sheet supported by direct riveted over-staying to tee bars, these latter in turn being supported by adjustable stays, secured to the tee bars riveted to the outer shell, allowance being made for contraction and expansion, and to avoid undue stresses on all of the firebox sheets and stays, and subsequent fracturing.

8th. The crown sheet being located below the boiler tubes, there is practically no possibility of damage to this sheet or its staying on account of over-heating, through reason of low water.

9th. The fire-box and combustion flues being located at the lowest position in the boiler will, through their intense heat, promote the evolution at this point and prevent the precipitation of the corrosive and other mineral ingredients contained in the feed water and the consequent pitting action on the sheets which usually occurs in the parts of the boilers which are at a relatively low temperature.

10th. A construction of boiler with a simple combustion chamber that will not only permit of the superheating of the steam by the furnace gases when they are of an intense temperature, and which is necessary for this purpose, but which will, in addition, allow of the use of long tubes, both points of which should receive every consideration for the reason that they are necessary for and productive of efficiency and economy.

11th. A smoke box, with no complicated draft arrangements, combined with a large diameter of smoke stack, for the unrestricted passage of gases.

Referring now to the boiler as regards maintenance:—

1st. An arrangement which will facilitate inspection, testing, washing-out and the removal of the foreign matter necessary to keep all the parts in good repair and in a clean condition to conduct the greatest amount of heat.

2nd. An arrangement of combustion chamber and smoke box which provides easy access to make repairs and renewals to the combustion flues, the boiler tubes and the tube sheets, which are the parts that receive the greatest stresses and require the most frequent attention.

3rd. The spacing of the tee bars and the stays to the crown sheet to be such as will allow for the ready cleaning and washing of the crown sheet without the removal of any of its attached parts.

4th. An arrangement of boiler tubes, the removal of which alone will give every opportunity to inspect, clean or renew the crown sheet and its stays, which is not practicable with the present type of boiler construction.

5th. There being from one-half to two-thirds less of the smaller tubes than as found in the ordinary type of boiler, the care and expense for the usual cleaning and re-setting will be greatly reduced.

6th. A proportion of furnace fire and cross-sectional combustion flue and boiler tube draft area which will permit of free draft and less liability of the passages to become inefficient on account of choking or neglect of attention when restricted by an accumulation of foreign matter, and the larger passages will reduce the amount of cleaning now necessary.

7th. The alternate expansion and contraction permissible by the corrugations to the large combustion flues will tend to loosen the scale which may form on the water side of these sheets.

Next, considering the advantages to be had through the operation and efficiency of this boiler:—

1st. An arrangement which will provide a generator and container for an indicated working steam pressure of 250 lbs. per square inch. The economy resulting from the use of a high steam pressure will readily be noted from the fact that while 6.6 heat units are required to raise a pound of steam from 150 to 200 lbs. pressure, only 12.2 heat units are required to increase the pressure from 150 to 250 lbs., which is an increase in pressure of 33⅓% at a proportionately reduced fuel cost of 15%. In addition, the higher the steam pressure, the more nearly superheated will be the steam itself, and in high pressure and superheating lie one of the most essential features conductive to economy and efficiency, especially in connection with obtaining the most successful results in the complete expansion of steam through compounding, resulting in an increased tractive power at a largely reduced cost per unit.

2nd. A furnace equipped with an underfeed method of automatic mechanical stoking and mechanical forced draft, which will promote the most perfect combustion, and permit of the steam, which is now used for inducing the draft and exhausted to the atmosphere, being used to develop further work by expansion in the cylinders and then to be released to heat the boiler feed water.

3rd. The longer, slower and more natural travel of the gases from the furnace to the atmosphere will result in a greater opportunity for conduction and convection, reduced wear on the tubes and sheets, and the gases of lower temperature will have a better chance to be absorbed by the water.

4th. Less loss of fuel through cinders, which are practically unconsumed coked coal, being drawn out of the furnace through the tubes and ejected into the atmosphere, and from unconsumed coal falling into the ash pan through the grates.

5th. Less liability to set out fires along the right of way.

6th. The larger proportional diameter of the flues and tubes will promote and complete the combustion, for the reason that they will carry the flame farther than in the case of the smaller two-inch tubes that lead directly from the furnace and where the flame comes into immediate contact with the larger quantity of incombustible gas beyond the air supply. Besides this, the temperature of the smaller tubes, which are surrounded with water, is so reduced that the flame is soon cooled, and the igniting temperature of combustion cannot take place after the gases enter the ordinary smaller two-inch tubes.

7th. The corrugated combustion flues provide a larger free draft to carry a long flame, and which, by facilitating a uniform transfer of heat, can practically be considered a continuation of the firebox heating surface, that in itself is so much more efficient than the smaller tube heating surface. The corrugations to these flues, while increasing the heating surface, also serve as baffles and retard the passage of the hot gases and flame, increasing the efficiency of the boiler. Their use will also maintain the combustion chamber gases at a high temperature, resulting beneficially in the superheating of the direct and exhaust steam to and from the high pressure cylinder to the low pressure cylinder, which will overcome the losses in the latter through cylinder condensation.

8th. The firebox and combustion flue heating surface, located at the lowest position in the boiler in contact with the water of the least degree of temperature, will facilitate steam generation on account of the distribution at this point of the most intense and uniform heat the entire length of the boiler proper. With the present type of locomotive boiler the intense heat is at the rear, or firebox end only, and the front, or smokebox end, contains the lowest degree of temperature. By noting the travel of the gases in the proposed boiler it will be seen that with the arrangement of the furnace under the extreme ends of the boiler tubes at the smokebox end of the boiler, and the combustion flues under the forward ends of the boiler tubes in connection with the combustion chamber at the front of the boiler proper, a much more uniform distribution of the heat is provided to the water to facilitate steam generation, and to allow for the equal contraction and expansion of the boiler.

9th. An arrangement of the furnace combustion flues and the boiler tubes which will promote combustion and transmit to the water, to a greater extent, the heat contained in the furnace gases before they are released to the atmosphere.

Presuming that through imperfect combustion, carbon dioxide, carbon monoxide, hydrogen and nitrogen will leave the furnace and enter the combustion flues, the latter and the combustion chamber will allow sufficient room for the flame to carry, and the association of these gases with each other and the additional heated air, will tend to promote a more complete combustion by producing a greater proportion of carbon dioxide, oxygen and nitrogen gases before the entrance of these gases to the 2½ in. boiler tubes, and their consequent release to the atmosphere.

The travel of the gases also being for 48 ft. in contact with the water surfaces, as compared with at the most 27 ft. in the present type, this will reduce the temperature of the furnace gases before they are released, from the present temperature of from 700 to 1,200 degrees Fahr. to between 450 to 550 degrees Fahr., the difference being due to the heat units which will be conducted by the sheets to the water to assist in generating steam.

10th. The boiler tubes being 2½ ins. outside diameter, as compared with the usual practice of 2 ins., will provide freer draft, and in connection with mechanical forced draft and automatic stoking a more natural and slower passage of the gases will be obtained through these tubes, so that their length will be more fully utilized, and there will be less liability to choke and to become inefficient through obstructing the passage of the gases.

11th. The smaller tubes being located high in the boiler barrel will give less trouble through incrustation and the clogging of the water spaces between the crown and firebox sheets, while the larger flues being near the bottom of the boiler, where they will be in contact with the colder water and the most intense heat, will promote a more decided circulation and steam generation, and the steam generated at this point will have a free opportunity to disengage itself. There will also be less liability of an accumulation of incrustation around the flues at the firebox flue sheet connection, as must now be contended with, on account of the scale and sludge washed from the crown sheets lodging on the small tubes near the firebox tube sheet connection, restricting the contact of the water with the intensely heated sheets at this point, and resulting in mud burning, failure and renewals.

12th. A large proportion of firebox, combustion flue and boiler tube heating surface, which will facilitate the generation of steam by their absorption of more heat. If it is necessary to provide additional heating surface in this type of boiler in order that it may be used in connection with a larger capacity locomotive, an arraagement of extended wagon top will be located at the first course of the cylindrical shell, which will permit of additional boiler tubes being located higher in the cylindrical portion of the boiler proper, and at the same time provide for the steam space that will be required, due to the increased height of the normal water level.

13th. A large storage space for water and steam.

14th. An arrangement of interior parts which will provide every opportunity for the free circulation of the water around the plates subject to the most intense heat, and ample disengaging surface for the generation of steam.

15th. Less water leg and restricted circulation, and consequently more heat storage and reservoir capacity, on account of firebox of less depth and more clearance between internal parts, which can be taken up for water storage.

16th. The dome being located at the front of the boiler barrel gives a shorter distance for the steam to travel to the cylinders, and less loss in pressure through friction. When working hard on grades there will be more steam space at this point, with the same comparative water level and less liability for the engines to prime on account of saturated steam.

17th. Ample capacity for steam generation being provided to fulfil the requirements of the cylinders without forcing, the loss through steam with entrained moisture delivered from the boiler, the percentage of which moisture increases as the rate of evaporation is increased, will be much less.

18th. The actual length of the flue water-joint in the firebox tube sheet being but 220 inches, as compared with from 1,900 to 2,500 inches, which is the practice in the same capacity boilers of the present modern type, the liability for losses and failure through firebox leaks will be reduced, in that proportion, from 900 to 1,100%, and the crown and side sheets to the firebox being made of one instead of three sheets will further reduce the liability for expense and failures through the same cause.

19th. When operating the locomotive at its maximum capacity, up grade, the volume of the steam space in the boiler will automatically increase, instead of decreasing as in the present type, at the dome location from which the steam is drawn for the engines, and this will insure less liability for priming and the heat losses through steam with entrained moisture being delivered from the boiler.

Also when tipping over summits, the water will flow to the front of the boiler and increase the level to protect the boiler tubes where they are the most intensely heated, while the rear or the cooler ends of the top rows of the same will not be damaged, even should they be entirely uncovered.

The flow of the water in the boiler will automatically favor steam generation, by increasing the water and steam volumes where most needed in the boiler to absorb the heat, and to maintain the working pressure when the locomotive is being operated at its maximum capacity over rolling country.

COMBUSTION.

A steam generator, is composed of two distinct parts, each with its independent function: the furnace for the proper combustion of the fuel, which is performed to perfection when the greatest amount of heat is obtained from a given weight of combustible, and the boiler proper for the transfer of the heat thus generated into useful effect, and to evaporate water into steam, which function is fulfilled completely when the greatest possible quantity of heat is thus utilized.

As a boiler is for generating steam, it can utilize for that purpose heat only of a greater intensity or higher temperature than the steam itself; therefore the gases of combustion cannot be reduced below that temperature and

the heat thereby represented is lost. The amount of heat energy that is lost will depend upon the amount of air which is admitted to the furnace and the increase of the temperature at which it escapes, and the more air admitted the greater will be the loss. The fallacy of all arrangements, whereby air and fuel are admitted above the fire, to produce perfect combustion will be readily understood when comparison is made between that method and the underfeeding of fuel with a combination of the proper amount of oxygen by means of mechanical forced draft, which combination will take place below the fire.

It is a common practice to estimate that the amount of air chemically required for use in the combustion of coke or bituminous coal is 12 lbs. per pound of fuel, this calculation of air supply being based on the assumption that each individual atom of oxygen in the air will come in contact and unite with its proportion of hydrogen or carbon in the fuel.

As this oxygen, however, is intimately united with about four times its volume of nitrogen, whereby to a certain extent it is separated from the fuel, and as the quality and the distribution of the fuel and the passages arranged in an attempt at an equal distribution of the air, increase the obstacles, it will be evident that the above assumption cannot be maintained in practice. It is, therefore, necessary in practice to furnish air in excess of the calculated amount to insure complete combustion in all parts of the furnace, and the amount of air so supplied for dilution must vary greatly in different cases.

Accepting that 12 lbs. of air per pound of fuel is necessary for complete combustion, the amount required where 100% is supplied for dilution, as is the case with natural draft and hand firing, would be 24 lbs., but with mechanical forced draft and underfeed stoking, this amount can be reduced to from 14 to 15 lbs. per pound of fuel.

As an insufficient supply of air causes imperfect combustion of the fuel, which in bituminous coal will be indicated by the production of smoke, and as an excess of air causes a waste of heat to the amount corresponding to the weight of the air in excess of that which is necessary, and to the elevation of the temperature at which it is discharged from the stack above that of the external air, it is obvious that the maximum efficiency to be secured in the process of combustion must be between these two extremes, and which will more nearly be produced by the use of the underfeed stoking and mechanical forced draft.

The heat produced by the burning of one pound of carbon to carbon dioxide is 14,650 heat units, and to carbon monoxide 4,400 heat units. The great loss of heat, due to incomplete combustion of carbon, is clearly represented in the differences between the total heat of perfect combustion, or 14,650 units, and the product of incomplete combustion, or 4,400 units.

The average bituminous coals contain from 75 to 80% of carbon, 5 to 6% of hydrogen and 14 to 20% of earthy and miscellaneous matter. In the case of the coal referred to 2.53 lbs. of oxygen would be required for the complete combustion of each pound of coal, which would necessitate about 1.8 lbs. of air to burn its hydrogen, 9.6 lbs. for the carbon, and as a portion of the other substances of which coal is composed is combustible, we can estimate the amount of air required for the total combustion at about 12 lbs., and which combustion will yield from 13 to 30 lbs. of gas, the volume varying according to the temperature. As it is impossible to remove the whole of the oxygen from the air in any ordinary furnace, it will be found necessary to supply about 14 lbs. of air per pound of coal to secure satisfactory combustion, and as each pound of free air at 60° temperature contains 13.06 cubic feet, about 183 cubic feet of air will be required for the proper combustion of the pound of coal. Such coal when heated to about 1,200° Fahr., will have the 5 or 6% of the hydrogen united with three times its weight of carbon, about 20% of the coal will be converted into gas, and a large amount of the heat will be absorbed or becomes latent. The temperature of a fire such as is usually found in a locomotive furnace varies from a dull cherry, or 1,470° Fahr., to a clear cherry, or 1,830°, orange, or 2,010 to 2,190°, white heat, 2,370°, and incandescent, 2,730 to 2,900°.

The ideal temperature of combustion for bituminous coal, which is the case where the exact amount of oxygen required for the complete combustion of a pound of carbon is supplied, is given as 4,718° Fahr. With 50% for dilution, or when 18 lbs. of air is supplied per pound of carbon; this is reduced to 3,353°, with 100% to 2,600°, with 150% to 2,124°, and so on. Automatic underfeed mechanical stoking with mechanical forced draft should give a temperature at no time of less than 2,500°, and with the blast air supplied, previously heated by special means, the increased and ideal temperatures should be even more nearly reached.

As one pound of pure carbon when burned yields 14,650 heat units, this heat would, if all utilized in a boiler, evaporate fifteen pounds of water at 212° Fahr., at atmospheric pressure. A boiler which will evaporate 7½ lbs. of water for each pound of combustible, utilizes but 50% of the total heat, and even this is much more than the average result of the ordinary American type of locomotive boiler. As about 15% can be considered as good practice for the loss in smoke stack gases and in radiation, an evaporation of 12½ lbs. of water per pound of combustible can be considered as about the practical limit.

In the present universal type of locomotive boiler when coal is burned at the rate of about 50 lbs. per square foot of grate surface per hour, about 8 lbs. of water will be evaporated per each pound of coal, and if this rate of combustion is increased to 120 lbs. per square foot of grate surface, the evaporation falls to about 5 lbs. This is equivalent to a loss of water evaporated per pound of coal of nearly 40%, this loss being due to the failure of the heating surfaces to properly absorb the heat from the increased volume of gases passing over them, and to the imperfect combustion of the fuel upon the grate. All practical results have shown that the most efficient furnace action will accompany the lowest rates of combustion. The above will show the wastefulness of burning coal without a properly regulated supply of air coming in contact with the fuel to promote perfect combustion, and the latter cannot be obtained more satisfactorily than by the proposed arrangement of underfeed stoking in connection with mechanical forced draft.

The heat being transmitted through the heating surface of a boiler in proportion to the difference in the temperature of the products of combustion on the one side and of the water on the other, it will be understood that the admission of too much air, providing oxygen which will not combine with the fuel, will diminish, instead of increasing the amount of steam which is generated, by reducing the temperature of the gases in contact with the heating surface and by increasing the volume or quantity of the gases which must be passed through the tubes. Thus, if the volume of the gases is doubled by the admission of too much air, then, in order to pass through the tubes they must move at double the velocity, so that not only is the temperature reduced, but the time that they are in contact with the heating surface will be diminished in a like proportion, and the pressure of the steam in the boiler will suffer accordingly.

The gases going to stacks of the usual type of locomotive boilers, carry with them, on an average, according to good authority, 50% of the fuel, and even in the most economical types of boilers this cannot be reduced below 12%.

Referring to the loss of heat by sparks, while this has apparently received little consideration and has appeared small, at the same time, data from practical tests with different rates of combustion, will substantiate that this loss may represent from between 5 to 15% of the full value of the coal that is fired.

MECHANICAL FORCED DRAFT.

For the production of the forced draft there will be installed an arrangement of two volume blowers, each having 16 inch inlet and discharge openings, 48 inches outside diameter by 18 inches in width, weighing about 750 lbs. each. These blowers each to be capable of supplying 6,000 cubic feet of air at two ounces pressure, when operated at about 1,000 revolutions per minute, or 8,000 cubic feet of air at four ounces pressure when operated at about 1,500 revolutions per minute. Each blower will be capable of supplying a sufficient amount of air for the operation of the furnace when the boiler is being worked to the full capacity, the additional one being applied for relay service.

Each blower will be directly connected by a gear wheel and pinion with an independent six horse-power steam turbine, constructed to make use of steam by quadruple expansion, and the operation of the turbines to be controlled by an automatic governor, located in the cab, under the complete control of the engineer or fireman. The blowers and turbines to be supported on a self-contained cast steel bracket, fastened over the top of the boiler proper, just ahead of the coal tank, located in an accessible position, where there will be no restriction as regards the inlet of free air, and with suitable provision for protection during severe weather.

The blower discharge pipes to be connected with the main discharge inlet, which will enter the blast retort under the stokers, and suitable blast gates arranged in connection with the discharge pipe of each blower, which will be under the immediate control of the engineer and fireman, so that the blowers can be operated independently, or jointly.

With reference to the use of steam turbines to operate the blowers, improvements have been made in this type of generator which have resulted in almost a theoretical mean efficiency, as quadruple expansion turbines, constructed and operated, have shown about 87% of the power that would have been given out in the adiabatic expansion of the steam. That a steam turbine can be maintained at an economical cost and be depended upon for continuous service, has been demonstrated through six horse-power generators having operated from four to five years at a speed of 18,000 revolutions per minute and without failure, and also that in connection with high initial pressure, and especially with superheated steam, the efficiency of the steam turbine is made much more practicable.

It has been recorded by experiment that with 37° of superheat the capacity of a small steam turbine was doubled, and this indicates that much better results may be expected in the future, even though the economy of exceptionally large turbines has been taken at 14 lbs. of steam per indicated horse-power when running at full load.

Steam turbines, while not universally applicable for the work done by the ordinary steam engines, appear to be particularly well adapted to the driving of generators where a uniform speed is required, and their self-contained construction reduce the possibility of failure to the minimum.

The actual steam expenditure for producing the mechanical forced draft will not exceed 1% of the total steam produced, and even this percentage has in many instances been large-

ly reduced. The exhaust steam from the turbine will also be conveyed to, and utilized in heating the feed water during the time when the waste steam from the other sources is not available for this purpose.

When mechanically forced draft is employed, there is no reason why the products of combustion should not be cooled down almost to the temperature of the water in the boiler, providing that it is possible to introduce into the boiler sufficient heating surface to accomplish this result. As in hand firing, combustion is dependent on an induced current of air through the grate air spaces to provide sufficient oxygen to ignite with the carbon, and as in the present universal type of boiler, the flame is immediately conveyed to the small tubes, which, through their lack of volume will destroy combustion, a large amount of carbon monoxide will be produced, that, for the reason of its being the product of imperfect combustion, will produce 2⅓ less heat units than if the carbon had been properly supplied with air properly consumed.

The efficiency of the mechanical forced draft will readily assert itself as a means to provide for perfect combustion, and some of its advantageous features are as follows: The absolute command of the draft controlled by power for the generation of whatever amount of steam the conditions may require; positive and instantaneous in action; the steam pressure can be maintained more constant through more automatic control of the draft; efficiency which is greatly in advance of induced draft; the supply of air can be readily adjusted to effect efficient combustion of fuel of inferior and different qualities at different rates of combustion; independent of climate and weather, and no liability to be affected by atmospheric conditions; control of the rate of travel and hot products of combustion, insuring the highest possible combustion; less air required for dilution, resulting in a higher temperature of the fire, more rapid conduction of heat through the heating surface, and better economy of heat; possibility to increase the evaporative power of the boiler without injury or loss of economy through reducing the evaporative effect of the fuel; possibility to use low grades of fuel; adaptability to meet sudden demands upon the boiler; prevention of smoke with soft coal or screenings, and low cost for maintenance; also under certain severe conditions of weather, when with a normal proportion of boiler it would be impossible to maintain the desired steam pressure with natural draft, normal power may be insured with forced draft.

MECHANICAL AUTOMATIC STOKING.

The ideal arrangement for mechanical stoking for locomotive service consists of a steam cylinder and ram connected with a hopper for holding the gravity conveyed fuel outside of the furnace proper, and a retort, or fuel magazine, inside of the furnace into which the green coal can be underfed by means of the ram. Tuyere blocks for the admission of air by means of forced draft to be placed on either side of the fuel magazine, this retort to contain at its lowest point where the fire never reaches, an auxiliary ram, or pusher, by means of which an even distribution of the fuel may be obtained. By means of this ram, the coal can be forced underneath the fire, each charge of fuel raising the preceding charge upward, until it reaches the fire, which point it does not reach until it has been thoroughly coked, and when in this coked state, it is forced still further upward into the fire.

The action of the ram in pushing the coal ahead and upward provides the same action as the rocking of the grates in hand firing, and this will tend to keep the bed of the fire broken, and prevent the formation of any large amount of solid clinker. The gases being liberated under the fire and at that point mixed with the air, they must necessarily pass through the fire and be consumed, thus giving the benefit of all the combustible matter in the coal. The air is forced at a pressure of about two ounces per square inch from the tuyere blocks under the burning fuel by means of the mechanical forced draft from the blower operated by the turbine engines, automatically controlled. The coal being in the hopper and the ram plunger at its forward stroke, when more coal is needed the ram plunger is shifted by moving the lever either by hand or automatically; the coal then falls in front of the plunger, and upon the return movement it is forced into the retort, this movement being repeated until sufficient coal is in the retort.

The automatic movement of the stoker rams to be controlled by motion to be taken from an eccentric located on the rear driver wheel axle.

As the speed of the locomotive will, to a considerable extent, govern the proportion of the steam that will be used per hour, the corresponding movement to be derived from the eccentric motion referred to will fairly well regulate the automatic supply of the required amount of fuel to the stokers, and what irregularity may occur can readily be adjusted by the firemen, who will have entire control over both the automatic and independent action of the stoker feeds.

The air at a low pressure being admitted into the air chamber and through the tuyere blocks over the top of the green fuel in the retort, but under and through the burning fuel, the result is that the heat from the burning fuel over the retort slowly liberates the gas from the green fuel in the retort, and this gas being thoroughly mixed with the incoming air before it is passed to the burning fuel above, results in a bright incandescent fire, free from smoke, and the complete combustion of all the heat producing elements in the fuel. The retort being air tight from below and the fuel being in a compact mass in the retort, the air will find its way in the direction of the least resistance, which is upward; consequently combustion takes place only above the air slots, and the tuyeres of the retorts are always cool and not subject to the action of the fire. The incoming fuel from the retort forces the resulting ash and clinker over the top of the tuyere blocks on to the dead plates, whence it may be removed at any time and dumped through the drop grates into the ash pan at the rear, without in the least interfering with the fires over the retorts, and which will result in a high even temperature being maintained in the furnace at all times.

In brief, some of the advantages of mechanical automatic underfeed stoking in connection with locomotive boilers are as follows:

Adaptability to the combustion of the cheapest grades of fuel, economy of labor in firing, economy and increased effectiveness in combustion even with forced firing under proper management, constancy and regularity of the fuel supply and complete control over the admission of fuel into the furnace at all times.

There being but little necessity for the opening of the furnace doors, which must occur through hand firing, the chilling effect on the furnace plates will be lessened.

Facility for cleaning the fires, one portion of which can be done at a time and without reducing the burning of the fuel in the individual stokers.

By underfeeding the fuel, the green coal is continually introduced below the fire line, and in rising is brought to the coking stage, at which time the gases are liberated, pass upward and are consumed to the last degree, producing, as nearly as possible, complete combustion.

This method of stoking, besides providing a more uniform fire and consequent unvarying pressure, dispenses, by complete combustion, with the smoke nuisance, and there is no waste of solid fuel by loss through grate bars, or by being carried through the flues, tubes and smokebox, and ejected into the atmosphere.

There is no liability of holes in the fire and consequent cold air coming in contact with the gases passing to the heated sheets, producing severe stresses in the boiler and failures to steam.

An inferior grade of fuel, such as screenings and run-of-mine, can be burned to advantage, and at the same time steam coal can be used up to any size which would not be too large for economical hand firing.

The fuel magazines, or stokers, are practically self-cleaning, as on account of the upward and forward movement of the new fuel, the ash and clinker is forced upward and upon the dead plates, from where it can be readily removed as necessary, ample provision for this being made by the two furnace door openings and the drop grates at the rear, and where the incoming draft at this time will not have any detrimental effects on the furnace sheets.

The underfeed stokers also dispense with the use of rocking grates and rigging, which are liable to become out of order on account of burning out through neglect or mismanagement, and which usually result in a severe failure of the entire locomotive, expensive delays to train movements and renewals of parts to make repairs.

When fires must be drawn from the furnace, the amount of unconsumed fuel accumulated on the rocking grates, and which is wasted, will be overcome, and the stokers will facilitate and economize largely in the banking, renewal and starting of fires.

Mechanical stoking will also overcome the large losses in fuel on account of the irregular and wasteful methods of hand firing practised by different firemen, which are bound to occur under almost the same conditions.

It will show up not only economical results in the use of fuel, but, at the same time, the labor of the fireman will be considerably reduced through its requiring less effort and skill on his part to feed and operate than by hand firing. While the cost of fuel should receive every consideration, it is also necessary that economizing devices be inaugurated which will not only reduce the amount of fuel burned, but also the labor required of the average fireman to keep up the maximum pressure of steam with the engine operating at its full capacity under the methods and construction as applied to the present type of locomotives.

So much skilled labor not being required to operate the stokers, the fireman's time can be more given to assist the engineer in looking out for signals and attending to other duties not so severe, and which are more essential and productive of good results than the continual shovelling of coal. While constant attention is necessary in mechanical firing in order to regulate the rate of feed to the rate of evaporation, the total amount of labor is far less than required in hand firing.

Resuming the subject of the benefits to be derived from a combination of mechanical forced draft and mechanical and automatic underfeed stoking as applied to locomotive service, and compared with hand firing: The temperature of the furnace gases will be increased probably 1,000° by the more perfect combustion and as intense draft is one of the most important factors in the utilization of cheap fuels, the value of mechanical draft and stoking asserts itself. With fuels of moderate smoking qualities, mechanical draft in its simplest application can furnish an adequate amount of air under pressure sufficient to cause it to pass readily through the mechanically fed fuel, which will meet all the requirements of smoke preventives, even when all the air is admitted below the fire. The air required for a given weight of fuel may be reduced to the minimum, which will promote an economy in fuel in consequence of a better

supply of air and the higher temperature at which the fires are worked. There is also a reduced liability for failure to steam on account of steam pipe joint leaks which may occur, and which destroy the steaming qualities of the present type of locomotive, but which will have no effect with the mechanical stoking and draft.

The boilers can be operated at considerably above the rated capacity with less wastefulness of fuel.

The fires can be banked at any time by discontinuing the blower, which operates the mechanical forced draft, and they can be steamed up quickly by starting the same. This, especially, is of advantage in connection with large grate areas, where the burning of a large amount of fuel on the grates at a time when it may not be needed, will result in considerable waste of fuel and water.

The draft and stoking being under the direct control of the engineer and fireman, the fire can be reduced or forced as desired, on account of station stops, going down or up grades, waiting at meeting points, etc. Much less air being required than with hand firing, the volume of the heated gases passing out of the stack is reduced, and which allows for more time for the absorption of the heat by the boiler surface.

By the introduction of a boiler with a sufficient amount of heating surface, the products of combustion can be cooled down, as nearly as possible, to the temperature of the water in the boiler, which is of especial advantage, considering that one of the very important factors in connection with steam boilers is the proper amount of air necessary for the complete combustion of the coal and the consequent loss of heat from the products of imperfect combustion.

The failures to steam on account of irregularities in the alignment of exhaust nozzles and smoke stacks, steam and air leaks in the smokebox, draft pipes, dead, baffle and deflector plates out of adjustment, and netting choked and inefficient, will also be entirely eliminated. As these causes contribute largely to steam failures and increased fuel consumption, the attachments which are responsible for the same being dispensed with, will be appreciated by all mechanics who have been concerned in the adjustment of exhaust nozzle and smokebox devices to give the proper draft and for the removal of the cinders to provide for the necessary steaming qualities, no matter what the results may be as regards fuel economy.

THE PRE-HEATING OF THE MECHANICAL FORCED DRAFT.

While no arrangement or construction has been shown in the design, or made mention of in connection with the other economical features for combustion and evaporative efficiency, the intention will be to provide a simple, economical and efficient means for pre-heating the forced draft, by the utilization of the heat from the escaping smokebox gases.

As these gases after leaving the boiler proper will still be of a higher temperature than the maximum pressure of the steam, and will contain from 450° to 550° Fahr. of temperature, this heat can and should be used to advantage in the pre-heating of the air before it enters the furnace, thereby securing a higher temperature and an increased evaporative efficiency.

The tendency of the colder air admitted to the furnace when rapid combustion takes place is to chill the fire, and through pre-heating, providing this can be done by the waste gases, the chemical affinities between the air and the fuel will be intensified, and just that much less heat wil be absorbed from the fire, and from doing useful work in the furnace, to bring the temperature of the air to its igniting point,

As to make use of pre-heated air to advantage, mechanical means must be resorted to, to overcome the increased resistance, the arrangement of mechanical forced draft will prove to be a decided benefit in connection therewith.

INCRUSTATION AND SEDIMENT IN LOCOMOTIVE BOILERS.

Water as found in nature always contains impurities, and nearly all natural water contains more or less mineral matter held in solution, as well as the organic and mineral matter held in suspension. While the latter may be removed by filtration or settling, the former can be removed only by the agency of heat. The amount of mineral matter held in suspension in ordinary water, as generally supplied from cities, and what is found in rivers, streams, canals, fresh water lakes, etc., varies from 10 to 40 grains per gallon of 231 cubic inches, while well and mine waters will contain more. In some instances water containing as much as 200 grains of mineral matter per gallon must be used for steam boilers, and the effect of incrustations or deposits which will accumulate from the use of such water in locomotive boilers is in every way detrimental, adding much to the expense for fuel and repairs, as well as increasing the risk for damage and the deterioration of the life of the boiler.

In boiler practice the exact composition of the water is of very marked importance, for, as stated, upon the impurities held in suspension or solution may depend not only the economy of operation, but the life of the boiler itself. Some of the more common impurities are as follows: Sediment, mud, clay, readily soluble salts, bicarbonates of lime, magnesia and iron, and sulphate of lime, all of which produce incrustation; chloride or sulphate of magnesium, acid in mine water, dissolved carbonic acid, oxygen and organic matter which cause corrosion, and carbonate of soda in large amounts and organic matter from sewerage which cause priming.

Considering the substances that cause incrustation, the most reliable remedy to overcome this difficulty is filtration of the water or the precipitation of the foreign matter by chemical action before it is supplied to the tenders. If this cannot be done, the next best method is the heating of the feed water and the precipitation of a proportion, if not all, of the foreign matter before the water is fed to the boiler. As regards the balance of the incrustation and corroding and priming substances, with the exception of their precipitation or elimination by chemical action before reaching the boiler, the best remedy is subsequent blowing out and a thorough washing out with hot water under heavy pressure at periodical intervals.

Tests and practice have proven that fine, insoluble powders, such as calcium carbide or magnesia, when fed into boiling water, will cause foaming, while it has been the common practice to attribute this to alkaline water. From this we can conclude that it is the loosened scale matter in boilers that is mostly responsible for foaming, as, when the water contains a very large number of suspended particles, each serves to release the heat in its immediate vicinity. Steam bubbles are formed not merely at the heating surface, but in every part of the water, and the result is to increase the space occupied by the water to such an extent that priming may result. A sudden reduction of pressure outside of the boiler may carry over the water in any quantity, and water saturated with air or gas will boil with great disturbance. While animal matter put into a boiler will produce priming, under the ordinary conditions of service, priming is produced by suspended matter in the boiler, and without regard to the amount of alkaline salts. The foaming occasions loss of water and of heat, creates much danger in the boiler from the uncertainty as to the height of the water, and detracts from the power and efficiency of the engine.

Referring to the effect that incrustation on the sheets has on the cost for fuel, it is acknowledged by all authorities that an accumulation of dense, hard scale increases very materially the difficulty of heating water. Scale, whether hard or crystalline, or deposited soft and slushy, is a very poor conductor of heat, being relatively as to iron as 1 to 37, or $\frac{1}{32}$ in. of scale is almost equivalent to one inch of iron interposed between the heat of the fire and the water. Of the various estimates that have been made to determine as to the proportionate loss in fuel from dense, hard scale, the one most generally accepted is that $\frac{1}{16}$ in. of scale requires nine, $\frac{1}{8}$ in. seventeen, $\frac{1}{4}$ in. thirty-three, $\frac{1}{2}$ in. sixty-four $\frac{3}{4}$ in. ninety-one per cent. excess of heat to generate steam than what would be required if the boiler was clean.

As regards the repairs when a boiler has an accumulation of scale, the heating power between the fire and the water is reduced in proportion, readily increasing with each successive film on the iron, so that with a furnace or tube plate on which there might be an accumulation of scale or deposit $\frac{1}{2}$ in. thick, if it be necessary to impart over one-half more in the amount of heat to the iron, in order to produce the same temperature in the water, this excessive heating will result in defects to the plates, which will necessitate early detention of the boiler in the shop for repairs, if nothing worse.

A properly designed and well-constructed steam locomotive boiler, when of the capacity to perform the work required of it and intelligently cared for, should last in good condition from 20 to 30 years. In almost all cases, the depreciation of boilers is caused from the giving out of the fire sheets, and this trouble is almost entirely owing to deposits of sediment and scale which are composed of chlorides, carbonates and sulphates.

The proposed arrangement of the hot feed heating is such whereby the steam that is admitted will be in close proximity to the outlet of the hot feed to the pumps that will supply it to the boiler; this will cause an evolution at this point of the water, which will agitate and keep in motion the currents of heated water in the hot feed supplies. The tendency will be for the sulphates and carbonates to settle at the farthest distance from the point of evolution, seeking the most quiet location, which will be at the mud basin connected with the tank cistern feed outlet, and from where the accumulation can be readily removed each time the boiler is washed.

This precipitation of this foreign matter into the tender, instead of into the boiler where it would come in contact with and probably be baked to the sheets exposed to the greatest heat, will overcome considerable of the formation of scale in the boiler and its consequent disadvantages.

HEATED FEED WATER.

The weight of one cubic foot of pure water at 32° Fahr. (freezing point) is 62.418 lbs., and a pound contains no heat units; at 60° Fahr. it weighs 62.37 lbs. and contains 28.12 heat units, and at 212° Fahr. (boiling point) it weighs but 59.76 lbs. and contains 180.79 heat units. For general purposes the weight of water as taken in round numbers is 62.5 lbs. per cubic foot. Supposing that the specific heat of water at 32° temperature is considered as one, at 60° it is 1.0011 and at 212° it is 1.013. The pressure of water at 60° is .433 lbs. per square inch, and a pressure of one pound per square inch will be produced by a head of 2.309 ft.

The temperature of the water as delivered to locomotive tenders varies during the year on an average of from 50° to 60° Fahr. This temperature of the feed, if it can be raised by

exhaust or waste steam or gases before the water enters the boiler, will effect a saving of about 1% in fuel for each 12° that the temperature is raised. As water at 60° temperature contains 28.12 heat units, while water at 212° temperature, or boiling point, contains 180.79 heat units, if the feed water can be heated by the waste steam from the 60° to 212° of temperature, this will impart 192.67 heat units, and as 1,177.68 heat units are the total required to evaporate 1 lb. of water from 60° Fahr. into steam of 250 lbs. indicated pressure, the 192.67 heat units above referred to, which will be derived from the waste steam instead of from fresh fuel, will be equivalent to a saving of 12.79% in fuel.

Even under ideal boiler conditions, the evaporation of more than 12 lbs. of water from the combustion of 1 lb. of ordinary fuel cannot be expected. It is not so much by increasing the efficiency of a boiler that the increased evaporation from 1 lb. of coal is produced, but it is by utilizing the heat in the waste steam to evaporate other water at a lower temperature, while at the same time the steam is being condensed for further use as feed.

Feed water furnished to steam boilers has to be heated from the normal temperature, to that of the steam, before evaporation can commence, and this is generally at the expense of the fuel which should be utilized in making steam. All of this heat, therefore, which can be imparted to the feed water is just so much saved, not only in the cost of the fuel, but in the capacity of the boiler, and it is essential that this be done by heat which would otherwise be wasted.

As the heat imparted to the feed water by injectors and live steam heaters comes from the fuel and represents no saving, there are only two sources of waste available for this purpose, which are the exhaust steam and the exhaust gases. By the exhaust steam feed water may be maintained heated at from 200° to 210° with properly arranged and proportioned heaters.

The heating of the boiler feed water will also result in the precipitation into the water tank, instead of into the boiler, of a large proportion of the carbonates, chlorides and sulphates, or other mineral substances or scale-producing matter, a collection of which on the water side of the boiler sheets and tubes destroys the conduction of the heat from the metal to the water, and results in corrosion, more frequent renewals of the parts, and makes an increased cost for maintenance. This precipitation into the water tank can be readily cleaned out, and from a location where it does no harm, even should it be neglected.

As feed waters supplied from sources where they come in contact with vegetation are highly charged with carbonic acid, this, in addition to the presence of oxygen, will be the cause for active corrosion of the boiler plates.

The heating of the feed water will tend to deprive the water of the air, as well as to precipitate its carbon dioxide, and by introducing the feed water into the boiler at a temperature near boiling point, or vaporization, the corrosive action will be reduced to the minimum.

The above, in itself, is an item of considerable importance to result from the heating of the boiler feed water, as it will be a means for reducing the liability for accident, and the cost for maintenance.

The arrangement provided for the utilization of the waste steam for the heating of the boiler feed water will be described under the heading of "Tender Water Tank and Condenser Construction."

METHOD FOR FEEDING BOILERS.

The relative value of injectors, direct acting steam pumps, and pumps driven from the engine is a question of importance to all steam users. When feeding cold water direct to the boilers the injector has a slight economy, but when feeding heated water, or through a heater, the pump is the most economical.

Considering the efficiency of a direct acting pump feeding water into a boiler at 60° Fahr., without a heater, as a unit, then an injector feeding water into a boiler at 150° temperature Fahr., without a heater, will effect a saving of fuel of 1.5%, and an injector feeding through a heater in which the water is heated from 150° to 200° Fahr., will effect a saving of 6.2%, while a direct acting pump, feeding water through a heater, in which it is heated from 60° to 200°, or feeding heated water of 200°, will effect a saving of 12.1%.

Considering that two suitable vertical duplex high-duty pumps, one for relay service, each of a capacity to deliver from 1,800 to 3,600 gallons of water per hour at 212° temperature against a boiler pressure of 250 lbs., have been provided, the saving by this method of feeding water as compared with direct acting pump or injector, each feeding water at 60° temperature, will be about 12%. These pumps also being located so that the heated water will at all times feed by gravity to the water cylinders, will give efficient service and present little liability for failure, and the location provided for the same on the locomotive makes a convenient arrangement for piping and accessibility for maintenance.

The pump being constructed self-contained, and to run without lubrication, will require little attention or expense for their operation.

SUPERHEATING.

Since the volume of gas of a given pressure is proportional to the temperature, the effect of increasing the temperature by the superheating or saturated steam will increase the volume proportionally, and maintain the same pressure. Thus by superheating, a decided saving in the water will be effected, but at an expense of heat. In superheated steam the temperature is higher, the specific volume greater, and the density less than saturated steam of the same pressure, but it cannot exist in contact with the water from which it is generated. Considering that we have 1 lb. of saturated steam at a boiler pressure of 140 lbs. per square inch, which has a temperature of 360° Fahr., and containing 1,192 heat units with a volume of 2.92 cubic feet. If now, by the addition of 153 heat units the temperature of this steam is increased to 680° Fahr., the pressure remaining the same and the steam being permitted to expand, it will increase its volume to 4.06 cubic feet. Consequently by supplying 12.8% more heat, the volume is increased 39%.

Superheating must therefore result in gain, and the higher the superheating the greater the gain, and in practice, the advantage of increased volume is enhanced by the complete removal of the loss by cylinder condensation.

Of the sources of waste in an engine, the condensation of steam by the cooling of cylinders, or cylinder condensation as it is termed, is by far the greatest, and it has been established, practically, that in an ordinary single-cylinder non-condensing engine the waste through cylinder condensation amounts to, with an early cut-off, from 35 to 40% of the total steam used. The best means for partially or wholly preventing this loss is by the use of superheated steam, as water, no matter from what cause arising, cannot exist in the presence of superheated steam for the reason that it reduces some of the excess heat and is thus itself evaporated into steam. The steam is said to be superheated when it can give the boiler pressure a higher temperature than that of the water from which it is evaporated. The temperature of saturated steam cannot be raised without increasing its pressure, but the temperature of superheated steam that is allowed to expand can be raised without increasing the pressure, expansion being provided by the steam being drawn off and used.

If saturated steam be allowed to expand, doing the full amount of work of which it is capable during the expansion, it uses so much heat with its increased volume that partial condensation takes place. When this happens in the cylinder of an engine working expansively, some of the steam pressure must be lost, unless means are taken to prevent condensation. One method consists in surrounding the cylinder with a steam jacket, which can be kept at the temperature of the contents of the cylinder by heat admitted through the sides of the cylinder. The difficulty of such an arrangement consists in causing the steam to take up the heat with sufficient rapidity. Where the temperature of the boiler is not too high and the direct steam may be conveniently heated by the products of combustion before they enter the stack, the employment of the use of superheated steam is much more economical and efficient than the use of steam jacketing.

The superheating of the steam will overcome the losses through condensation in the cylinders for the reason that this steam will contain excess heat in a sufficient quantity to heat the walls of the cylinders and the metal surfaces so exposed, and at the same time retain enough heat to prevent condensation and loss of work in expansion.

The use of superheated steam in connection with compounding will give as efficient results as regards reduced loss through cylinder condensation as the triple expansion of steam without the superheating, for the triple expansion features as applied to locomotive mechanism will not produce any more economical results, considering the additional complications of machinery, the increased first cost, and cost for repairs and maintenance. With the proposed initial pressure and the effect of superheating, the cross compounding will give as economical results in the use of steam as can at present be considered as practicable in connection with locomotive service.

The direct steam pipe and receiver pipe of the proposed locomotive being located in the combustion chamber, in a position where a suitable high temperature is available, it will be noted that passing the steam through these pipes will insure its receiving a large number of degrees of superheat. This arrangement and the location and construction of these steam and conveyer pipes will provide a simple, durable and efficient superheating system, which, while being placed between the furnace and the stack will, at the same time, be located where the difference between the temperature of the saturated steam and of the escaping gases leaving the boiler will still be sufficient to superheat the steam produced. This construction of pipes will also be an arrangement that will admit of all the parts expanding and contracting freely without severe strains being placed on any of the joints which might cause them to leak, or through damage on account of overheating when the steam is not passing through them in a sufficient quantity to carry away the heat supplied by the passing gases. As the furnace gases must first pass through the combustion flues leading from the furnace to the combustion chamber, the superheaters will not be subjected to the direct action of the fire; and assuming that the boiler will be in regular service and the firing not uneven, no great fluctuation in temperature will take place. Moreover, this arrangement will be readily accessible for examination. Prevention against overheating during steam raising, and at all times when there is no circulation of steam through these pipes, is insured by the arrangement of the cast iron

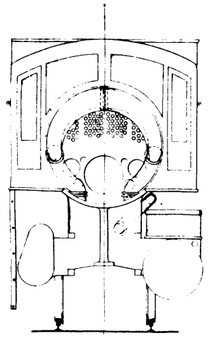


FIGURE 5.

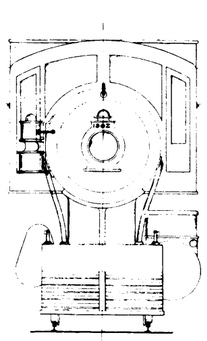


FIGURE 6.

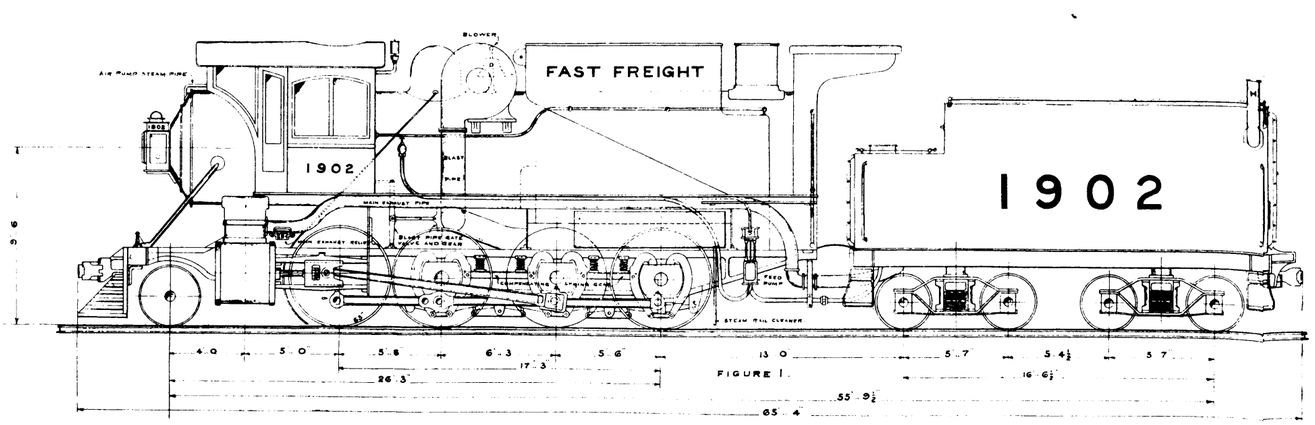
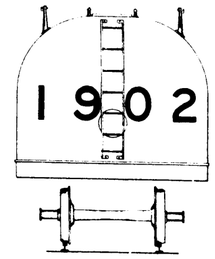


FIGURE 1.



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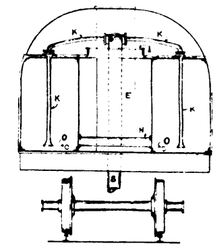
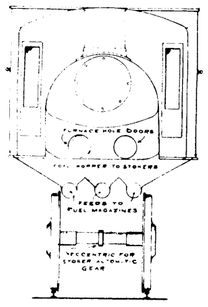


SECTION THRO' A.B.

FIGURE 10.



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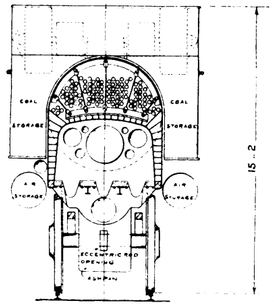


FIGURE 8.

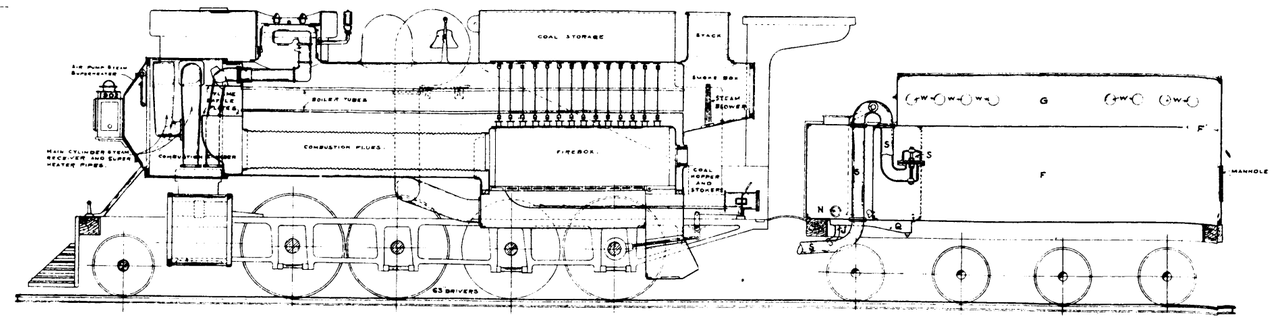
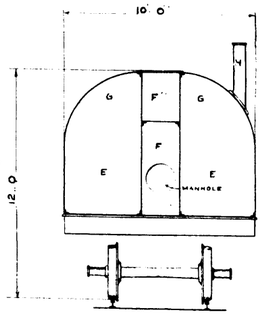
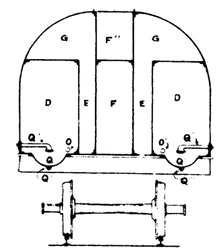


FIGURE 2.



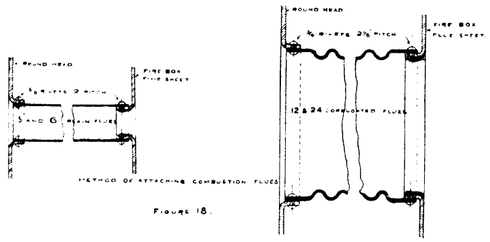
SECTION THRO Y.Z.

FIGURE 11.



SECTION THRO C.X.

FIGURE 12.



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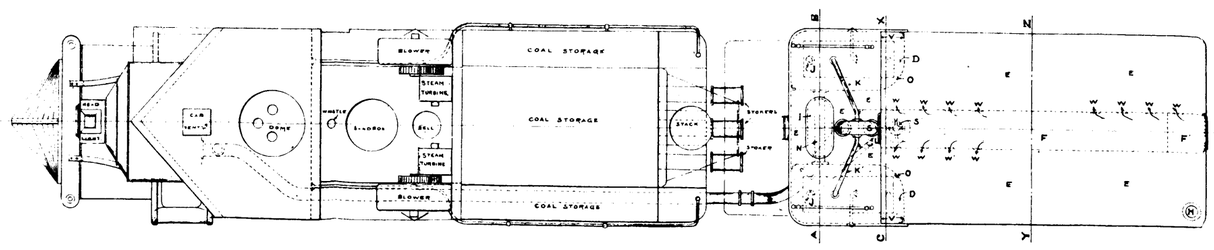
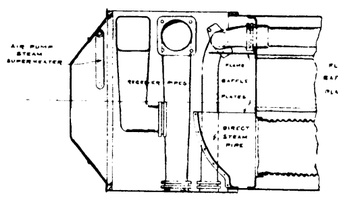


FIGURE 3.



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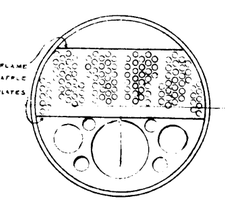

FIGURE 17.

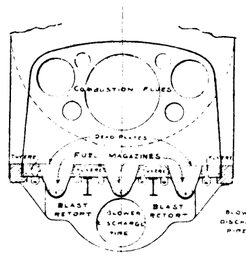

FIGURE 13.

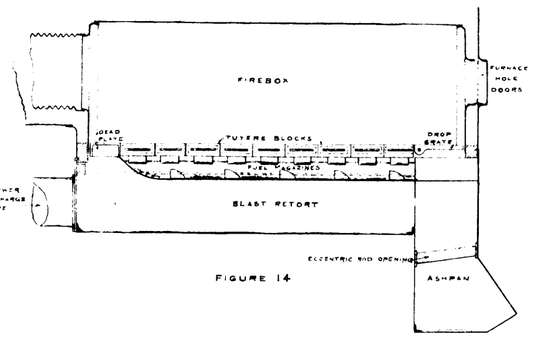

FIGURE 14

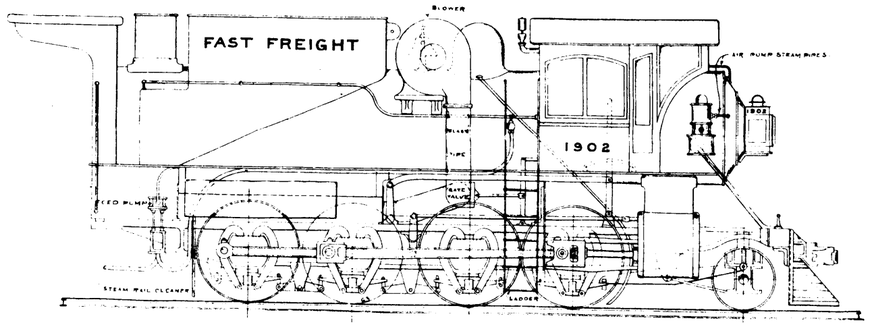

FIGURE 4.

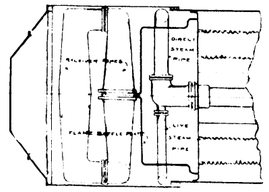

FIGURE 16.

LOCOMOTIVE FOR FAST HEAVY TONNAGE.

DESIGNED AND PATENTS APPLIED FOR BY J. E. MUHLFELD

MAY 7-N-1901

pipes, and the protection of the joints by means of asbestos packed cast iron deflectors and baffles, but which are placed so as not to prevent access for cleaning and repairs to the boiler tubes or flues.

The superheating will assist materially in producing more horse-power per pound of coal consumed, and working under ordinary conditions, an arrangement of this kind should produce an economy in connection with cross-compound engines of from five to fifteen per cent.

As lubricants are now easily obtainable with a flash point of from 780° to 790° Fahr., which will always be much higher than the mean temperature of the cylinder walls, no difficulty will be experienced in maintaining efficient lubrication through the possibility of the decomposition of the latter.

LAGGING AND JACKETING.

The coal pile represents an enormous percentage of the whole expense of operating a railroad, while but a small portion of the power it produces or can produce is utilized in actual work, and the remark that "The hand that manipulates the coal shovel reaches from the firebox to the treasury of the railroad company," is often made. It has long since been pointed out as regards the enormous loss of power that has been continually going to waste through heat radiation, and to prevent which but rather indifferent efforts have been put forth.

From the fact that the radiation from a hot body increases as the temperature rises, every attention should be given to the proper clothing of all parts of locomotive boilers and machinery that are generators and containers of high pressure, which would otherwise be exposed to the atmosphere. The rate at which the loss of heat extends will depend upon the difference in the temperature of the body emitting the heat and the surrounding atmosphere, and the condensation of steam inside of an unprotected steam pipe is dependent upon the atmosphere of the steam within, the temperature of the air without, and the velocity of the movement of that air. The metal composing the cylinders of steam engines is such a good conductor of heat that it responds instantly to the changes of temperature, and a great many efforts have been made to keep the cylinders sufficiently hot to prevent the wasteful effects of what are known as initial condensation and re-evaporation at the beginning of the return stroke. It has been demonstrated repeatedly by careful tests, and has been proven that a locomotive engine wastes more steam by cylinder condensation than does any other form of steam engine. The most successful remedy for this waste of heat has been the compounding of engines, which reduces the extremes of temperature in one cylinder. Besides the practice of compounding, a variety of other methods have been tried at other times to reduce the waste due to cylinder of condensation, one of these being steam jacketing, but little success has attended these efforts. The main difficulty with steam jacketing is owing to the fact that a proper method has not been arrived at for draining these jackets, which results in their being transformed into condensers, on account of the water of condensation being allowed to accumulate in them.

Under all the ordinary conditions, condensation is so great as to warrant a considerable expenditure for its prevention, and the most practical method for lagging cylinders and other surfaces transmitting steam is to make a design such as will locate these parts where they will be less exposed, and then make use of a good non-conducting lagging having the minimum facility for conveying heat, properly applied, which will result in as practical a means to prevent radiation as can be arrived at at the present time.

The practice still in vogue of creating an air space between the boiler, other steam sheets, and the various forms of lagging is of no advantage, from the fact that the air space so provided is not a dead air space. Air is elastic and is expanded by heat, thus becoming specifically lighter, and in that condition, it rapidly diffuses itself into the air outside of greater density, the colder air taking its place. Even when hermetically sealed, air cannot be considered as dead air, unless it is also non-circulating, and to depend upon air to prevent the escape of heat by radiation, it must be held immovable and not allowed to circulate, even in confined spaces, when there will be no transmission of heat except by the sluggish process of conduction.

In consideration of the proper material for a lagging, the proper elements are non-conductivity, efficiency, economical, ease of application, structural strength to withstand frequent removals and re-applications, freedom from corrosive acids, ability to withstand indefinitely the disintegrating effect of the action of the heat, and the vibrations and concussions incident to locomotive action.

In addition, the covering should be only of material which is non-combustible and at the same time of a porous or spongy nature, with numerous air cells or spaces which will retain air between the particles of the substance.

Of the various material used for lagging, magnesia can be considered one of the best and most practical for use in connection with locomotive service. This composition is of strict neutrality, and composed of inert mineral matter that will exert no chemical action, corrosive or otherwise, upon any metallic surface with which it may be brought in contact. It will remain unaltered under all conditions of heat and moisture which confront the coverings of modern locomotives. It has qualities of lightness, firmness, structural strength and porosity, the latter quality especially, upon which depends largely the efficiency as a non-heat-conductor; and this quality being most pronounced in magnesia, it affords the greatest resistance to the transmission of heat. It can also be molded into sectional blocks of any form and size desired for ready application and removal.

Practical tests have proven that the loss due to condensation of steam in the cylinders, steam chests, cylinder heads and in other conduits of steam about a locomotive, disregarding entirely the question of the firebox and boiler, of which the former, at least, is but partially and imperfectly protected with any kind of non-heat-conducting covering, varies from 10 to 50% of the whole amount of steam consumed. This loss of heat energy can and ought to be nearly all prevented by a complete and thorough insulation. It requires as much fuel to produce one of the deserting units of heat as it does one of the working ones, and it is a fact that the outlay required to remedy this condition, in comparison with the immense waste involved in the enormous and continual loss of power and consequent expense, is but of trivial importance. But few of the locomotives in service to-day, especially on this continent, have any part of the cylinder heads, steam chests, cylinders, or any other heat radiating surfaces protected with any kind of non-heat-conducting covering, which should be done to increase the efficiency of the engine, by at least partially protecting these parts from the almost unrestricted drain of mechanical energy through the dissipation of heat.

In this proposed locomotive, the design will be such as will locate all these steam containers where they will be, as far as practicable, the least exposed. All of the outside boiler sheets, except the smokebox and combustion chamber front, will be clothed with magnesia sectional lagging, securely jacketed and made detachable at points where periodical inspections and tests at roundhouse points will require its removal.

The cylinders and their covers, steam chests, and all other conduits and containers of steam will be lagged and jacketed in the same manner, and it is expected that the saving in radiation and condensation so effected by the additional first cost, will readily assert itself in the saving of fuel.

REDUCTION OF CYLINDER CLEARANCE.

It has been demonstrated that it is not only possible, but practicable, to reduce the cylinder clearance to as low as 2%, while in the existing type of simple cylinder locomotives the clearance averages from 5 to 10%. What effect reduced clearance will have as regards steam, and the consequent fuel consumption, will be shown from the fact that in a 20 in. x 26 in. simple cylinder the effect of saving at different points of cut-off in reducing the clearance from 10 to 2% will be from 31.5 to 2.5%. This percentage is calculated presuming that the steam which fills the clearance spaces is entirely wasted, which assumption, however, cannot be considered correct for the reason that the steam confined in the clearance spaces is not all lost, but does work during expansion, in the same proportion as the expansive action of the steam which is admitted behind the piston, in addition to what is confined in the clearance spaces.

However, the wasteful effects of the large amount of cylinder clearance in connection with locomotive engines, especially those having an arrangement of the usual type of piston valves in connection with single expansion cylinders, make it necessary that this cause for loss be given consideration.

In this locomotive a piston valve of such length as will reduce to the limit the travel of the steam from the chest to the ends of the cylinder has been arranged in connection with a steam chest located close to the high pressure cylinder. On the low pressure side, a balanced plain slide valve of a construction and adjustment which will handle promptly the large volume of steam which must pass it, has been adopted in order to reduce the clearance space to a greater extent than would be possible with a piston type of valve, which would answer for the requirements. This arrangement will provide for the least amount of clearance space practicable from the valves to the cylinders, and at the same time reduce the effect of the valve friction to the minimum, and give a proper steam distribution to the pistons.

From the fact that the excessive back pressure will be eliminated from the low pressure cylinder, due to the exhaust steam not being required to create an induced draft, and as the less the back pressure the less the percentage of clearance space required, the piston clearance can also be reduced to a minimum.

A further feature which will favor making the reduced clearance space practicable is the superheating of the steam to overcome the effect of cylinder condensation.

CROSS-COMPOUNDING.

That the use of the cross-compound type of cylinders in connection with locomotive service has passed the experimental stage is now generally conceded by all persons connected with railway mechanical departments, and it is also recognized as one of the known methods for effecting a practical reduction in locomotive fuel consumption.

The results of numerous road tests with cross-compound locomotives, and which are based on well substantiated claims of economical performance in freight service, show economies in coal and water ranging from 10 to 33%, at speeds of 45 miles and under per hour. Any increase in economy with an increase in the speed mentioned is mainly due

to a decrease in the cylinder condensation. While cross-compound locomotives will use from 15 to 25% less water than the single expansion, an additional economy will also be obtained by an increased evaporation, for as the coal burned per square foot of grate area increases, the evaporation of water at 212° decreases. If for a consumption of, say, 100 lbs. of coal per square foot of grate surface, about 6½ lbs. of water can be evaporated per pound of coal, and this coal consumption is increased to 180 lbs., the evaporation will fall to about 5 lbs. of water. Therefore, if there is 25% less evaporation required in a cross-compound locomotive than in a single expansion, there will be a saving of coal from the fact that not so much coal need be burned on the same grate surface, for the reason that there will be an increased water evaporation from the coal that is burned, and an additional saving due to better evaporation over and above the lesser amount of coal consumed. Where 10% of water will be saved, the fuel saving will be about 15%, and with 25% of water, a saving of 35% of coal, and so on in that proportion.

A successful cross-compound locomotive must show a saving in fuel and water which is the result of and is due from the compound principle; it must have an efficiency of power and control equal to that of the single expansion engine and the least complication to cause an increased cost for repairs and maintenance or liability for failure. The power must be equally divided between the two cylinders and both sides of the locomotive, to prevent excessive wear and tear on the machinery; it should be capable of developing a maximum power to start trains; there should be an automatic control to the employment of the single expansion, and there should be an adequate system of air circulation, or relief appled to the cylinders to prevent rough riding and damage to the machinery.

In regard to the use with economy of high pressures, initial pressures, it is true, have risen and made locomotives more powerful, but exhaust pressures have grown with this, and as a consequence the waste has increased accordingly. Through compounding, the rate of expansion is largely increased, thus making economically practicable the high initial pressures with practically no increased waste. From the fact that the cross-compound locomotive utilizes to a considerable extent in work the wasted power in the exhaust of the single expansion locomotive, and in consequence requires less steam from the boiler, this must result in a saving of both fuel and water. Owing to the relative variations in the temperatures of the cylinders of the cross-compound as compared with that of the single expansion engine, the range of temperature, and of loss, is then in both cylinders, that between the temperature of the initial and the exhaust steam. The corresponding reduction in cylinder condensation, through the heat from the steam not being expended to such an extent in warming up the cylinder walls, will, therefore, being utilized as power, effect a further saving.

This great variation in temperature which takes place in steam that undergoes a high rate of expansion causes an alternating flow to and from the walls of the cylinder, and this involves a suspension of energy. To overcome this difficulty, and to prevent losses, it is necessary to reduce the range of temperature which occurs within the cylinder, and this is effected in cross-compound engines by allowing the expansion to take place in two states and in two separate cylinders. The steam, for instance, may expand to three times its original volume in the high pressure cylinder, the expansion being accompanied by the corresponding fall of temperature, the extent of which will not be very great. It is then admitted into the low pressure cylinder, which is always at a lower temperature than the other, and may there again expand to three times its volume, which will give a total expansion of nine times the original volume. If this total expansion, however, takes place in a single cylinder the capacity of the cylinder would have to be sufficient to allow the full expansion, and its strength would have to be proof against the full pressure of the steam, thus necessitating an enormous mass of metal, in which the steam would be exposed to a very wide range of temperature, and the consequent dissipation of the heat would be very great.

The condensation of steam in the cylinder in consequence of the conversion of the heat into work is of itself by no means an evil, and if the condensed steam would leave the cylinders, the water of condensation would improve the efficiency of the engine, but during the exhausting process the steam is again evaporated, and the latent heat of evaporation is emitted from the cylinder, cooling the latter and leading to a partial condensation of the high pressure steam. During the next period of admission, the condensation of a portion of the steam causes, of course, a falling off in the pressure, but the giving up of the latent heat increases the pressure more than three times as much as the loss of the steam diminished it, and hence the pressure does not fall nearly so rapidly when saturated steam expands as when superheated steam expands. A partial condensation, however, would be beneficial but for the re-evaporation and for the consequent loss of heat mentioned. Sometimes it is convenient to employ steam which is not saturated when it enters the cylinder, but superheated. The steam thus heated can afford to lose a certain amout of heat without condensing, and if sufficient heat has been communicated to it, it may be kept on expanding to many times its volume, doing work all the while and still remaining dry steam. Thus in the proposed type of locomotive, for the reason of the advantageous location of the pipes through which the steam must pass on its way from the boiler to the cylinders, the possibility of superheating the steam and increasing its effectiveness by the absorption of some of the heat which would otherwise be wasted in passing to the atmosphere, will promote considerable economy.

To derive the benefits from the superheating of steam used in connection with compound cylinders, the two-cylinder, or cross-compound type, with a large capacity receiver, located between the high and low pressure cylinders, and which will be placed in the combustion chamber of the proposed type of boiler, will present an ideal arrangement.

Large receiver capacities neither lose by variation nor by a drop in the steam pressure in the receiver itself, and in this way they are conducive to economy, as a drop in the receiver pressure represents an actual loss of efficiency, since it is an expansion of steam without doing any work. The greater the capacity of the receiver, the more readily can the power to be generated in the two cylinders be equalized at the different cut-offs, by an adjustment of the valve gear cut-offs in the cylinders, and the less will be the effect of a change in the sequence of the cranks. Also the larger the receiver capacity, the greater the benefits to be derived from superheating, and the more uniform will be the effect of the back pressure on the high pressure cylinder piston. The receiver capacity should have not less than two times the volume of the high pressure cylinder, and as much larger as is practicable. With the proposed arrangement of combustion chamber a very large receiver capacity is possible, as the receiver can be located ahead of the direct line of the passage of the gases from the combustion flues to the boiler tubes at a point where no draft arrangements must be provided for, and there will be no restriction as regards cross sectional draft areas.

Some of the advantages of the two-cylinder type of compound, as proposed, are a reduction of expansion in one cylinder and the consequent reduction of internal waste; ability to adopt larger ratios of expansion with light operation and without the throttling of the initial pressure; ease with which they start heavy trains without lunging or having to take the slack, reducing the liability of damage to the draft rigging; increased length of time that the momentum with a train can be kept up on grades, enabling to haul heavy trains up long grades faster and easier by increasing the cut-off which is possible on account of the reduced back pressure; on account of longer runs between between fuel and water stations a faster schedule can be maintained without faster running; a longer distance can be run without having the fires cleaned; more forcing can be indulged in without danger of foaming; the flues and fire-boxes will last longer, and there will be less failures on account of leaking, through reduced stress on the boiler; increased boiler efficiency; reduced loss through the reduction of dead coal and water haulage; a greater uniformity of crank movements, and a larger efficiency of the machine and adaptability for a variable class of freight service, its flexibility as regards economy in such service being as wide of range as that of the simple type; increased fuel and water economy over the simple in the average freight service of between 15 to 25%, when maintained and operated properly, and which saving will arise from the higher rate of expansion, reduced cylinder condensation, and slower rate of combustion; possibility to maintain and keep in serviceable condition for regular performance with no more difficulty or cost than a simple type of the same tractive power; an intercepting mechanism whereby the change from simple to compound is effected automatically, and, at the same time, the engineer is given the power to operate the cylinders in simple gear when emergency requires it; a cylinder ratio of almost one to three, which is possible on account of the elimination of the large amount of the back pressure in the low pressure cylinder, high initial pressure, reduced terminal pressure and superheating; the possibility of rating compounds when operated over maximum grades slightly higher than the simple type; reduced cost of probably 20% in the boiler repairs and cost for maintenance as compared with the simple type, on account of the lesser stress on the boiler, lesser amount of washing out required on account of the reduced amount of water to be evaporated and not so much possibility of scale formation on the water side of the boiler sheets, which destroy the effect of heat conduction.

Another feature of the cross-compound is the possibility of the utilizing of a greater per cent. of the weight on the drivers for tractive power. As compared with the single expansion locomotive with cylinders large enough to furnish the needed expansion all in one cylinder, the tendency to slip the driver wheels will be so great that it will prohibit the use of much expansion, while with the cross-compound much saving will be effected by the greater expansion produced and the reduced tendency of the driver wheels to slip.

With good weather and rail conditions, a higher percentage of adhesive weight can also be used with advantage to assist trains up grades or on sharp curves, where the increasing frictional resistance of the locomotive as well as the advantage of adhesion, will admit of the cylinder power being increased temporarily from five to ten per cent., or even more. It is at such times that the cross-compound locomotive, with its more uniform turning power applied to the driver wheels and its reserve power through the possibility of admitting live steam to the low pressure cylinder, will be able to exert the maximum tractive force, which will take a

train over a grade that would stall a single expansion locomotive of equivalent capacity.

This advantage of being able to utilize a greater per cent. of the weight on the drivers will also facilitate the starting and the handling of trains under all conditions with less resorting to slacking, which is a destructive and expensive practice.

The reduction of the amount of water and fuel necessary to use in connection with the cross-compound locomotive will make a corresponding reduction in the number of water and coaling stations along the line, which must be considered of large importance by its lessening the cost for maintenance and supply, and by the provision of a lesser number of different qualities of water to be used in the boiler.

The cross-compound locomotive will require from the boiler less steam, owing to its increased rate of expansion and decreased cylinder condensation, and this will facilitate providing a greater efficiency of the boiler by a slower rate of combustion, greater possible absorption of heat from the products of combustion of the reduced temperature, and resulting loss in the waste gases from the smoke stack.

However, cross compounds, like all other heavy capacity power, must be maintained if good results are to be expected. If the intercepting valves are allowed to leak, piston and slide valves and cylinder packing to blow, and the machinery to be neglected until the locomotive knocks itself to pieces or is unfit to ride on, neither the engineer or fireman will favor them, nor will they be economical on account of the wastefulness in fuel and the hard riding, and for which they will soon be condemned.

As regards repairs and maintenance of the compounding mechanism and the locomotive's machinery, the cross-compound is subject to a much lighter stress at the beginning of, and to less variation in strain, during the stroke, than the single expansion engine, consequently the friction on the journals and guides will be less, and it will run more steadily, which will make a reserve of strength and durability in favor of the cross-compound as compared with the simple, where the working parts are of the same dimensions.

The intercepting valve gear and such other parts of the locomotive as are connected to the cylinders, and which are generally affected by compounding, if properly designed and constructed will require very little, if any, additional cost for maintenance, other than the usual repairs that will be made, the same as to any other part of the locomotive, when it goes into the shop for a general overhauling. At the outside the cost for the maintenance of these parts will amount to not more than 3% of the total cost of the locomotive repairs, and the saving in boiler repairs, due to the compounding feature, will more than offset this.

The cost for the lubrication of the cylinder gear for a cross-compound locomotive as proposed, should not be over 5% more than for a single expansion locomotive of the same capacity.

THE USE OF THE STEAM.

Higher steam pressure is the tendency of the times, and with good reason, for the higher the pressure the greater the opportunity for economy in generating power. The compound and triple expansion engines of the present day have reduced the cost of power some 40% over the performance of a few years ago, this, of course, being where higher initial pressures have been used in order to get the greatest advantage out of the compounding features.

The total heat acquired in the form of steam is expended in three ways:—first, in raising the temperature of the water to boiling point; second, in the work done in transforming water into steam; third, in the additional work done in overcoming the incumbent pressure of the surrounding atmosphere, so that an enlarged volume may take place. To raise the temperature of water from 32° to 212°, which is the sensible heat conveyed, 180.8 heat units are required. The latent heat required in the form of steam is an additional 894 heat units, in the expansion against atmospheric pressure 71.7 heat units, and to increase the pressure to 250 lbs. indicated, 59.2 heat units. This makes a total in work expended of 1,205.8 heat units to raise steam of 250 lbs. indicated pressure per square inch from 1 lb. of water at freezing point.

Steam now being provided in the generator, or boiler, at an indicated pressure of 250 lbs. per square inch, with a temperature of 406.17° Fahr., containing 1,205.8 heat units per pound, and weighing per cubic foot .5705 of a pound, is admitted through the use of a single-seated throttle valve in the dome, to a stand pipe and dry pipe of reduced length, through a crotch and direct steam pipe by the least possible amount of throttling and friction to the high pressure steam chest.

The throttle valve to be single-seated and of such construction and adjustment as will overcome the liability for leakage at a high pressure, balance to give ease of operation, and arranged to throttle the steam with the initial movement in order to prevent too sudden a lunging of the locomotive when it is moved to start the train, and which will overcome the action which usually results in break-in-twos and damage to the equipment.

The capacity of these conveyers of the steam from the throttle valve to the steam chests, not including the latter, on the usual type of simple engines, averages from 12,000 to 13,000 cubic inches, or about 1.3 times the capacity of one cylinder of a locomotive, which would be equivalent in tractive power to the proposed locomotive. In this locomotive, the capacity of the conveyers, not including the high pressure steam chest, is but ½ times the capacity of the high pressure cylinder, which comparison indicates the reduced travel of the steam from the boiler to the steam chest, and the resulting decrease in loss of pressure from friction, not considering the more sensitive control to the engineer over the operation of the motion gear. These conveyers also extend through the combustion chamber, where the temperature of the gases will vary from 1,200° to 1,600° Fahr., as compared with an average of from 700° to 1,200° in the usual type of smokebox. This provides an average increase of 450°, and which is from 800° to 1,200° over and above the temperature of the indicated 250 lbs. boiler pressure itself. This intense heat in direct contact with the conveyers of the direct pressure steam leading to the high pressure cylinder, also the receiver pipe, which conducts the steam from the high to the low pressure cylinder, will, by super-heating, overcome condensation losses, also increase the volume proportionally and maintain the same pressure, which must result in an increased efficiency and at no loss of fuel. This, for the reason that the superheat will be taken from the gases during their passage from the furnace to the atmosphere, and the heat removed from these gases for the superheating effect will not be sufficient to reduce the terminal temperatures of the smokebox gases to below that of the steam in the boiler. It is safe to say that the steam from the boiler will reach the piston valve to the high pressure cylinder with a reduction in pressure of not more than 8%, which will provide an initial cylinder pressure of 230 lbs., with a temperature of 399.2°, containing 1,203.7 heat units. A piston valve will be provided of ample proportions, with large steam passages, positive adjustment to give large and quick port openings, and thoroughly balanced in order to reduce the loss of power necessary to operate it. It will also be located in close proximity to the cylinder, to reduce the clearance spaces and proportionate loss of heat thereby, to the minimum.

By now dividing the use of the steam to be converted into useful energy between the high and low pressure cylinders in accordance with theoretical temperature proportions, the ratio between the two cylinder volumes would be in proportion as 1 is to 3.84, which would give a high pressure cylinder of 18⅜ inches and a low pressure of 36 inches in diameter.

By distributing the steam to equalize the power the ratio would be as 1 is to 3.09, or a high pressure cylinder of 20½ inches, and a low pressure of 36 inches in diameter.

To favor the relation of the slide valve gear cut-off adjustment between the two cylinders, also the effect of steam friction and condensation, and to increase the tractive power, the proportion decided upon is a ratio of 1 to 2.94, or a high pressure cylinder of 21 inches, and a low pressure cylinder of 36 inches in diameter. This proportion is much larger than the ratios of from 1 to 2.3 and 2.5, which are the usual limits for cross-compounds, and approaches more nearly the ratio which can be used in connection with four-cylinder compounds, and without the disadvantages of the latter.

The increased ratio so adapted will give a greater volume of expansion and more useful work out of a given volume of steam, and with the arrangement proposed, the usual disadvantage of large cylinder ratios through wire drawing, compression and impossibility to equalize the power between the two cylinders, will be overcome.

The available pressure per square inch for the high pressure cylinder is now 230 lbs., with a temperature of 399.2°, as compared with 180 lbs. at a temperature of 379.6° in the simple locomotive cylinder of a boiler having a capacity for 200 lbs. initial working pressure, and with an arrangement of throttle valve, stand pipe, dry pipe, steam pipes and location of dome in accordance with the usual American design. It will thus be noted that an increase of 50 lbs. initial steam chest pressure has been gained, with an increased temperature of 19.6° (not considering superheat) at an expense of but 5.6 heat units per pound of evaporation. Assuming that steam of 230 lbs. pressure will be admitted to the 21 inch diameter high pressure cylinder, at an actual cut-off of 24.2% of the stroke of 30 inches, this steam will be expanded 4.13 volumes to a terminal pressure of approximately 55.7 lbs.

Considering that with the large capacity of receiver the drop in the receiver pressure will be not more than 15%, the back pressure in the high pressure cylinder will average not more than 47 lbs., at which pressure the steam will equalize in the receiver pipe for its transmission through the intercepting valve to the steam chest to the low pressure cylinder. This conveying of the high pressure exhaust steam through the receiver pipe, which, as has been stated, is located in the combustion and superheating chamber, will increase the volume by superheating from 10 to 25%, and this with the increased temperature will overcome to a large extent the losses through a drop in the receiver pressure, and by cylinder clearance and condensation.

The low pressure steam chest being provided with passages to and from the cylinder, and with a slide valve, constructed so as to give quick admission and release of a large volume of steam, the latter will commence its work in the low pressure cylinder at about 47 lbs. pressure, and being admitted for an actual cut-off of 34.1% of its stroke of 30 inches, the steam will be further expanded 7.87 volumes, or to 12 times its original volume, when admitted to the high pressure cylinder, which will reduce it to a terminal pressure of about 6 lbs., with a temperature of 230.55° Fahr., and containing 1,152.3 heat units.

The effective work of the steam now having been completed, it will be released at a back pressure of from 2½ to 3 lbs. through an 8-inch diameter large capacity exhaust pipe, and conveyed for further use in heating, and for condensation to make boiler feed water.

Thus it will be noted that a pound of steam from the boiler at 250 lbs. indicated initial pressure of 406.17 temperature, and containing 1,205.8 heat units, has been expanded 12 volumes, and reduced, after having performed effective service on the pistons to operate the locomotive, to a terminal pressure of 6 lbs. of 230.55° temperature, and containing 1,152.3 heat units. This, as compared with a pound of steam of 200 lbs. indicated boiler pressure of 387.88° temperature and containing 1,200.2 heat units, being expanded about four volumes to a terminal pressure of 45 lbs., containing 292.5° temperature and 1,171.2 heat units, and at which point it is exhausted into the atmosphere, shows 53.5 as against 29 heat units contained in the same given quantity of steam which are used to perform effective work in the cylinders.

Deducting the 5.6 heat units that we originally required to increase the steam of 200 to 250 lbs. pressure, we have an actual increase of 18.9 heat units used to produce power in the cylinders, which is 65% more than the total heat units converted into useful energy in the single expansion cylinder.

In the above, no consideration has been given to the additional results which will come from superheating and the use of the exhaust steam for feed water heating.

The steam having been delivered at the water tank, now finds its way through two three-inch conduits, designated by letters KK' on the drawing, one each leading to the right and to the left hot feed storages, and the additional steam which cannot pass to these chambers without increasing the back pressure to more than 2½ lbs. is relieved into the lower portion of the central condenser passage, indicated by letter F. The steam being conducted to the rear of the tank through this passage, it returns through the central passage, designated by letter F", to the front of the tender, from which it is conveyed to the right or left steam spaces, designated by letter G, where it comes in direct contact with the cold feed storage. After having had an opportunity to condense during its travel through the tender, the steam is now relieved to the atmosphere in the form of a vapor, from the 8-inch diameter relief opening at the left back corner of the water tank, and which relief will prevent any back pressure in the tank or in the cylinders.

Should it be possible to utilize the heat contained in the steam which will be exhausted into and partially condensed in the water tank and condenser, to increase the feed water of an average temperature of 60° to 212°, or boiling point, the total heat units used to advantage would then be 105.6, or what was required to first generate the steam.

This, however, would not be practicable in locomotive service for reason of the losses which will come about through radiation and the inadequate means for condensing aad absorbing the heat contained in the waste steam.

However, as 1 lb. of steam, at the minimum exhaust, or 2½ lbs. pressure and at a temperature of 220° Fahr., containing 1,149 heat units, will heat to 212° temperature, or boiling point, 7.52 lbs. of water from 60° temperature, it will be readily understood of what advantage the use of the exhaust or waste steam will be, more especially during the colder and more severe atmospheric conditions, to store heat into the feed water preparatory to its being injected into the boiler, and it will be practicable to utilize, through the use of the steam as is proposed, at least 50% of the heat now being generated and wasted.

Presuming that during the time the locomotive has been operated with the steam distribution as above referred to, it has been running at a rate of speed of 35 miles per hour, at which adjustment it is proposed that this locomotive do the greatest proportion of its work, the tractive power developed will be about 18,060 lbs., the indicated horse-power approximately 1,694, and the hauling capacity 1,840 net tons of cars, with lading, on level, straight track, under ordinary weather conditions.

It is from this practical use of the heat energy which must come from the fuel which is consumed in the proposed type of boiler, that will be utilized the greater proportion of the heat units contained in and absorbed by the steam during its passage from the boiler to the atmosphere, as compared with the use of an exceedingly small proportion of the heat units utilized from the steam used in the average American type of locomotive, and at the same time the amount of work that will be performed as regards the draw-bar pull, has been an increased efficiency.

THE TENDER WATER TANK AND CONDENSER CONSTRUCTION AND OPERATION.

The tender will have the same type of under framing and running gear, with connections, as the ordinary American type with swivel truck. The usual coal and water tank will be substituted by a hot and cold water feed storage and a heater and condenser arrangement. The tank will be of a simple and durable construction, compartments sub-dividing the interior taking the place of the usual coal space sheets, splash plates and stays, and making no more complication or expense for first cost or maintenance. The water hole will be located at the front instead of the rear end, where it will be more convenient to the fireman than as at the present. A walkway will be placed centrally with and on the roof of the tank for the convenience of trainmen going to and from the locomotive to the train; also a rear end centrally located ladder and signal lamps arranged as on the present type of tenders.

Referring to the drawing of the tender tank, the sub-divisions are indicated by the letters, and the arrangement for the operation is as follows:

Presuming that the tank is empty, it will be filled through the water hole I, which is located on the flat deck at the head end; this waterhole being of ample dimensions, especially in width, so that the stand pipe spout can be more readily adjusted if the water hole is not stopped exactly opposite the stand pipe. If the water service requires that this tank be arranged with scoops it can be done.

The right and left hot feed water compartments, designated by DD', are equalized with each other by the six inch pipe N, and connected to the cold storage E by the 2½ in. inlet openings OO' located with the lower edge one inch from the tank bottom, and which will admit water from the cold to the hot storage in about the same proportion as it will be used, and maintain an equalization of the level. The hot feed compartments DD' will extend beyond the rear of the flat deck, in order to permit of opportunity for inspection, cleaning and repairs; also to permit of the more prompt filling of these wells when the tender is being filled, by an overflow of the water over the top of the partition when the cold storage tank is full, and from the surface where the water in the cold storage will be the most heated. This arrangement will also permit of a direct contact of the hot feed water with the exhaust steam, which will be confined in the space G when the locomotive is in operation, and will also relieve these compartments of any excess steam when the water is low in the tender.

The hot and cold water compartments now filled, on the starting of the blower turbines, air pump, stokers and water pumps, the exhausts from each being connected to the main cylinder exhaust pipe S leading to the tender, and the outlet S' of this pipe being retained closed by a gravity seating 8 in. diameter valve until the pressure of 2½ lbs., which is equivalent to ½ lb. more than the weight of the water of the greatest depth above the outlets to the auxiliary exhaust steam inlets KK' has accumulated, these exhausts will be conveyed into the hot wells direct. This arrangement will permit of the most constant possible induction of steam into these hot wells at all times.

The locomotive now being started, such a part of the released cylinder steam will also be conveyed through the pipes KK' direct to the hot wells as a back pressure of 2½ lbs. will convey through these outlets, and when the water in the tank becomes low, the excess steam will be relieved through the hot well into the cold storage through the opening V. The cylinder exhaust steam having reached a back pressure of 2½ lbs., will force the valve S' off its seat, and the main portion of the exhaust will pass into the lower compartment F of the central condenser space, partially condensing itself and heating the cold feed water on either side through its contact with the compartment plates. The steam now passes through this compartment to the rear of the tank, then up and forward through the upper compartment F" of the central condenser, the condensation at this point being relieved into the lower compartment, at the steam inlet opening F'. The steam is then relieved through four 6 in. openings W in the left and eight 6 in. openings W in the right condenser space side sheets, located centrally between the maximum water level and the top of the tank roof, into the steam space G which is of large volume, where it will come in contact with the surface of all of the feed water level. This space is relieved by an 8 in. exhaust pipe H, located at the left rear corner of the tender, where the escaping vapor during the severe weather will not obstruct the engineer's view to the rear of the train. The accumulation of water in the lower condenser compartment F can be readily relieved by closing the tank valve J' and opening the drain valve U, which makes a direct connection from the condenser space to the left-hand feed pump to the boiler. The lubricating oil which will find its way with the exhaust steam into these water compartments will not be of a sufficient amount to cause any bad effect in the boiler, and there will be little liability of any passing through the feed outlets JJ', which will be located in the bottom of the tank, as the oil will always remain at the highest water level, and can periodically be removed. However, should this oil be found detrimental, a skimming arrangement can be applied which will overcome any difficulty through this source.

It will be noted that the exhaust steam inlet pipes KK' to the hot feeds have rounded off conical mouthpieces, these being the most efficient for the efflux of steam, and they are located close to the outlets for the boiler feeds JJ'. This is arranged to keep the water at the outlet heated to the highest possible temperature, also to keep up an agitation at this point, which will cause the precipitation of foreign matter from the heated water to seek a more quiet location in the mud basin at the rear of the tank valve cisterns QQ' at the rear of the hot feed wells, from where it can be removed periodically by suitable connections Q" instead of finding its way into the boiler.

A water hose connection to the pipes Q" at the outer edge of the hot well, and the removal of the mud plugs Q" will facilitate the ready removal of all such accumulations of sludge.

A two-inch pipe connection will also be arranged from the boiler to the main exhaust

pipe leading to the tender, through which to relieve the boiler pressure when required, and store the heat in the tank feed water at times when this would be desirable and of practical advantage at the roundhouse.

OTHER SPECIAL FEATURES OF THE CONSTRUCTION.

The location of an independent and removeable coal tank, with a maximum capacity for 10 tens of bituminous coal which will be more than an ample supply for this locomotive, to be arranged over the rear of the boiler at a point where the additional weight will be of advantage to provide more adhesive power, instead of as a dead weight to be hauled. This arrangement will at the same time provide, by gravity, a fairly automatic conveyance of the fuel into the automatic stoker hoppers at the rear of the boiler. This coal tank to be so applied in connection with the boiler that it can be lifted and readily removed when necessary to make renewals of staybolts or repairs to other parts of the boiler which may be located under the tank. Its construction, however, will admit of access to most of the flat sheet stays for test, inspection, and renewal purposes, and to the washout plug openings, when the coal space is loaded, and without its removal. Its position is such that the coal supply can be taken from the same facilities which are now provided for the coaling of modern power, and the top of the coal space plates being at the top of the overhead clearance limit, overloading and the consequent loss of fuel by its falling on the right-of-way cannot be practised, while the connection of the coal space with the hoppers to the stokers will also eliminate the usual loss of fuel from the tender gangways. The coal space to be arranged with a roller metallic covering, placed to cover the coal from the weather during severe conditions and from which there might result some retarding action to the fuel reaching the stoker hoppers by gravity, or with what assistance the fireman can give by pulling down from the rear, on account of it becoming wet or frozen.

The constant removal of the fuel from the lowest portion of the storage will also prevent liability for an accumulation of slacked coal in the tank, with the resulting corrosion of the plates, and for the decomposition of the fuel itself.

A compensating equalizing spring gear in connection with an under hung driver spring gear will be arranged over the three pairs of rear driver wheels, to maintain the framing in a normal position over the driver axles and to provide for the proper distribution of the additional and fluctuating weight over these parts, which will occur on account of the coal storage being located on the boiler. The under hung spring gear will of itself be able to carry the weight when the coal space is under a light load, but when filled with from 5 to 10 tons of fuel the compensating gear will come into play to take its proportion of the load and to maintain the proper adjustment, alignment and riding qualities.

The front cab for the engineer and the fireman, and its contained operating mechanism, will be located over the front of the boiler proper and the combustion chamber surrounding the dome. The front of the cab will be constructed to give an unobstructed view for the engineer, straight ahead, on either side of the track, and at curves, and to present the least atmospheric resistance.

The location of the dome at the front of the boiler, and in, and just forward of the rear of the cab, will admit of a very short travel of the steam from the boiler to the high pressure cylinder, making the control of the engines more positive and sensitive to the engineer's handling, by the reduced dry and steam pipe volume, and it will also reduce the loss in the boiler pressure through friction and make a higher initial pressure in the high pressure steam chest for the commencing of the work in that cylinder. This location of the dome will dispense with the necessity for another dry pipe connection to the boiler for the usual steam throttle box connections, such as for the operation of the stoker pistons, water pumps, blower turbines, lubricator, steam rail cleaner, steam gauge (except the fireman's at the rear of the boiler), steam heat and air pump equipment, all of which can be applied direct to the barrel sheet of the dome, which will locate them in a convenient position for the engineer, and give a full supply of dry steam. The usual pop and steam whistle stand and its additional hole in the boiler will be dispensed with by locating the three pop valves in the dome cap, and the steam whistle in and at the rear of the dome and the cab. This will simplify the rigging for operating the steam whistle, and by its better location the train crews will be able to hear the blasts more distinctly at the rear of a long train.

These connections and the cab location will eliminate any possibility of the obstruction of the engineer's view by steam trailing back from the parts referred to, or from defective piston and valve rod or other packing, which are located ahead of the cabs now, and cause considerable annoyance during severe weather. The main throttle valve rod will be connected through the front of the dome barrel, and the connection of the throttle valve and reversing gear will be such as to give the same response, in the movement of the locomotive, as with the present movement of these levers. It will be noted that with this arrangement, all parts concerned for the operation are more concentrated and convenient to the engineer, and with a much lesser arrangement of pipe fittings and holes in the boiler proper.

It has been learned through practical tests that have been made with air brake pumps in good order, that in the handling of the average freight train of to-day, six and seven-tenths per cent. of the total fuel consumed in the locomotive is used to generate the steam to operate the air pump. This is a very large percentage of power to be absorbed for this purpose, but which will continue so long as the present style of air pumps, which are apparently constructed with no consideration whatever being given to the economical use of steam, are used, and in connection with leaky train pipes. The only means whereby this waste can be reduced is through a higher initial pressure and by the superheating of the steam used to operate the pumps. With this in view, a superheater chamber has been arranged, cast in connection with the cast iron front ring to the combustion chamber. The steam pipe leaving the throttle valve at the dome passes straight ahead over the top of the boiler, to its connection to the smokebox front. It there enters the superheater chamber, where, the pressure remaining constant, the volume must increase, and this increased and superheated volume will eliminate cylinder condensation, and effect a saving of from 10 to 15% in the use of heat, and a greater percentage in steam. All independent connections being made ahead of the combustion chamber, the liability of failure is reduced to the minimum.

To further increase the efficiency of the air pump, a differential of 2½ inches has been made in the diameters of the steam and air cylinders, the latter being the larger. As the surplus of the normal steam pressure over and above the maximum main reservoir air pressure required is 160 lbs., or more than 170%, the extremely poor design in maintaining the present ratios is apparent, when economical operation is considered.

An acetylene gas or oil headlamp with an illuminated number bonnet to be located in the centre of the combustion chamber front door, to replace the present arrangement of number plate, usually located at that point. The number as shown from the headlamp will answer for all the requirements of the train rules, both by day and night, and the headlamp so located will give a better illumination of the track and ahead, and be sufficiently high not to affect the line of vision of persons working at the head end of the locomotive, making couplings.

The cylinder exhaust steam pipe to the tender will be equipped with a six inch diameter air relief valve located just at the rear of the low pressure cylinder. This relief valve will automatically open, when the locomotive is drifting, and prevent suction into the cylinder of the steam from the minor exhausts ; also act as a drain for any water of condensation.

The combustion chamber will be equipped with suitable cast iron flame baffles which will deflect the heated gases coming from the furnace, direct them to their outlet through the boiler tubes, and protect the steam pipe joints and the chamber proper sheets and connections from overheating. These baffles will be arranged so as not to obstruct the access to the boiler tubes for inspection, repairs or cleaning, and so they can be readily removed and replaced when necessary.

Located in the combustion chamber, where there will be the intense temperature that is required for steam superheating purposes, are the receiver pipes, or containers for the high pressure cylinder exhaust and the subsequent low pressure cylinder initial steam. These pipes will be of a simple and durable construction of cast iron, secured to allow for free contraction and expansion, and located to provide a fairly satisfactory surface that will absorb from the circulating gases the superheat for the contained steam.

The arrangement will also be such as not to obstruct the entrance to the combustion chamber for washing out, cleaning and repairs.

The capacity of these receivers will be about 35,500 cubic inches, or, approximately, 1¼ and 3½ times the volume of the low and high pressure cylinders, respectively.

This, it will be noted, is a high ratio as compared with the usual practice of 2½ and less of receiver per high pressure cylinder volume, and will, in addition to the provision for superheating, result in the advantages explained under the subject of cross-compounding.

Cast or malleable iron direct pressure and receiver steam pipes will be used for reason of their greater durability and reduced cost as compared with copper.

THE SPECIAL FEATURES IN THE OPERATION.

An engineer and fireman competent to handle any cross-compound type of locomotive now in service will have no difficulty in obtaining efficient and economical results from the proposed locomotive.

The only special features which require attention in operating are the stokers, blower, hot feed pump and the draining of the steam condenser space in the water tank.

The mechanical automatic feeding of the fuel to the furnace and the mechanical forced draft can be adjusted to suit the requirements of the tonnage, speed, weather conditions, gradient, quality of fuel, condition of the boiler and machinery and the train despatching.

The stokers and the draft, while being controlled automatically, can, without disturbing the adjustment of the automatic devices, be operated by hand when such may be required to overcome the conditions existing for the time being, and when it would not be advisable to disturb the automatic adjustments.

The accumulation of condensed water in the tank condenser chamber can be drained and pumped into the boiler at the required

intervals by the operation of the valves as has been described.

Other than as above stated, there will be no difference in the operation, except that the labor and grief to which some of the engineers and firemen are now heir, will be considerably reduced.

THE GENERAL FEATURES OF ADVANTAGE AND DISADVANTAGE OF THE PROPOSED LOCOMOTIVE.

To learn the greatest efficiency of any locomotive boiler, the ideal basis for comparison is the number of heat units usefully applied, divided by the heat units supplied to the furnace. Considering the heat units supplied to the furnace, these are from the coal, from the air and from the feed water. The heat units usefully applied are the heat in dry steam, in moisture and water mechanically suspended in steam, in dry flue gases, in moisture in coal, in water resulting from combustion, in vapor in air (the latter three at the temperature of the flue gases), and losses through incomplete combustion to carbon monoxide, in ashes and unconsumed fuel, through radiation and otherwise unaccounted for.

The efficiency of a boiler is totally dependent upon the relation of its grate area to its heating surface and upon the rate of combustion of the fuel. Under the same conditions of boiler and of fuel, the greater the quantity of fuel consumed per hour, the greater is the amount of water evaporated per hour, but, at the same time, the quantity of water evaporated per pound of coal deereases, because of the higher temperature of the escaping gases. This loss can be diminished only by increasing the heating surface either in the boiler or in a separate heater, while the decreased draft, due to the lowered temperature, can easily be made good if necessary, by mechanical means. It is to be carefully noted that all this relates to a condition of increased boiler capacity, resulting from a greater coal consumption. The desirable features to give the best results with low grades of fuel are : an ample draft and thick beds of fuel to produce high firebox temperatures, large ratio of heating to grate surface, so that while burning coal at a high rate of combustion there is sufficient heating surface to reduce the temperature of the escaping gases to 450° Fahr., or less if possible, and not come within the limit of the temperature of the water in the boiler, and a combustion chamber, if possible, to be provided, and separated as much as practicable from the heating surfaces, so as to avoid their cooling effect.

The relation between the area of the grate and the heating surface, which may be expressed as surface ratio, can be represented by the area of the heating surface as divided by the area of the grate surface. This relation usually varies in locomotive boilers from 30 to 100, and as compared with 60 in the proposed boiler.

Making use of the above basis for comparison, and noting the requirements which are necessary for efficiency and economy in the transforming of energy into useful work, it will be convincing that the features involved in the construction and operation of the proposed type of locomotive boiler will quite satisfactorily utilize to the best advantage the heat contained in the fuel supplied.

A summary of the advantageous features combined in this proposed locomotive, which will give practical results as compared with the present American type of locomotive are as follows: Increased initial steam pressure; reduced terminal and back pressure, clearance spaces, cylinder condensation and loss through radiation; superheating; cross-compounding; automatic and mechanical underfeed stoking; mechanical forced draft; all cylinder exhaust steam at least partially condensed, and the heat contained therein utilized for heating feed water; increased furnace fire area; increased efficient firebox, combustion flue, and boiler tube heating surface; increased draft area and less liability of becoming inefficient through choking; increased length of boiler tubes; increased travel and reduced terminal temperature of the furnace gases before release to the atmosphere; reduced amount of air for dilution; elimination of smokebox draft restrictions giving a free, natural and slow passage for the gases and more time for the heat to be transmitted to the water; practically perfect combustion; reduction of unconsumed fuel drawn from the furnace and exhausted through the stack or lost through the grates; proper depth of firebox from the crown sheet to the fire area and for the depth of the fire from the fire surface to the flues; increased width of furnace fire surface; a boiler economical to maintaid in good order and with freedom from water leaks; increased boiler, heat and water storage, and capacity; a storage for heated feed water; the utilization of turbine, water pump, air pump and other exhausts by condensation and heating of feed water; the use of water and condensed steam which is partially freed of mineral matter and heated to a high degree of temperature for boiler feed; the use of high-duty duplex pumps instead of injectors to feed hot water to the boiler; practically perfectly balanced piston and slide valves proportioned and adjusted to produce the most practical expansive use of steam; a reduced range of expansion in the cylinders, and a more uniform turning effort applied to the drivers will eliminate the tendency to slip; less liability of casualty on account of the location of the engineer where he can get an unobstructed view of the track and right-of-way on all sides and ahead, and a locomotive adapted to give the efficient and continual service required with no increase in cost for maintenance or despatching and a 50% reduced cost for operation.

Another decided advantage in the use of this locomotive will be its adaptability to service through tunnels and subways, as the usual objections to the present type on account of the smoke nuisance, also the gases and the noise from the exhausted steam, will be entirely eliminated.

The location of the coal space in relation to both the front and rear cabs, and its capacity to hold much more fuel than will at any time be required for any ordinary run, will promote cleaner quarters for the crew.

The large coal and water storages have not been designed as a necessity for the successful operation of the locomotive, but more as a surplus capacity in event it is required, owing to long haulage between coaling or water stations.

The larger water tank capacity will also permit of more opportunity to store heat in and facilitate maintaining a high temperature of the feed water.

Some of the disadvantages as compared with the present modern type of locomotive are: Separation of the engineer and fireman; restriction of the amount of room for passage from the rear of the boiler to the engineer's cab; more operating mechanism, and a greater first cost for the entire locomotive. However, as regards the separation of the engineer and fireman when they are at their individual locations for duty, an arrangement of speaking tube has been provided for between the two cabs, which will facilitate communication, as may be required, between them.

THE ECONOMY TO RESULT FROM THE GENERAL OPERATION AND MAINTENANCE.

A summary of the minimum economy which will result from the general operation and maintenance of the proposed type of locomotive as compared with a simple cylinder, modern American type of the same haulage capacity, may be estimated as follows :—

Considering first the operation, and presuming that for the engineer's and fireman's wages, fuel, water, sand, lubrication and supplies, the total cost for the operation per locomotive mile run will be 19.79 cents, distributed as follows: Engineer and fireman, 5.56 cents; fuel, 13.56 cents; water, .33 of a cent; sand and miscellaneous supplies, .09 of a cent. While the labor of the fireman will be considerably reduced as regards the firing of the boiler proper, and as the ability now required in that regard will not be so essential, his services will be given to more advantage in assisting the engineer in looking out for signals and in the operation of the other parts of the locomotive, and this cost for their wages will be considered as remaining constant, or 5.56 cents per mile run. Taking next the fuel cost as being 13.56 cents per locomotive mile run, this will be reduced proportionately as follows :—

Means to Effect Saving.	Effected per cent. saving on total cost.	Effected saving in cents.	Reduction in total cost for fuel per mile run.
By two-cylinder cross-compounding	15	2.03	11.53
By more perfect combustion, through automatic underfeed, stoking and mechanical forced draft	10	1.15	10.38
Heating of feed water with waste steam	10	1.04	9.34
Higher initial and lower terminal pressure	10	0.93	8.41
More thorough radiation and convection of heat, from the gases passing through the boiler, on account of the constructive features of the latter, and reduction of the terminal temperature of the gases	10	0.84	7.57
Superheating of the direct and low pressure cylinder initial steam in the combustion chamber, increasing the volume and eliminating cylinder condensation	5	0.38	7.19
Reduction of clearance, made possible by reduced terminal and back pressure, and compression.	5	0.36	6.83
By the feeding of the boiler with steam pumps instead of injectors	5	0.34	6.49
By other means, as follows: No loss of unconsumed fuel through the grates or stack; use of a cheaper and inferior grade of fuel; possibility to force the boiler to over its rating with less waste of fuel; less loss through hauling a dead weight of coal and water; by partial elimination of incrustation on the water side of the boiler sheets by the heating of feed water and the precipitation of the sediment into the tank; less steam to operate the air pump on account of the higher pressure and superheating; less radiation from the boiler and cylinder sheets, on account of thorough lagging	15	0.97	5.52

These figures show a reduction of 8.04 cents in the cost for fuel alone, or a decrease of almost 60%. To bear out that this statement is based on facts, and that such results can be easily obtained by the methods referred to, it is only necessary to cite one instance, which is that the present modern type of locomotives in freight service does not, as an average, evaporate more than 6 lbs. of water per pound of coal, and as a boiler which evaporates 7½ lbs. of water per each pound of combustible utilizes but 50% of the total heat, it is not an unreliable statement to say that a locomotive service giving 12 lbs. of evaporation should be looked to, and even this would still allow a loss of 15% in gases, or a terminal temperature of from 450° to 500° for escaping gases. However, the above statement considers the evaporative efficiency of the boiler alone, and

does not consider the savings that can be further effected through the other means enumerated, which are, compounding, heating of the feed water, higher initial and lower terminal pressure, superheating, reduced cylinder clearance, reduced loss of unconsumed fuel, the use of steam water pumps instead of injectors, cheaper and inferior grades of coal, elimination of incrustation and radiation, etc. Therefore the statement made with reference to the 60% reduction in the cost for fuel can be safely considered as a practically reliable minimum estimate.

Considering next the cost of water being 0.33 of a cent per mile run, this will be reduced at the least 20%, for the reason of the cross-compounding features, superheating, condensation of the exhaust steam from the low pressure cylinder, air pump, water pumps, steam turbines, automatic stokers and other exhausts, reduced liability for waste through leakage on account of the constructive features of the boiler, reduced piston speed and less slipping through the greater adhesion on the drivers by the additional weight of the coal storage over the boiler. This reduction of 0.066 of a cent will reduce the total figure for water to .264 of a cent, as compared with .33 of a cent.

With reference to the cost for sand and supplies, the increase of adhesive power owing to the storage of the fuel over the driver wheel base, should with the tractive power given, reduce the slipping effect to the minimum, and this cost can be reduced 50%, or to .045 of a cent.

As regards lubrication and waste, the operation of the additional steam cylinders of the water pump and turbine, the bearings for the blower for the mechanical forced draft, and the steam cylinder and operating gear for the automatic stokers, together with the higher initial steam pressure, will probably increase this cost to exceed not more than 25%, or .06 of a cent, making the total cost .31, as compared with .25 of a cent.

These figures for the operation give a total of 11.7 cents, as compared with 19.79 cents, or a reduction of 8.09 cents, or 40% per locomotive mile run, the wages of the engineer and fireman remaining a constant quantity, and having been considered in these figures at a disadvantage to the proposed service in the comparison.

As regards the maintenance, presuming that the cost for the general shop, the running repairs, and the handling at the roundhouse, per locomotive mile run, not including any charge for supervision or the use of shop tools and machinery, is as follows: Repairs to machinery and boiler per locomotive mile run, 3.77 cents; washing out, cleaning and despatching, per mile run, .88 of a cent., or a total of 4.65 cents.

In the proposed type the extra equipment required in addition to or to replace equipment now in use on the present type of locomotives is as follows:—

MACHINERY.

Device.	To Replace.
Cross-compound cylinders and operating gear.	Single expansion cylinders and operating gear.
Two water pumps and connections.	Two injectors and connections.
Driver spring compensating gear.	Extra.
Exhaust conduit from the low pressure cylinder to the tank.	Extra.

BOILER.

Two blowers and steam turbines, with blast pipes and gates, and connections.	Exhaust nozzle stand pipe and tip and connections, smokebox netting, draft arrangements, cinder hopper and hand-hole plates.
One 13 ft. x 24 in. x .500 in. gauge corrugated flue, two 13 ft. x 12 in. x .375 in. gauge corrugated flues, two 13 ft. x 6 in. x .250 in. gauge plain flues, and two 13 ft. x 5 in. x .250 in. gauge plain flues.	Extra.
$\frac{135}{138}$ ft. 6 in. x $2\frac{1}{2}$ in. x .135 in. gauge boiler tubes.	$\frac{3}{16}$" ft. x 2 in. x .125 gauge boiler tubes.
One smokebox, door and front.	Extra.
One combustion chamber.	One extended smokebox.
Three automatic stokers and operating gear.	Rocking grates and gear.
Stoker blast retort.	Front section of ash pan, dampers and rigging.
Coal tank and cover.	Coal space sheets, gates, etc., and tender tank.
Stoker hopper coal conduit.	Extra.

TANK.

Exhaust steam inlet connections to the condenser and hot feed space.	Extra.
Condenser drain valve and pipe.	Extra.
Compartment plates.	Splash and stay plates.

By noting the above, it will be seen that while some of the new and special equipment will replace equipment which is now in use, at the same time the cost for this locomotive, complete, as compared with the present American type of the same haulage capacity, will be about 15% more. The other arrangements will be practically the same, excepting the minor alterations which will have to be made to suit the conditions. While the construction of the additional mechanism will be durable and one which can be easily maintained, it will, however, require overhauling each time the locomotive goes into the shop for general repairs. The extra cost involved to maintain it can be safely placed at not to exceed 10%.

Considering the boiler construction, this is such that in consideration of the lesser stresses to which it will be subjected, it being more flexible to adapt itself to expansive and contractive influences, the reduced water joints and seams in contact with the intense furnace heat, and on account of the arrangement of the flues, boiler tubes and crown sheet, the reduced cost for maintenance should not be less than 20%. This reduction will, practically, over-balance the increase for machinery repairs, and the total cost for maintenance will remain the same.

The cost for washing out, cleaning and handling at terminals, on account of the reduced amount of fuel to be supplied, the easy method for and the less cleaning to do of the fire and ash pan, the use of condensed and hot feed water preventing an accumulation of scale and foam producing matter in the boiler and less washing out required, the larger tubes being less liable to choke and easily cleaned when required, convenience to fire up, and but few more surfaces to keep clean, should be reduced, as an estimate, about 10%. This reduction will amount to .088 of a cent per mile run, or make a total cost of .79 of a cent, as compared with .88 of a cent.

The cost for fuel for firing up will also be reduced, as the blower turbine can be connected to the roundhouse steam pipe, which will promptly provide the draft to promote the firing up of the coal in the stokers with a very small amount of kindling or fuel oil; and one stoker fired, a few live coals taken from it and supplied to the others will suffice to fire all, and with no resulting additional loss of unconsumed fuel from the grates, as is now the case, or the suction of a large amount of cold air through the boiler tubes to produce the excessive expansion of the sheets that is caused by the present arrangement of induced current with the steam blower.

As compared with the present total cost for this service, and by permitting the engineer's and fireman's wages, which are about 23% of the total, and which remain a constant quantity, to figure in, the total cost for operation and maintenance will be 16.26 cents, which is a reduction of 8.18 cents, or 33½%. These figures which have been taken are from a practical and theoretical basis, considerably below the margin, and may be relied upon to be forthcoming in actual practice.

THE OPERATION AND MAINTENANCE OF MOTIVE POWER IN THROUGH FREIGHT SERVICE.

While in the following remarks the unfavorable conditions in the more severe weather districts have been kept in mind, the general ideas may, however, be considered as applicable to the more favorable climatic localities as well.

In the design and construction of power, too much attention cannot be given to the interchangeability of the parts of all types, that the least number of metals, patterns for castings, and forgings will be required for the general shop stock, and to be kept on hand at the roundhouse points for emergency repairs. It is of decided advantage to have extra finished parts on hand at all roundhouse repair stations, that can replace the parts of the machinery which are most liable to failure from wear and running service, and thereby prevent unnecessary detention of the power from service.

Simplicity and interchangeability of design should be adhered to, and patented devices and fads which have no actual practical value should be eliminated.

A type of locomotive having been provided adapted for the service required, the methods for its successful handling over the district or division should receive the next consideration. Therefore, to further increase the efficiency and the economical operation and maintenance of motive power, the following recommendations are submitted:—

Each locomotive, after it has given such an amount of service as will justify heavy repairs, or providing the condition otherwise warrants it, should receive a thorough overhauling when it is taken into the general repair shop.

On many systems is found the practice in vogue, and which is encouraged, to stimulate by competitive methods between the various shops, a large monthly output of locomotives, due consideration not being given in making the comparisons, to the class of the repairs made, or which should have been made, to put the locomotive in a thoroughly serviceable condition.

Correct records kept of the dates and classifications of repairs, together with intelligent inspections, and work reports from the engineers and road and roundhouse foremen to whom the locomotives may be assigned, will determine the class of repairs required to each locomotive as it goes into the shop, and the work so specified, and what additional may be found necessary by the shop inspectors, should receive every consideration from the shop authorities. The proper place to make heavy repairs to power is at the general shop, where facilities for handling this class of work the most economically are provided, and much relief will be given to the roundhouse expense, and detention of the power from service, if the work is cared for as above mentioned.

The tendency to make repair shops of roundhouse terminals should be discouraged, and this evil can be eliminated only by performing first class work at the general shop.

A locomotive turned out for road service after having received a first-class overhauling and a thorough test, will soon assert its condition by efficient, economical and continuous service, when properly operated.

But no matter how efficient a condition a locomotive may be put in, it will not remain in good repair unless it is given constant attention by a competent roundhouse organization.

If the service and the cost for the maintenance, operation and shop repairs of a locomotive which has received thorough attention and enters the general shop in the average condition, due to wear and tear, after having made a satisfactory mileage since its last shopping, is compared with one that did not receive the

required repairs or attention, either in the shop or at the roundhouses, it will be readily determined which method will prove the most advantageous and economical to the railway.

The practice of requiring locomotives to run a certain mileage between shoppings should be discouraged, as its general condition, not the mileage, should condemn it if it is not capable to render satisfactory service. The condition of two parts of each locomotive, especially the boiler and driver wheel tires, should receive every attention as regards their proper maintenance, for no economy will result to any railroad, under any circumstances, through the operation of motive power with these parts defective.

The repair forces should be concentrated at the least possible number of roundhouse points that the conditions will permit, in order that the maintenance of each locomotive will be in charge of the fewest number of persons.

This will also reduce the number of roundhouses necessary to be equipped with facilities for executing repairs, and will increase the number of strictly despatching stations.

Upon the roundhouse and its staff depends the duty of maintaining and despatching locomotives in condition to render successful and continuous service, and its equipment, both as regards men and tools, should have the first consideration of the department.

To successfully produce a large individual locomotive monthly mileage, and maintain and despatch the power without delay, and economically, the roundhouse terminal must be provided with suitable buildings, arrangement of tracks, and the minor facilities and appliances for handling the work, and these to be in charge of a first-class organization.

A modern roundhouse plant for the despatching of a large number of locomotives must provide ample building room, with stall capacity sufficient for the requirements of the heaviest period of service during the most severe weather conditions.

The roundhouse proper should clear not less than 85 ft. in length inside the walls. The stall doorways to clear 16 ft. 6 in. in height, 13 ft. in width, and to be provided with solid wood framed doors equipped with substantial automatic latching devices for securing the same, open and closed.

Above each doorway should be as much window area as can be substantially provided, and at the outer circle wall, high and wide windows to be located centrally between the pits.

Such an arrangement of window area for the admission of daylight, with the interior walls and roof kept properly whitewashed, will provide ample light without the further use of undesirable skylights.

As attachments should be provided so that no smoke or steam will escape from the locomotives into the building, but few ventilators, if any, are required.

The floor of the roundhouse should be preferably of concrete or vitrified brick.

Telescope smoke jacks, operated from the floor by means of levers connected to straight line lifting and lowering devices, should be placed at the proper location to each stall and connected with wooden chimneys extended above the roof.

The locomotives to be headed into the roundhouse, for the reason that it is a much more convenient method for a hostler to locate it under the smoke jack, and less liability for accident. Also, as most of the mechanical work is done at the front end of the locomotives, the greater floor and lighting space at this point of the building will facilitate the transporting of material and the making of repairs, and in severe weather the mechanics will be located farther from the cold drafts produced through the opening of the stall doors as the locomotives enter and depart.

The stalls to be provided with convex bottom pits of suitable depth for the class of power in use, extending the entire length of the locomotive, to facilitate inspection and repairs, and thawing out, in winter.

Each of the pits to be well heated by hot air equipment distributed to the best advantage as regards contact with the entire locomotive, and to be drained by an 8 in. pipe, making connection with an individual mud basin, located in a 16 in. main sewerage, with ample fall, at the inner circle of the building. The mud basin to be fitted with loose iron covers to facilitate the removal of obstructions and cleaning out.

The stall rails to be supported on coping made from 10 in. x 12 in. x 3 ft. white pine or cedar, laid crosswise on top of the pit side walls, extended two inches beyond the inside and 29 inches beyond the outside of the rail flange, and the outer end of the coping to be supported on longitudinal stringers bedded in concrete. Such an arrangement will provide an admirable foundation for the support of the rails, and for removable pit planks, jacks, etc., which must be used in making repairs to the locomotives.

Each pit should have a connection to an underground gravity draining water blow-off 3 in. pipe, which will return the hot water which must be removed from the boilers, to a hot well for its further use for washing out or stationary boiler feed. An overhead steam blow-off 2½ in. pipe to carry the steam that must be relieved from the boilers to the hot well for the heating of the cold feed for boiler washing.

Suspended overhead, hot and cold water service 4 in. pipes for washing out and filling boilers and tenders, steam or hot air heating conduits, steam blower 1½ in. pipe, and compressed air 2 in. pipe, all provided with drops so that direct connection can be made to each pit, and with interchangeable hose connections for attachment. Electric incandescent lamps to be provided for lighting, distributed to the best advantage at the head end and be between the stalls; also inside of the windows over the stall entrance doors to provide light both for the interior of the building and the outside turntable space. Four lamps to be located on the turntable, one elevated at each corner, to provide light and to act as signals to show its position. Incandescent lamps to be distributed for the lighting of the water cranes, in and outside of the coal, ash and sand handling and storage plant, office, storeroom, and other rooms or buildings, and removable extension sockets and metallic lamp guards to be provided for the use of hand lamps as required, to enable mechanics and others to do their work without making use of other than the electric lighting.

The exposed electric wiring in the interior of the buildings to be conveyed through conduit tubing, to prevent the decomposition of the insulation and liability for accident.

Provision to be made in the roundhouse for suitably located bracket benches between the pits at the outer circle wall; portable benches; ventilated cupboards for the employes' personal effects; a centrally located tool room for all small and readily portable general use tools, and racks for the heavier tools which it is more desirable, for convenience, to locate in suitable places in the roundhouse. A pneumatically operated drop pit to be arranged near a side wall in connection with two stall tracks, to facilitate the dropping, and the handling and loading of wheels with an overhead hoist, and a complement of hydraulic jacks, pneumatic motors and hammers, cylinder boring, valve seat facing and slide valve adjusting machines, spring pullers pinch bars, wrenches and other handy and light tools to be provided for general roundhouse use.

Centrally with the outer circumference, and adjacent to the wall, if possible, should be located an annex for a stationary boiler, engine, washout-pump, air compressor, and dynamo, and machine tool rooms. The equipment of the same to consist of two (one for relay service) self-contained internally fired, return draft, tubular boilers, capable to carry 165 lbs. pressure and of suitable capacity, arranged with boiler feed pump, feed water heater, and mechanical forced draft in connection with automatic underfeed stoking, for the burning of an inferior grade of fuel; a small horizontal stationary engine; one duplex high-duty hot water pump for washing boilers with 100 lbs. pressure; air compressor in connection with large storage reservoirs located in suitable places on the premises for maintaining 100 lbs. pressure; direct connected engine and alternating current dynamo, engine lathe, planer, shaper, pneumatic press, grind and emery stones and blacksmith's forge and tools.

Near this location, and in connection with the same track which will be used for conveying the stationary boiler fuel to the storage house, should be provided a small store shed for the storage of castings, gas pipe, tubes, lumber, equipment and all heavy material which will not be handled from the general locomotive supply and store room.

A hot well of 40,000 gallons capacity should also be located under ground near to the boilerroom, into which all the heated boiler water and exhaust steam drainage can be conveyed and utilized again for washing out and stationary boiler feed purposes. The saving in water bills, and through reduced stress on the boilers by washing out with hot water, will soon pay for the installation of this equipment.

The foreman's office, general locomotive supply storeroom, engineer's and foreman's register room and the employes' rest, bunk, wash, bath and toilet rooms should be arranged in one building, in the most convenient location on the premises for all concerned.

In a cellar to be built under the storeroom should be placed containers for the various oils required, the latter to be conveyed to the storeroom above by air pressure. In the same cellar can be stored the surplus oil in barrels, which location will be of especial advantage in severe weather. This storeroom to contain all the general small and light supplies for locomotive and roundhouse use, the same to be placed in a centrally arranged counter, in preference to wall cupboards and shelving.

The engineers' and firemen's room to be located off the store-room and equipped for the use of the crews, to examine bulletin books and boards, register in and out, report the condition of the locomotives, and attend to what other clerical work they may be called upon to do. The employes' rest, bunk, wash, bath and toilet rooms to be the second story of the building and maintained by the railway, providing it will be of a mutual advantage.

The roundhouse, as well as all other concrete or brick wall buildings, to be constructed with valley roofs.

A power conveyer system for a combined coal, ash and sand handling plant and storage, with dynamometer weighing, gravity unloading coal pockets, to be arranged in one building and in connection with two incoming, one coal and sand supply and ash car, and one outgoing tracks. Such a plant, when operated in connection with hopper or drop-bottom coal and sand supply cars, has the advantages of supplying the coal and sand, and of cleaning the fires of locomotives at the same time. The minimum cost per ton for handling the coal, ashes and sand will also result, and the large storage capacity, which is of especial advantage in severe weather locations, independence of switching service, reduced labor employed, ability to weigh the coal supplied to the individual locomotives, and minimum delay in supplying the tenders will all tend to facilitate the work in connection with despatching locomotives.

The car repair, steam wrecking crane and other buildings to be located as near to the roundhouse as the yard track and switching accommodations will permit.

A 200 ton capacity, 75 ft., half-through steel plate girder turntable to be installed in connection with the roundhouse so that the radial tracks leading therefrom will not have crossing frogs. The center to be supported on anti friction roller bearings and the table to be operated pneumatically.

A positive brake and table-latching device to be provided which will be under the complete control of the operator.

The turntable pit to be made with vitrified brick or concrete bottom, well drained and with steam heat piping installed to clear the snow where the locality requires this.

An arrangement of roundhouse tracks to be provided which will facilitate the coaling, sanding, cleaning of fires, watering and turning of locomotives for outgoing trains with the least switching or handling, and without the necessity for locomotives to be run in two directions on any one track.

The tracks to be equipped with automatic switches and cross-overs to facilitate the disposition of arriving and outgoing power and to prevent any liability for blockade or delay to the outside work of despatching. Water cranes with 10 in. outlets, receiving their supply from one or more 100,000-gallon capacity tanks, 50 ft. high, to be located conveniently for both incoming and outgoing locomotives.

An ash pit 30 ft. in length, with entrance under the rail on one side, should be arranged in connection with the outgoing tracks at each water stand pipe, to permit cleaning of the ash pans, as is especially required when they come in partially frozen during severe weather, at the same time that the water tank is being filled, previous to the locomotive leaving the roundhouse tracks.

Suitably located water hydrant and hose, and chemical extinguisher equipment must also be provided for fire protection.

Such a plant as has been referred to must be in charge of an active foreman, competent as a machinist, and to handle both the running repair work and the despatching of the power. He should command the respect of the employes of all departments, and must be backed by the necessary authority and a good organization. He must, in addition, keep himself, by personal knowledge and office records, acquainted with the condition of each locomotive assigned to his station, and see that the periodical inspections, tests, washing out, and the repairs resulting therefrom, receive systematic attention and are not neglected. This done, each locomotive can be kept in its regular turn and in a condition which will fit it to fulfil the requirements at the least cost for maintenance and operation per mile run, until casualty or general bad order condemns it for the general shop. No matter how thorough the organization or system that may be in vogue, the foreman must follow up each detail and have a thorough knowledge of the situation at all times, and see, in addition, that the railway's labor, material and supplies are being utilized to the best advantage, and that rules and regulations are being obeyed by all concerned.

The labor involved in making repairs should be specialized as much as practicable, as this will provide means for the immediate placing of responsibility for irregular work, and the consequent freedom from failures and elimination of the loss in efficiency resulting from the latter.

The inspection of locomotives and the work required, to be reported separately by the engineer and the roundhouse inspector, and on approved forms, immediately after the arrival of the locomotive on the roundhouse tracks. The work so reported to be checked off when done by the mechanic who makes the repairs, as a record for the railway and for the foreman in charge.

Monthly statements showing the average cost for the repairs and the handling, separately, for each locomotive despatched from the various terminals, also the cost for the handling of fuel per ton, and making comparison with the corresponding period, will be of decided advantage as a means for checking irregularities and to stimulate foremen in charge who may not be directing their efforts to the best advantage.

With proper organization and facilities, provided there is no reason why this modern type of power cannot perform the same, if not more, mileage under the identical local conditions, between shoppings, that has been derived from the previous lighter equipment.

To derive the best results from the operation of the power it should be either single, double or swing crewed, so that in no instance will more than two different engineers or firemen be regularly assigned to one locomotive. In the event of a regularly assigned man being off duty, a person from the extra board should fill the vacancy, continuously, until the regular man returns, or another regular assignment is made.

This will provide an arrangement whereby regularly assigned crews can make uniform wages, and as great a monthly mileage can be obtained from each locomotive is as practicable; at the same time all concerned will interest themselves more directly to inspect, maintain and keep the locomotive in a clean condition, and they will be operated more efficiently and economically.

In the event of deficient service or failures, it will also be possible to determine the respons bility more readily, and the instruction or discipline, if necessary, can be more justly imposed.

The power to be distributed on the various districts and localities, according to its adaptability for the service required and the conditions, and for the information of all the officers concerned in the operating departments, the hauling capacity, as rated on a straight, level track at a speed of 10 miles per hour, should be stencilled on each side of the exterior of the cab just above the running board. This information, together with a train resistance rating schedule, will provide all the data required for the proper rating of the car and lading tonnage.

If three or four months' additional wear and service can be obtained from power before shopping, by changing its location, this can be considered as a net saving, as there will be practically no increase in the cost for the general shop repairs that will be required.

As the intention should be to derive the greatest possible individual mileage from the heaviest available locomotives adapted for the requirements, the minimum amount of power should be kept in service during the slack season, to facilitate the making of repairs to and the whiteleading of locomotives, which will be needed during the heavy business season and the probably more severe weather. Such a distribution of the power between the road and the shop will not only permit of the general condition of the equipment being more successfully maintained, but it will assist to bridge over the heavy season with less power and avoid the purchase of additional locomotives that otherwise would not be required for actual service during the greater portion of the year.

The monthly mileage that can be derived from any class of motive power, if turned out of the general repair shop in good condition, is limited only by the terminal delay required to maintain its general condition, and for a sufficient rest for the crews, and the despatch with which it is handled over the division.

The divisions or districts over which the locomotives are to be run should be lengthened to the maximum practicable, and which will make it necessary for one crew to remain in continuous service from 10 to not over 16 hours as a limit, excepting in case of emergency or under the most severe weather conditions.

Provision for the lay over should be made at the home stations to which the crews and the locomotives may be assigned, and the running repair terminals, if possible, to be located at the business end of the line, so that the most of the power will be automatically available for the transportation department when it is wanted.

It might also be well to state here that too much consideration cannot be given, when locating water stations, to the quality of the water which will be available. An inferior quality of water will be responsible for as much grief, expense and detention of locomotives from service as any other one requirement, and the provision of a suitable quality should not be lost sight of.

There is probably no means whereby a railroad can increase the hauling capacity of its motive power and reduce the cost for the maintenance and operation to a greater extent for the same cost as through the elimination or reduction of grades and curves. However, when these adverse physical conditions must be contended with, it would be more advisable, when stimulating an increased tonnage of trains, that the basis for rating shall be on the train resistance and such as will provide the heaviest tonnage that can be handled by the locomotive under the different weather conditions over the maximum grade which it is required to ascend without helper assistance and when the locomotive is operated at its maximum capacity.

Cross-compound locomotives are designed with the intention to reduce the cost for operation, and not to be worked in simple gear, to haul more through tonnage, regularly, than a single expansion locomotive of the same hauling capacity, and if the unlimited authority of some of the operating officials who are responsible for the making-up, despatching, and the handling of trains would be lessened, there is no doubt but that the net cost for the hauling of a ton of freight would be materially reduced.

The location and arrangement of water, coaling and the other despatching stations and grade crossings; also train movements which will necessitate the least number of stops, especially at points which are at a disadvantage for the stopping or starting of heavy trains, will assist materially in reducing the schedule time and the fuel bill.

If, when making out new time-tables, the road foremen, engineers and others in the motive power department whose daily and practical experience in handling trains should make them competent to judge as to the time required between stations to successfully handle certain trains to the best advantage to the locomotive, would be consulted, the information so obtained could no doubt often be used to advantage in making more desirable connecting and meeting points, which would result in a reduced cost for operating the power and the trains.

By placing adapted locomotives which are in the best condition where the service is the most exacting and the conditions the most severe, and removing the partially worn and replaced locomotives to a more favorable locality, the most successful service can be rendered and a greater mileage obtained between shoppings.

With the ordinary type of locomotive boiler, furnace, grate arrangement, hand firing and mechanism, upon the quality of the fuel supplied will depend largely the steaming capacity of the locomotive and the cost for maintenance and operation. More especially will this be noted where the distances are long, schedules fast, weather and despatching conditions un

favorable, and little or no opportunity given to clean the dirty fires which will accumulate on large grate areas when an inferior grade of coal is used. Under such conditions the better the quality of the coal furnished the more satisfactory will be the results as regards efficiency.

However, with a locomotive construction with the features such as have been proposed, the possibility to derive satisfactory and efficient results from an inferior grade of fuel, with the corresponding economy, will be of decided advantage, especially in localities where the cost for either a superior or an inferior grade of coal is an item of vital consideration.

A system of individual checking and a means for the correct distribution of the quantity of fuel and oil to the engineers, in preference to the locomotives, should be inaugurated and the monthly performance bulletined. Individual check books can be supplied for each month, and which can be arranged to be self-recording in order to reduce the clerical work to the minimum. The comparative statement, to rank the men in accordance with the quantity of coal and oil used per locomotive mile, which will be a convenient calculation to make, and a fairly good basis for the comparison of the service being rendered by engineers and firemen operating locomotives of the same type under similar conditions. The service of those men who may fail to give an average performance to be investigated, the cause learned, and the necessary instruction or discipline extended.

The promotion of engineers and firemen to advanced and more desirable positions in consideration of their fuel, in connection with their general locomotive service, will also provide a means for stimulating economy, and with no resulting inefficiency, if the road performance is checked, and the cause for inferior service of men who may not be up to the standard promptly investigated.

Every consideration should be given by all concerned to the cleanliness, not only of themselves, but of their surroundings and the locomotives. A small expenditure for whitewash, paint and labor at the intervals required to maintain clean buildings and premises, and well-directed efforts on the part of the foremen, engineers and terminal employes to keep the power in a presentable condition, will be more than justified by the net returns which must be derived from such methods. For the reason that the employes, buildings and the work pertaining to the motive power department must of necessity be associated with more or less uncleanliness, this should be all the more an incentive for the maintaining of the most orderly and cleanly conditions consistent, and scoured locomotives will certainly be a relief to the usual condition in which they are found, with no parts other than the steam blower throttle knob and the coal scoop polished, or receiving any attention.

The care for the comfort, convenience and contentment of all employes connected with the operating departments cannot be overestimated. A fair, impartial and considerate treatment will, next to their own welfare, produce a disposition on the part of the majority, if not all, employes to exert themselves and direct their efforts to an improved service and general condition of the company. Civil service, if at all consistent, should govern in promotions, and merit being equal, seniority to receive the preference.

So long as railroads are to be operated successfully, strict discipline will be necessary, and the intentional or careless violation of the rules should be punished by reprimand, suspension or dismissal, as the case may justify.

Each case of disobedience, no matter how minor, or with what intent, should be investigated as promptly as possible after the occurrence, and the responsibility placed and censure or relief extended.

Also for extra good service rendered, a substantial recognition of the same will in almost every case be appreciated and instil a further desire to similar actions.

However, in the imposing of a sentence, in no instance should the offender be permitted to feel, if he will be reasonable, that an injustice has been inflicted, or that he is not deserving of the discipline, and will not accept it for the purpose as given.

If more attention would be given by some of the officials in direct charge, to assist their subordinates, by education and instruction, to keep out of trouble, rather than setting traps for them to fall into, the general service would, in many instances, profit accordingly. If roundhouse and shop foremen, travelling engineers, air brake instructors and master mechanics who may be concerned in the maintenance and operation of the motive power of a division, are given the authority which it is necessary and consistent that they should have to effect results, and if they will then combine their efforts towards harmony, and co-operate with each other and the officials in the other departments, to bring about railway instead of departmental results, such supervision will tend greatly to facilitate efficient and economical service which would not otherwise be forthcoming. No matter, though, how thorough the organization, or carefully established the system, only personal contact with the details and a knowledge of the situation as a whole will bring the greatest success to the person in charge of any work, and to the railway that employs his services.

In conclusion it may be added that, if for the promotion of either new or untried and which may be practicable ideas that are advanced from time to time, more assistance was received from and interest manifested by some of the railway mechanical men who in

general are looked upon as authorities, and whose recommendations usually decide in such matters; also by some of the railway publications whose main desire is apparently to have history repeat itself and fall back to old established rules and practices, the locomotive service of to-day would be much more advanced in efficiency, and decidedly in economy.

It is not presumed that the ideas which have been embraced in this article shall be considered as new or original, or that the expected results could be derived without a considerable amount of embarrassment, but if this resume shall result in an inauguration of practices which will be productive of a more efficient and economical locomotive service, the expectations will have been fulfilled.

RAILWAY FINANCE, MEETINGS, ETC.

Bay of Quinte Ry. Co.—A special general meeting of shareholders was called to be held at Deseronto, Ont., Dec. 9, to confirm a by-law increasing the capital stock; to confirm a by-law for the issue of part of the shares in the capital stock as preferential shares; to determine upon a scheme for the payment and redemption of the existing bonded indebtedness upon the railway and property of the Co.; to take such further action in the premises, and for the promotion of the objects of the Co. as might be deemed advisable.

The Co. gives notice of application to the Dominion Parliament for an Act confirming an agreement between the Co. and the Rathbun Co. respecting the issue of preferred and common stock and the rights and positions of the parties and authorizing the issue of such stock and the increase of the capital stock of the Co. and extending the time for the completion of the Co.'s lines.

The Calgary and Edmonton Ry.'s net earnings for Oct., 1901, were $14,576.61 against $8,132.48 for Oct., 1900.

Canada Atlantic Ry.—Following is the statement for the years ended June 30:

	1901.	1900.
Earnings	$1,786,338 27	$1,824,865 28
Expenses	1,411,433 04	1,458,828 58
Net earnings	$374,905 23	$366,036 70

Canadian Northern Ry.—Notice is given that a duplicate of a mortgage dated Nov. 1, 1901, from the C.N.R. Co. to Hon. R. P. Roblin and Hon. D. H. McFadden, trustees for the Manitoba Government, securing the issue of bonds on the Gilbert Plains branch, has been filed in the Department of State at Ottawa.

Premier Roblin, accompanied by the Attorney-General, the Minister of Public Works and the Provincial Treasurer of Manitoba, spent some days in Toronto early in Dec. settling the terms of the mortgage in connection with the aid which the Province gives the Co. under the terms of the contract made early last year. Mr. Roblin subsequently stated that the Province had been therein given full control of rates, and thoroughly safeguarded in every way. He had no doubt about the completeness of the control even in the event of the line being transferred to another company. The details would not be made public until after the terms had been laid before the Lieutenant-Governor, and possibly not until the Legislature met.

Canadian Yukon Ry.—In 1897 the Dominion Government entered into a contract with Mackenzie, Mann & Co. for the construction by the latter of a railway to Yukon territory. The contract was not ratified by the Senate, though it was agreed to in the House of Commons, consequently all progress was stopped. Mackenzie, Mann & Co. thereupon made a claim on the Government for $510,422.27 on account of expenditures made, and interest, together with 15% on all amounts. During the period since elapsed the claim has been reduced to $302,717, owing to the settlement of a number of claims at a smaller figure than the original amount asked, and by the sale of rails, fastenings and various supplies. The whole matter of the account has been referred to the Exchequer Court and will be dealt with by Justice Burbidge. The Government objects, among other things, to the charge of 15% profit on the expenditures.

Dominion Atlantic Ry.—Gross receipts for Nov., 1901, $78,500, an increase of $14,442 over Nov., 1900. Gross receipts for 9 months to Nov. 30, 1901, $906,836, an increase of $107,670 over corresponding period.

Great Northern Ry. of Canada.—The report presented at the recent annual meeting at Quebec pointed out that since the opening of navigation in 1901, notwithstanding the almost unprecedented stagnation in the grain trade, a continuous business in grain shipments was carried on over the railway and through the Co.'s elevator. Up to the end of Oct. 17 large steamships were loaded, besides two steamers previously loaded in Montreal, which were obliged to unload and reship their cargoes at Quebec. All those steamers were loaded with full cargoes without any detention whatever, had rapid despatch, and took, besides grain, large quantities of flour, lard, dressed meats, pulp, paper, pressed hay, live stock, furniture wood, deals and other goods. The Co. loaded the largest cargo that has ever been shipped from the St. Lawrence. The Leyland Steamship Line is furnishing a very satisfactory service of large modern steamers, running between Quebec and London in connection with the railway. Negotiations are in progress for other lines to Manchester, Liverpool and other ports for next season. The local traffic of the railway is most promising. The great manufacturing industries at Grand Mere and Shawenegan Falls are already giving the railway a large quantity of freight, and when the new mills now under construction at the latter point are completed a very heavy traffic may be looked for. The railway is also receiving a most satisfactory business from the other towns along the line, and from the rich agricultural country through which it runs. The receipts and operating expenses demonstrate a healthy condition of things for a railway yet in its infancy. The report of the Chief Engineer, A. E. Doucet, sets forth the physical condition of the road and the very considerable improvements and betterments which were carried out during 1901.

The directors for the current year are: President, Hon. P. Garneau, Quebec; Vice-Presidents, J. McNaught, New York; H. H. Melville, Boston, and V. Chateauvert, Quebec; other directors, J. T. Ross, Hon. J. Tessier, J. G. Scott and E. Ling, Quebec; W. L. Bull, New York; J. Joyce, Boston; H. E. Mitchell, Philadelphia, and Hon. S. N. Parent, Mayor of Quebec, ex-officio.

London and Port Stanley Ry.—After extended negotiations between the London city council, and the directors of the Lake Erie and Detroit River Ry., terms for the lease of the L. and P.S.R. have been arranged and were ratified by the London council, Dec. 23. The old lease has been surrendered and a new lease for 30 years has been granted, the rental for the first 13 years being $17,500, and for the balance of the term $20,000 a year. There are also some concessions as to rates.

New Brunswick Ry. and Coal Co.—As stated in our last issue this Co. has purchased the Central Ry. of New Brunswick. It is probable that the two lines will be run as separate enterprises under one management. E. G. Evans is Supt. of the Central Ry. and will probably be given a similar position with the N.B. Ry. and C. Co. He is already in charge of the construction of the latter line.

Newfoundland Ry.—The St. John's News says it is reported that R. G. Reid's claim upon the Newfoundland Government under the Bond railway settlement, for improvements, etc., since 1898, amounts to $2,500,000. This is in addition to the $1,000,000 for the reversion of the line, and the $850,000 which has been paid him for repurchase of the lands given under the 1898 contract. The claim, it is said, is for money expended by Mr. Reid during the time he was owner of the railway, and which, probably, would not have been expended but that the line was his property. The new arrangement provides that Mr. Reid is to be reimbursed for this outlay, and the claim decided upon by arbitration.

Ontario and Pacific Ry.—An action has been instituted by S. Coulson, of Montreal, against R. MacKenzie, bank manager of Kingston, Ont., J. Bergin, D. A. Flack, A. P. Ross and J. Kerr, all of Cornwall, Ont., and J. B. O'Hanley, of Ottawa, asking for a declaration by the court of the trusts upon which MacKenzie holds $37,500 received by him pursuant to an agreement made in 1897 between the Ontario and Pacific Ry. Co., and J. Bergin, and also for a declaration that the plaintiff and the defendants other than MacKenzie are beneficially interested in and entitled to an account of the dealings of MacKenzie with the fund. The amount in question is understood to be the purchase money paid by the Ottawa and New York Ry. Co. for the charter of the Ontario Pacific Ry., the parties to the action other than MacKenzie being the original holders of the charter.

Ottawa, Northern and Western Ry.—The shareholders are reported to have voted to increase the capital stock to $10,000,000 to provide for the recent purchases of the Interprovincial bridge, the Pontiac and Pacific Jct. Ry., and the Hull electric railway.

Qu'Appelle, Long Lake and Saskatchewan Ry.—Net earnings for Oct., 1901, $1,257.98, as compared with $3,033.32 for the corresponding period of 1900; making for the 11 months a net loss of $3,767, against a net loss of $8,282 for same period, 1900.

Quebec Central Ry.—Gross earnings for Nov., 1901, $44,561.25; working expenses, $34,248.97; net earnings, $10,312.28; against $7,446.53 for Nov., 1900. Gross earnings from Jan. 1 to Nov. 30, 1901, $579,392.55; working expenses, $387,539.26; net earnings, $191,853.29, against $163,977.79 for same period, 1900.

The St. Lawrence and Adirondack Ry.'s shareholders have decided to increase the capital stock from $1,300,000 to $1,633,000, and to retire debenture bonds of $310,000 by issuing in payment therefor 3,515 shares of the capital stock at par and 5% premium under the terms of the trust agreement providing for the retirement of the bonds.

The Temiscouata Ry. Co.'s annual meeting was held at Quebec, Dec. 3. The directors for the current year are: President, F. Grundy, Sherbrooke; Vice-President, J. H. Walsh, Sherbrooke; other directors: A. Steele, Sherbrooke; W. Cook, K.C., A. H. Cook, K.C., W. N. Campbell, and A. Laurie, Quebec. The line is reported to be making fair progress. F. Grundy is also General Manager of the Quebec Central Ry.; J. H. Walsh is its General Freight, Passenger and Baggage Agent, and A. Steele is its Superintendent.

Toronto, Hamilton and Buffalo Ry.—For the six months ended Sept. 30, 1901, the gross earnings were: $273,719, an increase of $65,702; expenses, $152,366, increase, $18,364; net earnings, $121,353, increase, $47,608; fixed charges, $65,600, surplus, $55,753, of which $22,666 was credited to the sinking fund, leaving a balance of $33,086.

J. W. Young, who was a promoter of this line and is engaged in a law suit in connec-

tion with its construction, has purchased from the Brantford city council the $25,000 of common stock held by it for $3,000. Mr. Young says the stock will not earn a dividend in the near future, but its possession will be a benefit to him in his action.

White Pass and Yukon Ry.—Gross earnings for week ended Nov. 14, 1901, $6,210, making from Aug. 1 to Nov. 14, $673,653.

C.P.R. Earnings, Expenses, Etc.

Gross earnings, working expenses, net profits and increases or decreases over 1900, from July 1, 1901:—

	Earnings.	Expenses.	Net Profits.	Increase or Decrease.
July	$2,851,455.31	$1,755,588.37	$1,095,866.94	$211,493.04+
Aug.	3,118,551.32	1,812,919.23	1,305,632.09	251,156.49+
Sept.	3,264,024.16	1,911,292.44	1,352,731.72	292,031.71+
Oct.	3,582,403.05	2,115,363.83	1,467,039.22	388,864.81+
	$12,816,433.84	$7,595,163.87	$5,221,269.97	$1,145,546.05+

Approximate earnings for Nov., 1901, $3,506,000; increase over Nov., 1900, $839,000.

DULUTH, SOUTH SHORE AND ATLANTIC RY.—Gross earnings for Oct., 1901, $231,159.56; net earnings $69,106.93; against $237,202.80 gross and $83,095.07 net, for Oct., 1900. Net earnings for four months ended Oct. 31, 1901, $382,063.26, against $366.775.12 for the same period 1900. Approximate earnings for Nov., $204,895, against $176,123 in Nov., 1900.

MINERAL RANGE AND HANCOCK AND CALUMET RDS.—Approximate earnings for Nov., 1901, $48,938, against $46,935 for Nov., 1900.

MINNEAPOLIS, ST. PAUL AND SAULT STE. MARIE RY.—Gross earnings for Oct., 1901, $692,708.82; net earnings $423,224.22, against $424,653.53 gross, and $198,978.06 net for Oct., 1900. Net earnings for four months ended Oct., 31, 1901, $1,200,535.75, against $605,590.91 net for same period, 1900. Approximate earnings for Nov., 1901, $671,731, against $404,086 in Nov., 1900.

Canadian Pacific Railway Land Sales.

	Acres.		Amount.	
	1900	1901	1900	1901
July	40,715.46	49,089 96	$129,483.42	$154,646.84
Aug.	32,178.50	50,747.82	103,480.78	165,871.16
Sept	21,807.57	60,060.46	69,012.54	197,057.61
Oct	18,858.89	150,572.96	62,769.54	465,655.62
Nov.	22,408.68	151,922.89	69,627.27	512,862.94
	135,969.10	462,394.09	$434,373.55	$1,496,094.17

By an unfortunate mistake in our last issue the figures for 1900 and 1901 were transposed, showing a decrease in the latter year, instead of an increase.

The Co.'s land sales during the past year have been unprecedented in their value. In a recent interview Land Commissioner Griffin said—"We estimate that the sales for 1901 will be about 840,000 acres for $2,750,000. The Canada Northwest Land Co.'s sales have also been exceptionally large. The annual statement will show that this Co. has sold in the neighborhood of 105,000 acres of land for $585,000. The past year was a record one in the matter of land sales, and they have been nearly all to farmers or intending settlers."

The Dominion Coal Co., Glace Bay, N.S., has sold 80,000 tons of coal to the Boston and Maine Rd., and 15,000 tons to the Maine Central Rd., for delivery within the next three months.

A. O. Norton reports that his factory at Coaticook, Que., is crowded with orders for ball-bearing jacks, several large shipments having recently been made to Europe and South America.

Grand Trunk Earnings, Expenses, &c.

The following statement of earnings, supplied from the Montreal office, includes the G. T. of Canada, the G. T. Western, & the Detroit, Grand Haven & Milwaukee Rys.

	1901.	1900.	Increase.	Decrease.
July	$2,365,970	$2,177,495	$188,472	....
Aug.	2,645,340	2,439.045	206,295	....
Sept.	2,631,773	2,468,948	162,825	....
Oct.	2,741,318	2,541,141	200,177	....
Nov.	2,464,299	2,407,068	57,231	....
	$12,848,700	$12,033,697	$815,003	....

The following figures are issued from the London, Eng., office:

GRAND TRUNK RAILWAY.

Revenue statement for October:

	1901.	1900.	Increase.	Decrease.
Gross receipts	£462,800	£430,300	£32,500	....
Working expenses	298,900	270,800	28,100	....
Net profit	£163,900	£159,500	£4,400	....

Aggregate July 1 to Oct. 31:

	1901.	1900.	Increase.	Decrease.
Gross receipts	£1,754,900	£1,623,600	£131,300	....
Working expenses	1,134,200	1,038,600	95,600	....
Net profit	£620,700	£585,000	£35,700	...

GRAND TRUNK WESTERN RAILWAY.

Revenue statement for October:

	1901.	1900.	Increase.	Decrease.
Gross receipts	£79,300	£71,700	£7,600	....
Working expenses	66,100	61,500	4,600	....
Net profit	£13,200	£10,200	£3,000	....

Aggregate July 1 to Oct. 31:

	1901.	1900.	Increase.	Decrease.
Gross receipts	£297,100	£276,400	£20,700	....
Working expenses	256,800	242,700	14,100	....
Net profit	£40,300	£33,700	£6,600	....

DETROIT, GRAND HAVEN AND MILWAUKEE. RY.

Revenue statement for October:

	1901.	1900.	Increase.	Decrease.
Gross receipts	£20,900	£20,000	£90	....
Working expenses	15,800	15,000	800	....
Net profit	£5,100	£5,000	£100	....

Aggregate July 1 to Oct. 31:

	1901.	1900.	Increase.	Decrease.
Gross receipts	£80,600	£77,900	£2,700	....
Working expenses	58,000	59,100	....	£1,100
Net profit	£22,600	£18,800	£3,800	....

TRAFFIC RECEIPTS OF THE SYSTEM.

Traffic receipts, July 1 to Oct. 31:

	1900.	1901.	Increase.	Decrease.
Grand Trunk	£2,171,518	£2,023,899	£147,619	.....
G. T. Western	363,811	350,701	13,110	.....
D., G. H. & M.	101,111	98,013	3,098	.....
Total	£2,636,440	£2,472,613	£163,827	.....

Appreciation of C.P.R. Shares.

The following table shows the prices of C.P.R. shares from 1895 to 1901 inclusive:—

Year.	Highest.	Lowest.
1895	65½	35
1896	65⅛	51
1897	85½	46¾
1898	92⅞	74
1899	102⅝	87⅜
1900	102½	87½
1901	118¼	90

The appreciation in the value of the Co.'s $65,000,000 of common stock during 1901 was about $16,000,000.

Report of the Clergue Companies.

The annual report of the Consolidated Lake Superior Co., which controls the extensive mining, steel-making, railway, paper manufacturing and other enterprises in the Sault Ste. Marie district of Ontario, being carried through by what is known as the Clergue syndicate, refers to the past year as an eventful one. The absorption of the Ontario Lake Superior Co. gave the consolidated company control of the Algoma Central Railway and Steamship companies; the Manitoulin and North Shore Ry.; the Algoma Commercial Co.; the British-American Express Co., and the Algoma Central telegraph lines. The operating companies owned by the company are: Lake Superior Power Co., Sault Ste. Marie Pulp and Paper Co., Tagona Water and Light Co., Michigan Lake Superior Power Co., and the Algoma Steel Co., Ltd., just organized. On October 31 there was outstanding of the preferred stock $14,475,800. During the year ending June 30, 1902, there will be outstanding an average not exceeding $18,000,000, upon which the dividends for the year amount to $1,260,000.

The directors say: "The amount of net earnings which will be realized from June 30, 1901, to June 30, 1902, upon the sale and transportation of iron ore from the Helen iron mine, will alone be sufficient to pay the entire preferred stock dividend of the company during the period named. This statement is based upon earnings now being realized, without considering the increased value which will result from mixing the Helen ore with the high-grade Bessemer ore from the Josephine mine. The large earnings, therefore, which will certainly be derived during the same period of time from the steel works, government bonus, ground wood and sulphite-pulp mills, ferro-nickel works, sulphuric-acid works, water-power rentals, railway and steamship operations, timber sales, and the sales of ore from other than the Helen mine, will all be tributary either to surplus account or for dividends upon the common stock of your company."

The following is the income account for the year to June 30, 1901.

CREDIT.

Balance July 1, 1900		$ 7,634
Dividends received:		
Lake Superior Power Co., preference stock		39,600
" " " " common stock		555,628
Sault Ste. Marie Pulp and Paper Co., preference stock		59,688
Sault Ste. Marie Pulp and Paper Co., common stock		30,000
Total income		$692,550

DEBIT.

Preference stock dividend	$420,000	
Less dividend instalment receipts	164,371	
	$255 628	
Common stock dividend	420,000	
General expenses	8,044	
		$683,672
Balance to income account		$ 8,877

BALANCE SHEET—ASSETS.

Subsidiary companies	$18,889,370
Lake Superior Power Co	1,541
Cash balance	8,336
Total assets	$18 899,247

BALANCE SHEET—LIABILITIES.

Preferred capital stock	$6,000,000	
Less in treasury Lake Superior Power Co	1,109,630	
		$ 4,890,370
Common capital stock		14,000,000
Profit and loss		8,877
Total liabilities		$18,899,247

The subsidiary companies' account embraces the ownership of the Sault Ste. Marie Pulp and Paper Co., the Lake Superior Power Co., the Michigan Lake Superior Power Co., and Tagona Water and Light Co.—Marine Review.

At the recent annual meeting of the Consolidated Lake Superior Co., at New Haven, Conn., the following directors were elected: E. J. Berwind, W. L. Bull, and C. E. Orvis, New York; H. A. Berwind, J. Butterworth, W. P. and F. V. Douglas, J. S. Freeman, E. C. Lee, F. S. Lewis, J. Pitcairn, S. M. Provost, S. Rea, T. C. Search, and J. S. Swartz, Philadelphia; F. H. Clergue, Sault Ste. Marie, Ont.; and L. Harrison, New Haven, Conn.

The Underfeed Stoker Co., Ltd., reports recent sales of Jones underfeed stokers to the following concerns:—New hotel, Toronto; Lever Bros., Toronto; Pugsley, Dingman & Co., Toronto; Brantford Starch Co., Brantford; Brantford Packing Co.; Woodstock water works; Canadian Copper Co., Copper Cliff; Dominion Bridge Co., Montreal; Cumberland Ry. & Coal Co., Springhill, N.S.; Acadia Coal Co., Stellarton, N.S.; Marshall Field & Co., Chicago; Ashland block, Chicago; Milwaukee St. Ry. Co.; Owasso Ry. Co., Owasso, Mich.; Union Trust Co. building, Detroit; Lindell hotel, Lincoln, Neb.; Chicago university, Chicago; Inland Steel Co., Indian Harbor, Ind.; Arnold print works, North Adams, Mass.; Remington, Martin Paper Co., Watertown, N.Y.; Purington Paving Brick Co., Galesburg, Ill.

The Exchequer Court has decided that the Minnie M., a U.S. steamer, purchased by F. H. Clergue, on behalf of the Algoma Central and Hudson's Bay Ry., and given a British registry, without having left U.S. waters, is not liable for duty, on application being made for Canadian registry. The Collector of Customs at Sault Ste. Marie held that the vessel was liable to $3,500 duty, which was paid under protest, and an action taken to recover the same, with the result as stated. Judge Burbidge said that while it was competent for the Dominion Parliament to impose such a duty it was not clearly or unambiguously imposed by the Tariff Act of 1897.

Galena-Signal Oil Co.—The Galena Oil Co. and the Signal Oil Co. have been consolidated into the Galena-Signal Oil Co., which new company will carry out all the contracts, perform all the duties and continue the business of each of the old companies.

Passenger Traffic Matters.

On Dec. 17 we were advised that the place and date for the meeting in connection with the Canadian Excursion agreement for 1902 had not been decided on.

The Niagara Frontier Summer Rate Committee will meet at the Murray Hill hotel, New York, Jan. 23, at 10 a.m. The rate clerks will meet at the same place the day previous to prepare figures.

All the special trains and the cheap fares which were in operation during the season from Canadian points to Buffalo, were withdrawn in Nov. None of the companies realized as much from the traffic to Buffalo as they estimated.

The G.T.R. exhibit at the Sportsmen's Exhibition at Philadelphia occupies 5,000 square feet, and comprises the Co.'s Pan-American exhibit, one of the features of which was an oil painting of the city of Montreal, 17 x 40 ft., showing the Victoria Jubilee bridge.

By adding a dining car to the transcontinental express trains, at the Vancouver end, the C.P.R. has a complete dining car service from St. John, N.B., to Vancouver, B.C. Until the new service was inaugurated at the end of Nov., passengers had to alight at North Bend, B.C., for meals.

An arrangement has been made between the G.T.R., and the Delaware and Hudson Co., which will enable the two companies to run through trains between Montreal and New York, of the same quality and speed as the G.T.R. International Limited. This gives a third through fast route between the two cities.

The Midland Ry. of Nova Scotia, which was recently opened for traffic between Windsor and Truro, is running one train each way daily. On Nov. 30, we were officially informed that at that time there was nothing in the report that the Dominion Atlantic Ry. would run through trains between Yarmouth and Truro, via the Midland Ry.

J. E. Quick, General Baggage Agent, G.T.R., and Secretary-Treasurer of the American Association of General Baggage Agents, announces that the next annual meeting of the Association will be held at Portland, Ore., on May 14, and not on June 11, as originally fixed. There is, however, a possibility that the meeting may be changed to some more central point, possibly Chicago, on account of the new regulations respecting the issue of exchange passes.

The decision of the Central Passenger Association to put a stop to the practice of allowing clergymen to travel half-rate on production of a certificate, after Jan. 1, 1902, will not materially affect Canadian lines, as such rates were not generally in force over them. The C.P.R. grant half-rate to mission clergymen west of Winnipeg throughout Manitoba and the Territories, and a clergyman coming east to Ontario or Quebec points for a holiday is granted this privilege; the same privilege is also granted in respect of I.C.R. points reached also by the C.P.R., but only from the point of contact with the I.C.R., this latter line issuing half-fare rates all over its lines. There are no half-fare rates in operation locally in Ontario and Quebec.

Petitions are being signed in a number of agricultural districts of Ontario, asking the Dominion Parliament to make railway companies liable for all damages done to stock getting on a railway line through the failure of the companies to maintain cattle guards and fences.

T. McNabb, Master Mechanic Alberta Ry. and Coal Co., Lethbridge, Alta., writes: "THE RAILWAY AND SHIPPING WORLD is quite an up-to-date, bright, newsy paper, and much appreciated."

Grand Trunk Railway Changes.

Since the earlier pages of this issue, containing the railway appointments department, went to press, we have received a copy of a general order issued by President Sir C. Rivers Wilson, Dec. 26, as follows:—"G. B. Reeve having retired from railway life to take up his residence in California, C. M. Hays is hereby appointed 2nd Vice-President and General Manager, and will take over the duties of that office on Jan. 1, 1902."

G. B. Reeve issued the following circular on Dec. 23 to the G.T.R. Staff:—"Although I have been connected with the G.T. System since 1860—with the exception of six months—filling various positions, as you are doubtless aware, I have only been General Manager for 12 months. The duties of that position are onerous and at times very unpleasant, but I feel that these burdens have been reduced to a minimum by the earnest co-operation of the entire staff in every branch, and, therefore, I feel it not only my duty, but it gives me the greatest pleasure in thanking you for the same, and, in retiring, I can assure you that I shall always look back with a great deal of pleas-

NOTICE is hereby given that the Canadian Northern Railway Company will apply to the Parliament of Canada at its next session, for an Act empowering the company to construct the following lines of railway, namely:—

1. From a point on the company's line between Port Arthur and Fort Frances; thence north-easterly and south-easterly to the City of Quebec; and from points from this line to Port Arthur, Ottawa and Montreal;

2. From a point on the company's line at or near McCreary Station, Manitoba, to the southerly boundary of Manitoba;

3. From a point on the company's line near the narrows of Lake Manitoba to a point between Edmonton and the Yellow Head Pass;

4. From a point on the company's line near Swan River to the Pacific Coast at or near Skeena River, by way of the Pine River Pass;

5. From a point on the line east of Edmonton in Alberta or Saskatchewan to the Red Deer River;

6. From a point on the company's line near Hanging Hide River (Saskatchewan) to the mouth of the Carrot River near Pasmission.

Also, increasing the capital of the company and empowering it to issue stock, debentures or other securities in connection with the acquisition of vessels, hotels, terminals and other properties; and to acquire and utilize water-powers for the generation of electric and other power and to dispose of surplus power; and to acquire or establish pleasure resorts; and to aid settlers upon lands served by the company's railways; to improve the company's lands, and to acquire and hold lands outside of Canada; also confirming the amalgamation between the company and The Edmonton, Yukon and Pacific Railway Company.

J. M. SMITH, Secretary.

Dated 24th December, 1901.

NOTICE—The Manitoba and North Western Railway Company will apply to the Parliament of Canada, at its next session, for an Act authorizing the company to construct and complete within seven years from the passing of the Act, the lines of railway which it was authorized to lay out, construct and operate by section 9 of an Act of the Parliament of Canada, 56 Victoria, chapter 52; and for other purposes.

By order of the Board,

H. CAMPBELL OSWALD,
Secretary.

NOTICE is hereby given that an application will be made to the Parliament of Canada at its next Session for an Act authorizing and empowering the Canadian Pacific Railway Company to own, hold, lease and operate land and other property outside the Dominion of Canada; amending its charter in so far as relates to the qualification, status, powers, and election of its Directors; authorizing a further issue of consolidated debenture stock for the purpose of aiding in the acquisition of steam vessels; increasing and extending the Company's powers of dealing with its landed, mineral, timber, hotel and other properties; enabling the Company to manufacture or otherwise acquire and use electricity for motor and other purposes, and to dispose of surplus electricity; empowering the Company to improve its landed properties by means of irrigation and otherwise; to establish parks and pleasure resorts on its lands; to aid and facilitate in such manner as may be deemed advisable the settlement of the lands of the Company, and to assist settlers upon such lands, and generally for securing to the Company in connection with its lands, the powers of an Irrigation and Land Company; and for other purposes.

Dated at Montreal, this Sixteenth day of December, 1901.

By order of the Board,

CHAS. DRINKWATER,
Secretary.

ure upon the harmony and goodwill that has surrounded us during the past 12 months. In leaving, I wish that each of you may enjoy good health, long life, and prosperity."

Copyrighting of Contents.

The matter published in this paper is prepared with scrupulous care, every possible effort being made to secure accuracy. Our data is obtained almost entirely from official sources, largely by correspondence entailing a great amount of work and occupying considerable time.

Frequently original matter appearing in our columns is copied by other publications without any acknowledgment of its source being made. We have, therefore, entered this issue at the Department of Agriculture at Ottawa under the Copyright Act, and intend doing the same with each issue in future.

Our contemporaries are at liberty to reproduce matter appearing in this paper provided they prefix it by the words "THE RAILWAY AND SHIPPING WORLD, Toronto, says:—" or, "From THE RAILWAY AND SHIPPING WORLD, Toronto," but not otherwise.

ELECTRIC RAILWAYS.

British Columbia Electric Ry. Co. earnings and expenses for Oct., 1901:

GROSS EARNINGS.	1900.	1901.	Increase or Decrease.
Railway—Vancouver division	$ 9,060	$10,308	$1,248+
Victoria "	8,318	11,086	2,768+
Westminster "	11,733	11,530	203—
Lighting—Vancouver "	12,282	14,208	1,926+
Victoria "	6,869	7,941	1,072+
Total gross earnings	48,262	55,073	6,811+
Working expenses	25,549	30,625	5,076+
Net earnings	22,713	24,448	1,735+
Aggregate gross earnings, from April 1 to Oct. 31	$275,198	$307,791	$32,593
Aggregate net earnings from April 1 to Oct. 31	$112,360	$120,677	$8,317

+ Increase. — Decrease.

The Co.'s leases in Vancouver have been consolidated, with the consent of the city council, and at their termination in 1918 the city will have power to acquire the lines, etc., without any payment for goodwill.

It is proposed to develop the water power at Coquitlam lake, and deliver 5,000 h.p. into Vancouver for use in the Co.'s operations. The power can be increased to 15,000 h.p. A total expenditure of $500,000 is involved.

R. H. Sperling, Superintendent of the Co.'s operations at Victoria, has been removed to Vancouver, succeeding K. G. Dunn, who has resigned.

Halifax Electric Tramway Co.—Gross earnings:—

	1901.	1900.	Increase or Decrease.
Jan.	$ 9,543.14	$11,474.26	$1,931.12—
Feb.	8,042.11	8,982.41	940.30—
Mar.	9,448.32	9,765.83	317.51—
Apr.	9,370.98	9,359.13	11.85+
May	9,467.45	9,185.10	282.35+
June	11,336.52	11,061.74	277.78—
July	14,203.82	12,936.14	1,267.68+
Aug.	16,330.33	14,680.23	1,650.01+
Sept.	16,547.68	15,761.45	786.23+
Oct.	12,581.23	10,994.84	1,586.39+
Nov.	9,675.33	10,327.95	652.62—

With the completion of some links a belt line has been opened giving a circle of 4½ miles. The grades of the new portions of the line are easy and trailers can be used.

Hamilton, Grimsby and Beamsville Electric Ry. Co.—Negotiations have been in progress on behalf of the International Rapid Transit Co. for the control of this line. Individual shareholders have been offered $200 for each $100 share on condition that the Co. clears off all present liabilities. There are only about 14 shareholders in the H. G. and B. Co., and they were reported to be prepared to sell at the price mentioned if the money was put up in time. The expressed intention of the International Rapid Transit Co. is to secure a continuous line from Niagara to Hamilton.

Montreal Park and Island Ry. Co.—Gross earnings for the last fiscal year, $128,677.83; expenses, $100,096.06; net revenue of $28,581.77; interest on bonds, $61,500; deficit, $31,918.23. The officers for the current year are: President, Hon. L. J. Forget; Vice-president, Jas. Ross; Managing Director, F. L. Wanklyn; other directors: K. W. Blackwell, F. C. Henshaw and W. G. Ross.

Montreal Street Ry. Co.—Gross earnings for Nov., $154,912.78; net earnings, $58,423.01; fixed charges and interest on loans re Montreal Park and Island Ry., $13,967.09; surplus, $44,455.92; against $42,168.46 for Nov., 1900; making for the two months ended Nov. 30, gross earnings, $320,973.42; net earnings, $139,273.16; fixed charges, $29,350.93; surplus, $109,922.23, against $106,025.98 for the corresponding period of 1900.

The report presented at the recent annual meeting showed that the Co.'s earnings for the year ended Sept. 30, 1901, were $1,888,967; miscellaneous receipts, $11,712, against earnings, $1,762,557 and miscellaneous receipts, $7,346 for the previous year. In dividends $551,700 was paid in 1901, against $512,500 for 1900. There was transferred to contingent account $50,000, the same as that transferred in 1900. There was transferred to surplus account $47,551, against $84,746 in 1900. The income over and above expenses and fixed charges, exclusive of dividends, amounted to $649,251, against $647,246 for 1900. The officers for the current year are: President, Jas. Ross; Vice-President, F. L. Wanklyn; other directors: Hon. L. J. Forget, K. W. Blackwell, F. C. Henshaw and H. M. Allan.

Two new 1,600 h.p. engines and dynamos have been installed in the power house. These additional engines are required to provide for the extra mileage now being operated and the additional number of cars in the service. There are now over 300 cars in use, against 287 a year ago.

Negotiations are in progress between the M.S.R., the G.T.R., and the municipality of St. Lambert, with a view to the extension of the M.S.R. Co.'s lines over the Victoria bridge, to St. Helen's Island, and along the river front to Longueuil and La Prairie. The proposal is to ask the G.T.R. to apportion the south side of the bridge for a double track, leaving the north side for vehicles. Direct connection would be made with the St. Etienne line. The M.S.R. will build its lines to connect with the bridge in the event of the G.T.R. deciding to retain the operation of electric cars over the bridge under its own control.

The M.S.R. Co. paid a dividend of 2½% for the last quarter of the fiscal year 1900-1.

The Co. has recently added 25 new cars to its equipment.

Nelson Electric Tramway Co.—The following were elected directors at the annual meeting held Dec. 19th: H. E. Croasdaile, T. J. Duncan, W. A. Macdonald, G. V. Holt, C. S. Drummond and E. Garke. The Co. had under consideration the question of its surplus power, and it is proposed to sell it to the city. If this cannot be arranged the Co. will have to consider the possibility of stopping the service, as it is being operated at a loss on account of the contract with the West-Kootenay Power and Light Co. to take a certain quantity of power, whether used or not.

J. A. Dickey, C.E., Mayor of Amherst, N.S., writes: "I enjoy the contents of THE RAILWAY AND SHIPPING WORLD very much, as it keeps me in touch with the old railway life."

Canadian Baggage Agreement.

On the call of J. E. Quick, General Baggage Agent of the G.T.R., and R. H. Morris, General Baggage Agent of the C.P.R., a meeting was held at the General Baggage Department of the G.T.R., Union Station, Toronto, Dec. 12. Those present were: J. E. Quick, G.T.R.; R. H. Morris, C.P.R.; A. W. Nonnemacher, G.B.A. Lehigh Valley Rd.; T. Marshall, G.F. & P.A. Lake Erie & Detroit River Ry.; R. McEwen, G.F. & B.A. Richelieu & Ontario Navigation Co.; E. O. Grundy, General Pass. Dept., Quebec Central Ry.; and W. E. Tibbits, G.B.A. Niagara Navigation Co. Mr. Morris also represented the Canadian Northern Ry., and Mr. Quick the Muskoka Navigation Co., New York & Ottawa Ry. and Wabash Rd. The Editor of THE RAILWAY AND SHIPPING WORLD attended by invitation.

The rules and regulations adopted Aug. 1, 1900, were gone over thoroughly, the following changes being recommended:

References to baby carriages, etc., to be struck out of rule 1, clause B, and a new clause to be added as follows:—"Baby carriages, go-carts, baby sleighs, when containing only necessary articles, such as pillows, robes or blankets, may be checked, subject to the same charge as 50 lbs. of excess baggage. No charge less than 25c. This charge is separate from and has no connection with the charge for excess baggage proper." This is specially recommended as it is the uniform custom of all lines in adjacent territories, and will be the universal practice of all lines beginning with 1902, and will give Canadian lines the privilege of checking baby carriages through to destination on any connecting line, which will be an advantage to the travelling public.

Clause B to have added to it as articles that may be checked and carried in baggage car or steamer when properly released—"curling stones and the paraphernalia of theatrical companies."

Clause D to be amended as follows:—No piece of baggage, except foreign immigrant baggage, weighing over 250 lbs., will be accepted or checked as baggage. This applies to all classes of baggage, including theatrical property checked or handled in the regular baggage car.

The following clause to be added:—"Automobiles, motor-cycles and motor-tricycles not to be carried as baggage in regular train baggage cars."

The following to be added to clause E:—"In checking baggage on a coupon ticket punch each coupon thereof with B.C. punch when checking to destination. When checking short of destination punch or mark each coupon up to that of the road on which the station to which the baggage is checked to is located."

The following to be added to clause F:—"On trans-Pacific steamship business, where steamship ticket or order is presented in connection with railway ticket to trans-Pacific ports, the several lines interested will allow 350 lbs. of baggage on each full ticket of any class, and 175 lbs. on each half ticket. Baggage must not be checked beyond Pacific coast terminals."

Rule 2, commercial samples, clause A, add after "Commercial travellers may be allowed 300 lbs. of samples," the words, "when contained in sample trunks or sample cases." Also add: "No special allowance beyond 150 lbs. per ticket shall be made commercial travellers presenting ordinary first-class tickets issued to the public even though commercial travellers' certificate is presented in connection with such ticket." This is in accordance with resolution adopted at meeting of Ontario transportation lines held at Toronto, Nov. 26.

Rule 9, storage. The following to be added:—"Charges for storage must include Sun-

days and legal holidays when baggage has been marked for storage previous to Sunday or legal holidays intervening." In connection with the storage rule it is the understanding that storage will be collected on baggage held by Customs in bond, when same is held at destination of the baggage, but that storage will not be charged on baggage held by Customs in transit.

The following rules to be added:—"C.O.D. Checks.—It is intended that all charges for excess baggage, storage and transfer charges will be collected by the forwarding agent, but when baggage is received from a connecting line to collect charges that have accrued, or in any case where it is necessary to forward such property to destination to collect charges, it should be forwarded under a c.o.d. check, printed on blue cardboard, and giving explicit directions as to collections, showing amount to be collected, what for and how it should be credited. Agents collecting charges on c.o.d. checks at destination will report the amount to the accounting department of their company and settlements between lines will be made through the accounting department."

"Station Identification Checks.—All baggage delivered at stations by transfer lines or expressmen or by individuals must bear a claim check or a station identification claim check will be issued by the station baggageman when baggage is received. The companies will not accept baggage left upon premises unless it bears a check as above, or a station identification claim check is accepted by the party delivering the same. In all cases, baggage when left on the companies' premises while there will be entirely at the risk of the owner and the companies will not be responsible therefor under any circumstances."

The other changes made consisted merely in the relettering of clauses.

It was agreed that Mr. Quick, acting for lines represented, should advise all lines not represented of the action of this meeting, asking their approval of the rules recommended and upon receiving approval that rules be printed to bear signatures of all lines agreeing so that copies can be furnished to lines desiring them, to be posted at all stations.

In regard to the request of the Ontario transportation lines meeting, that the general baggage agents frame a rule to obviate the disadvantage of lines able to supply only small baggage cars in competition with lines offering larger cars, the general baggage agents decided that they could not make a recommendation owing to the difficulty in arranging for weighing.

A plan is under consideration to provide a superannuation allowance for the employes on the I.C.R., the maximum allowance of two-thirds of salary to be paid after about 35 or 40 years' service. A suggestion is made that the Dominion Government should vote $100,000 to place the plan in a good sound position at the start.

Montreal Harbor Elevators.

The differences of opinion between the Minister of Public Works and the Montreal Harbor Board, relative to the plans for the elevator, submitted by J. A. Jamieson, are not any nearer settlement, the different engineering experts continuing their letter-writing for and against. However, the Minister declines to sanction the building of an elevator according to these plans, and that ends the matter. In his latest communication to the Board, Mr. Tarte says, in regard to the elevator and general harbor improvement proposals: "If your commission desires it, I will appoint one or two engineers of my department to discuss with your staff the plans to be prepared. I propose also to ask the opinions of the railway and steamship companies before coming to a final decision, but I think it would be an excellent idea if your engineers and those of my department could meet and prepare a preliminary plan."

The position of W. J. Conners in regard to the Board has been thoroughly discussed by a committee which met Mr. Conners and his counsel. The result of these deliberations was that a resolution has been passed by the Harbor Board to the effect that as soon as the Conners syndicate has signed an agreement to cancel the deed of allotment and agreement of Jan. 9, 1900, and gives the Board full possession of the property allotted and abandons all the work done, $47,000 out of the $50,000 deposited will be returned by the Board. This sum was arrived at by deducting $6,000, the cost of putting the Windmill Point property into the state it was given to the Conners syndicate, from $50,000 plus the interest at 3% accrued since it was deposited.

Meaford Elevator.—The new elevator operated by the Meaford Elevator Co. at Meaford, Ont., has a working house of 150,000 bush., with a storage annex of 600,000 bush. capacity. The foundation is of concrete, and the deck is a solid concrete pier 28 ft. deep; the floors are all of concrete, while the superstructure is of laminate work. The bins were built of 2x8, 2x10, and 2x6 hemlock timbers,

the balance of the timber being Norway pine. The elevator is entirely covered with corrugated elevator siding, painted black. The marine leg is of steel, with a capacity of 15,000 bush. an hour. The inside lifters have cups 32x7x8 inches, the belts travelling 700 ft. a minute. There are 4 conveyers made of 40-in. rubber belting, travelling 1,000 ft. a minute, and a full equipment of steamship shovels. The engine is capable of developing 500 h.p., and steam is supplied from 2 horizontal boilers. There are also 4 1,200 bush. hopper scales of new pattern, and 4 bifurcated loading spouts for loading cars, and the track accommodation provides for the loading of 200 cars a day of 10 hours.

SHIPPING MATTERS.

The Dredge J. Israel Tarte.

The powerful hydraulic dredge the J. Israel Tarte, built by the Polson Iron Works, Toronto, was given its official test, Nov. 26, in the presence of the Minister of Public Works, and a large number of others interested in shipbuilding and the development of Canada's waterways. After the dredge had been inspected and a test of its capacity made, the company was entertained at luncheon on board by the proprietors of the works.

In proposing the toast of the builders of the dredge, Mr. Tarte said he was proud of them, they had shown what they could do when they had the opportunity. It had been designed by a Canadian, built by Canadians, and a great proportion of the material used was Canadian. He trusted that the day was not far distant when Canadian ships would be built entirely of Canadian material. In connection with the improvement of the water-ways, the Government had built six new dredges for the St. Lawrence, and with these 80 miles of the river had been dredged to a depth of 30ft. for a width of from 450 to 800 ft. There were only 15 miles of the distance between Montreal and Quebec that needed to be dredged to this depth to make a 30 ft. channel between the two places. Referring to the scarcity of Canadian vessels suitable for carrying of grain on the lakes Mr. Tarte said: "You all know what has happened within the last few days. Firms in Winnipeg and Montreal asked the Government to allow U. S. vessels to load grain at Fort William and carry it to another Canadian port. After due consideration we decided to say 'No.' A U. S. boat may go to Fort William and carry grain to a U. S. port, but when the grain is to be taken to a Canadian port it must be shipped in a Canadian bottom. If we have not ships enough for our trade, we must build them. We have proved that we can build Canadian ships on Canadian territory, and it is the duty of this nation to see that there are enough Canadian bottoms to carry all our trade through Canadian channels."

F. B. Polson, in reply, stated that the Polson Iron Works also tendered, and were prepared to build within the time limit the two large cruisers recently ordered by the Marine and Fisheries Dept. of the Dominion Government from Scotland, but owing to well-understood conditions, their price was necessarily higher than the Scotch firm, and they therefore lost the order. This only goes to show the necessity of something being done by the Government to put our home ship builders in such a position that they can compete on at least equal terms with those of other nations for the home supply. He added that the system of financing shipbuilding schemes was wrong, and an abnormal rate of interest was charged those who borrowed money to invest in shipping. The rates of insurance were sufficient to cover any possible risk, and there was no excuse for demanding 8 or 10% for money loaned on security of ships to be constructed.

Mr. Tarte, in reply to the toast of his health, which was proposed by F. B. Polson, said the question of transportation was not a party matter but a national one. It was a question whether the people were prepared to spend the money necessary to carry forward the work which had been started. He thought the people should go ahead with the work of developing their waterways, and concluded, "I, for one, am prepared to take a bold stand upon this national question. I am not the 'Master of the Administration.' I am sorry, of course, that I am not, but if I were I would not hesitate about spending money in building up the country now. We are not in it, so far as trade is concerned, and we must improve wherever improvement is needed. Whether it be the establishing of a fast line, the deepening of rivers and harbors, or the improvement of other works, we must keep steadily at it."

The J. Israel Tarte is the largest and most powerful dredge of its kind ever built, and represents the highest development of engineering in this direction. Its total cost is about $250,000, but it will be cheaper in operating when compared with the small dredges hitherto operated on the St. Lawrence. The hull is built of steel, and is 160 ft. long, 42 ft. wide and 13 ft. deep. It is fitted with an opening or well in the centre, through which the gigantic suction pipe operates. This suction pipe is 40 in. in diameter, and is built in the form of a square box girder, having extended flanges of great width to resist the strains of coming in contact with the bottom. At the lower end of this suction pipe there is an immense rotary cutter built entirely of steel. This cutter is 9½ ft. in diameter, and weighs 10 tons. It is driven by a pair of double tandem compound engines mounted on top of the girders at the upper end. These engines are 300 h.p., and are of the most massive construction. The cutter is designed to excavate hard clay or any other difficult substance other than stones or rock, without difficulty, and it is sufficiently strong that if any immovable resistance, such as rock, should be encountered no breakage will occur, but the engines will simply stop, all the working parts being strong enough to stall the engines. It is not, however, intended that this dredge will work in localities where the material is hard, as it is pre-eminently a soft material dredge of large capacity.

The great advantage of this type of dredge over any other is that it transports and discharges all the dredged material at one operation without the use of scows, with their attendant expenses and interruptions. In fact, it would be almost impossible to provide sufficient scows and manipulate them fast enough to take away the large amount of material which this machine is capable of dredging. In this dredge the operation is continuous and uninterrupted, the material being discharged through a long, floating steel pipe with flexible connections. This pipe is 3 ft. in diameter and 2,000 ft. long, and floats upon the water like a huge snake. Each length of pipe is 100 ft. long, and it is sustained by two cylindrical pontoons 42 in. in diameter by 98 ft. long. There are thus practically three pieces firmly braced together in each length. The central one forms the conduit, and the two sides form the air chambers or floats. The discharge end of the pipe is carried over a large-sized wooden scow which is anchored in position where required, and is able to feed itself along as the dredge progresses, by means of a steam winch. Some idea may be had of the enormous capacity of this dredge from the fact that the main pump discharges at the rate of 75,000,000 gallons per 24 hours, which is about four times the capacity of all the pumps of the Montreal water works. Under ordinary working conditions from 20 to 25% of this volume is solid material, thus giving the dredge a capacity of 3,000 cubic yards per hour. As a cubic yard of material is equal to 1½ tons, this means that the dredge can excavate from a depth of 50 ft. and deliver 2,000 ft. away 4,500 tons of material per hour. In practice, however, about one-half of this amount is realized, owing to the incidental delays and conditions of work.

The motive power of the dredge is a set of triple expansion engines of 1,200 h.-p. which drive a large centrifugal pump. This pump is of special construction for the work, being designed for great efficiency and so that it will not clog with large masses of solid material. There are 4 boilers adapted for 160 lbs. of steam and fitted for induced draft. The consumption of fuel will be about one ton of coal per hour when in full work. The dredge is capable of working to a depth of 50 ft. and of making a cut 400 ft. wide with one setting of the anchors. Its movements are controlled by powerful steam winches at either end, by means of which the dredge is fed over the bottom at any desired rate and under perfect control at all times. Commodious quarters for the officers and crew are provided both on the the main and upper decks. There is also a complete electric light installation so that the dredge can work night and day.

The construction of this dredge marks a new era in the method of carrying on our public works in which dredging is required, and the dredges of the future will be large, high power machines capable of doing from 6 to 10 times the work of the old fashioned machines of a few years ago, and at a fraction of the cost. This forward movement has been rendered necessary by the great developments that have taken place during the past 10 years in transportation interests, both land and marine, which have brought into prominence the great importance of so developing our waterways that trade will not be restricted. The weight and hauling power of locomotives has more than doubled, and the carrying capacity of freight cars in proportion to their dead weight has also more than doubled. On water so great is the economy brought about by the building of big ships that small vessels can no longer compete with large ones where there is sufficient volume of trade. As an instance of this the large cargo carrying str. Celtic may be quoted. This vessel has a load line displacement of 26,000 tons, and she can carry one ton of pay cargo 100 miles on 4 lbs. of coal, whereas the largest cargo steamer of 10 years ago required 10 lbs. to do the same duty. This result is mainly due to the large increase in carrying capacity, and to the fact that a large vessel requires less power per ton to propel it at a given speed than a small vessel. It is also due in some measure to the advances which have been made in the design and efficiency of the marine engine. All this means that to keep pace with the rate of progress we must increase the depth of our harbors and waterways so as to permit the use of large and economical vessels. It is a fact that the only limitation at present to the size and capacity of ocean steamships is the capacity of the harbors and docks and depth of water in the channels. Only quite recently British shipbuilders sent inquiries to this country to know how big ships they dare build for the St. Lawrence route, and it is evident we will be greatly handicapped in the race for supremacy if we do not offer the facilities that are demanded.

The six dredges built for the Government have all been of an increasing size, and the one projected for the Lower St. Lawrence is to be larger than the J. Israel Tarte. This latter is the second dredge built for the Government by the Polson Iron Works, and for which A. W. Robinson, of Montreal, a Canadian mechanical engineer, whose work in this line

is well known in the U.S. and abroad, supplied the designs. The other dredge which was built for service in B.C., is named the King Edward VII., and was described on pg. 374 of our issue for Dec. 1900. Mr. Robinson has designed and built over 100 dredges of all kinds, and his experience has enabled him to bring them to a high state of perfection. He is now engaged as consulting engineer on a contract for deepening the ship channel of New York harbour, and has just completed a dredge for that work having a capacity of 40,000 cubic yards per day. It is a matter for congratulation that a huge machine such as this can be successfully built and engined in Toronto, and that we have in our midst energetic business men like the proprietors of the Polson Iron Works, who have the confidence and energy necessary to undertake such a contract, and who have associated with themselves a staff competent to carry out the work in such a satisfactory manner. The naval architect of the Polson Iron Works is W. E. Redway; the marine engineer is A. Duncan, and the boiler maker is J. J. Main, and upon them fell the responsibility for the arrangement of details and general execution of the work. It is equally commendable on the part of the Minister of Public Works to select a Canadian concern to carry out his plans instead of ordering the dredge abroad, thereby keeping the money in the country. We trust that this dredge is but the precursor of other marine structures to be built in Toronto which will help to establish shipbuilding in Canada upon a sure and stable foundation.

Notices to Mariners.

The Department of Marine has issued the following notices:

No. 99. Nov. 16.—Nova Scotia.—Unchartered rocky patch in Halifax harbor.

No. 100. Nov. 18.—British Columbia.—1. Portier pass, buoyage. 2. Grappler reef, change in character of buoy. 3. Active pass light, arc of visibility. 4. Constance cove, dolphin destroyed.

No. 101. Nov. 22.—Prince Edward Island.—1. Hazard point range lights, change in color. 2. Leard's range backlight moved.

No. 102. Nov. 23.—British Columbia.—Middle passage, Skeena river mouth, sailing directions.

No. 103. Nov. 26.—Newfoundland.—Off Cape Race, magnetic variations, currents, etc.

No. 104. Nov. 27.—Ontario.—1. Hand foghorn at Thessalon light station. 2. Detroit river entrance, wreck off Bar point. 3. St. Lawrence river, uncharted shoal near Macnair island.

No. 105. Nov. 29.—Nova Scotia.—1. Hand fog-horns at light stations. 2. Port Maitland light.

No. 106. Nov. 29.—Ontario.—1. Stag island shoal light.

No. 107. Dec. 3.—Quebec.—1. Change in Quebec harbor range lights. 2. Greenby island, position of lighthouse. Labrador.—3. Amour point, position of lighthouse.

No. 108. Dec. 5.—New Brunswick.—1. Bliss island light, change in color. Nova Scotia.—2. Abbot harbor light maintained all year. 3. Channing pile beacons.

No. 109. Dec. 5.—Quebec.—1. Pointe à Basile range lights and day beacon. Newfoundland.—2. St. John's leading lights and day marks.

Maritime Provinces and Newfoundland.

Port Hawkesbury, N.S., is exporting railroad ties to the U.S.

A five-masted schooner of 1,655.75 tons has just been launched on the Penobscot river, near Moncton, N.B.

The Dominion Atlantic Ry.'s str. Prince Edward has been chartered for three months from Jan. 10 to sail from Miami, Fla., as last year.

The Dominion Iron and Steel Co. has made arrangements to send pig iron to Halifax over the I.C.R. for shipment to European and other ports.

The str. La Grande Duchesse, formerly owned by the Plant line, but recently sold to the Ocean Steamship Co., has, after an overhaul, been named the City of Savannah.

The reports that the Plant line str. Olivette had been sold to be placed on a run between Tacoma and an Alaskan port is denied. She will go on her usual winter run between Tampa, Fla., and Havana, Cuba.

Vessels arriving in Newfoundland from a foreign port, and intending to proceed to other ports in the colony, must make a full report of their whole contents at the first port of entry, under a penalty of $400.

The Dominion Coal Co. shipped over 900,000 tons of coal from Sydney, N.S., to St. Lawrence ports during the past season. For the winter months the Co.'s fleet of steamers will carry coal to Europe and to U.S. ports.

The Cumberland Ry. and Coal Co. is reported to have placed orders for two 1,000 ton barges for carrying coal, to be built at Parrsboro, N.S., and for one at Harvey Bank, N.S. They will be of the following dimensions:—length, 155 ft.; breadth, 35 ft.; depth, 12 ft.

Reports show that orders have recently been placed with Nova Scotia shipbuilders for a large number of wooden vessels in addition to those mentioned in our last issue. The Parrsboro, N.S., yards have orders for 13 sailing vessels, 1 tug, and 2 barges of 1,000 tons each.

The Tidal Survey branch of the Department of Marine has issued in pamphlet form tide tables for Charlottetown, P.E.I.; Pictou and St. Paul, N.S., for 1902, with tidal differences for Northumberland strait, and for the open gulf shore from Miramichi, along the north coast of Prince Edward Island.

H. and J. S. Harding, of St. John, N.B., are looking at the sites offered for shipbuilding yards at Sydney, Halifax, and Dartmouth, N.S., and St. John, N.B., with a view to selecting one for a yard to be operated by a company, of which they with H. M. Whitney, J. Thompson and G. McAvity are members.

A delegation of St. John, N.B., merchants recently waited on the Dominion Government asking for an improved service between Canada and Jamaica. The present service is a monthly one from Halifax, N.S., and the St. John people want a fortnightly service with a faster steamer, and the inclusion of St. John as a port of call.

H. H. Greens, Cheverie, N.S.; W. M. Christie, J. A. Shaw, A. F. Armstrong and F.

Curry, of Windsor, N.S., are applying for incorporation under the Dominion Companies' Act as the Barque Star of the East Co. (Ltd.), with a capital of $20,000 to carry on business as shipowners and carriers by sea. The head office is to be at Windsor, N.S.

The St. John, N.B., council has appointed a committee to look into the structure of dry docks in U.S. ports. G. Robertson, M.L.A., who is promoting the scheme, says that if the council does not insist upon a granite dock being built, the construction of a dock either of concrete or wood will shortly be commenced. The council previously pledged a subsidy of $2,500 a year for 40 years for a granite dock.

The Newfoundland Legislature at its last session passed an act constituting a marine court of enquiry for the colony, such court to comprise a stipendiary magistrate or practising barrister of 10 years' standing who shall be assisted by one or more nautical or engineering assessors, for the purpose of investigating any marine casualties occurring in Newfoundland waters, or on the seas contiguous thereto. The act is in its general terms similar to one passed by the Dominion Parliament last session.

For a short time last winter the str. Stanley ran between Tormentine, N.B., and Summerside, P.E.I., but was withdrawn. As the result of deputations the Minister of Marine has directed the str. Stanley to be put on the route again this winter. The new service was inaugurated Nov. 20, by a special steamer and the Stanley was put on the run on Dec. 23. The I.C.R. will fix the rates over the new route with the New Brunswick and Prince Edward Island Ry. It is intended to give the route a thorough trial this winter. It is claimed that the new route has considerable advantages over the route between Georgetown, P.E.I., and Pictou, N.S.

Province of Quebec Shipping.

The Richelieu and Ontario Navigation Co. has increased its wharfage accommodation at Quebec by the purchase of Hunt's and Crawford's wharves.

The number of sea-going vessels entered inwards at Quebec for the season of navigation of 1901 was 383, of which a large number proceeded to Montreal.

The Richelieu and Ontario Navigation Co.'s new steamer, which it is proposed to name the Montreal, will be launched at Toronto, Jan. 15. The new steamer is for the Montreal-Quebec service.

It is reported that the Dominion Steamship Line, which transferred its business to Portland, Me., in 1900, will return to Montreal next season, the Portland experiment not having been altogether a successful one.

Three lightships which were retained in Lake St. Louis, above Montreal, for the convenience of the grain trade somewhat later than usual, were caught in the ice, Nov. 28, and had to be cut out, tugs having failed to move them.

The Leyland line, it was reported, offered to run a special steamer to Quebec in Dec. last, if the Dominion Government would pay $6,000, the extra expense and insurance on the vessel, but the Minister of Marine said, while the matter was talked of, no proposition was submitted.

Commodore J. U. Gregory has been directed by the Department of Marine to hold an enquiry to investigate upon the condition and safety of the St. Lawrence river, especially at the mouth of the Saguenay, as a result of the complaint of Price Bros. on the recent grounding of the Urania there.

During the last season of navigation 396 steamers, with a tonnage of 988,018, arrived in Montreal from oversea ports, against 416, with a tonnage of 1,038,234 in 1900. The coal imports from Nova Scotia ports amounted to 932,170 tons, and from British and U.S. ports to 76,982 tons.

W. Nordin, of O. W. Nordin & Co., Paris, France, who are engaged in the Baltic trade, has been visiting Quebec with a view of keeping the river from that port to the sea open for winter navigation. Below Quebec the river is never entirely frozen over, the chief danger to navigation being the floating fields of ice.

The barge Ahele took a shipment of 22,000 bush. of wheat from Kingston, Ont., to Quebec last season to discharge. This was the first grain carrying vessel to reach the port from the west, and it is expected that, as the experiment was a success, a large business will be done between Quebec and Ontario ports in grain next year.

On Nov. 23 last the Department of Marine began to remove the lightships and buoys below Quebec, against which action the shipping men of that port protested, as five vessels were still scheduled to leave there. One of these vessels subsequently struck on St. Roch shoal, but got off leaking. The Government agent at Quebec states that a permanent pier and light was placed at the Traverse, near this point, to guard against such an occurrence, which light was approved of by pilots and vesselmen.

The remarks made by R. Reford, of Montreal, when a deputation of the shipping interests of that city waited on the Dominion Government in Nov. last were briefly referred to in our last issue, since which a fuller report has been received. Speaking of marine insurance on steamers using the St. Lawrence route, Mr. Reford said: On a steamer of about 8,000 tons, costing £100,000, or $500,000, a reasonable valuation, the rate of insurance for 12 months would be between 9 and 10%, as against 4 to 4½% on a steamer of similar size and cost running to Boston or New York, with which Montreal has to compete for its ocean freight, so making a discriminating charge of about 5% against the St. Lawrence route. This on $500,000 is $25,000, and the average number of trips that a steamer can make to the St. Lawrence being about 5, the discriminating rate against the St. Lawrence route thus amounts to $5,000 a round trip. Ocean marine insurance is usually fixed for a period of 12 months in advance, and although a steamer can only use the St. Lawrence route for 6 months, this extra insurance is levied on the entire year's work, although she may trade the other six months to the U.S., showing that the whole difference of 5% is levied against the St. Lawrence route and its supposed dangers.

Ontario and the Great Lakes.

A writ has been issued in the Ontario High Court by the J. D. Shier Lumber Co. (Ltd.) against the Muskoka Navigation Co. (Ltd.) et al. for $11,623.

The Detroit, Belle Isle & Windsor Ferry Co. is reported to have placed an order for an excursion steamer for the Detroit-Bois Blanc island run, to be completed by June next.

The U.S. government has approved of plans for widening the ship canal at Sault Ste. Marie at a cost of $750,000. The proposed works will take 18 months to complete.

The total tonnage passing through the Canadian and the U.S. canals at Sault Ste. Marie, in 1901, up to Dec. 1, was 27,817,811 tons, an increase of about 3,000,000 over 1900.

The barge Roberval, corn-laden, which sank in Johnston bay, below Prescott, was split open owing to the swelling of the grain. The corn has been pumped out with a wrecking pump.

At Marlton's yard, Goderich, a new tug is on the stocks; a contract has been secured for a second, and other steamers are being figured on. One of these latter is a large passenger boat.

The lockmaster at Rosedale locks on Balsam lake reports that during the season of 1901 the number of lockages was 892 against 526 in 1900. The number of steamers locked through was 559.

Materials are being taken to Port Carling, under the direction of the Ontario Public Works Department, for the purpose of being ready to start work on lengthening the lock between lakes Rosseau and Muskoka.

The total tonnage passing through the Soulanges canal for the season of 1901 was 911,327, carried in 2,995 vessels. There was a falling-off in the grain shipments as compared with 1900 of 1,391,062 bush.

A. A. Hackett, Wiarton, Ont., who is removing the machinery from the str. J. J. Long, recently burned in Meldrum bay, has a contract for building a new boat for Capt. Cleland, owner of the burned steamer.

The Montreal Transportation Co.'s steamer Bannockburn has been laid up for the winter and for repairs at Midland, owing to the impossibility of obtaining accommodation at the Government dry dock at Kingston.

W. J. Brown, of Detroit, Mich., who owns the str. Pittsburg, trading between Sandusky, Ohio, and Sault Ste. Marie, Ont., and intermediate Ontario ports, will, it is reported, place an additional steamer on the route next year.

J. Stewart, who had charge of the transporting business of the Canada Atlantic Ry. at Coteau, Que., last season, says the Co. handled 13,000,000 bush. of grain at that point by the barges of the Kingston and Montreal Forwarding Co.

The Myles Transportation Co. of Hamilton is seeking to recover damages from Long Bros., Ltd., of Collingwood, for not having a cargo ready for the propeller Myles on a trip to Collingwood in Nov. on the alleged order of Messrs. Long.

Captain W. E. Clark, who was Superintendent of the Northwestern Steamship Co. last season, says it is doubtful if the Co.'s four vessels will ever return to the lakes again; if they do they certainly will not attempt to trade to Europe again.

During the past season the harbor improvements at Collingwood have been completed so far that vessels drawing 18 ft. 6 in. were able to come alongside the elevator. The Strathcona was the first vessel so deeply laden to enter the harbor.

A press report states that the Toronto Navigation Co. is having two steamers built on the Clyde, to be put on the Niagara route next season. As the T. N. Co. is now being wound up in liquidation, there cannot be any foundation for this statement.

The new owners of the Crandella include J. H. Lennon, F. K. Begbie and Captain Elliott, and it is stated it is their intention to rename her the City of Lindsay when the repairs are completed. She is to be put on the slip at Lindsay and practically rebuilt and refitted.

Vessel owners and freighters asked that insurances on the great lakes be extended for a week last season in order to enable them to carry grain until Dec. 12. It is understood that the insurance companies made no objection to undertaking certain of the risks.

The U. S. engineers engaged in the lake survey service state that the Chicago drainage canal is responsible for the lowering of the lake levels. Lake Superior is 6 in.,

Michigan and Huron are each 1-10 of a ft., and Erie is 6 in. lower than last year at the end of Nov.

It is stated by the C.P.R. management that there is no truth in the daily press statement that that Co. and the New York Central Rd. are jointly interested in a plan to run a line of steamers between Kingston and the Saguenay, in opposition to the Richelieu & Ontario Navigation Co.

It was reported in Nov. last that the Algoma Central and Hudson's Bay Ry. would put on two new freight and passenger steamers for the Windsor-Sault Ste. Marie run next year. On Dec. 5, 1901, F. H. Clergue, President, informed us that no information for publication was available.

During the season of navigation of 1901, the str. W. L. Brown, operated by the Canada Atlantic Transit Co., made 25 round trips and moved 180,000 tons of freight from May 10. All but one of the trips were made to Depot Harbor with grain, the odd trip being to Ashtabula with 6,600 tons of iron ore.

Hon. J. I. Tarte, Minister of Public Works, recently visited Port Colborne to inspect the harbor improvement works in progress there. A large breakwater is being built, and it is proposed to build elevators and freight sheds, so that the largest lake carriers can be accommodated and their cargoes handled.

The question of prolonging the season of navigation on Lake Superior is, it is claimed, very simple so far as Port Arthur is concerned. For 20 years, and without any artificial methods, steamers have been trading between there and Duluth, and ordinary fishing tugs have done business on the bay until Christmas.

Up to November 24, 1901, there were shipped from Fort William about 9,000,000 bush. of wheat, a greater quantity than was shipped during the whole season of navigation in 1899, which was the record year. At the same date there were 3,000 tons of freight to be unloaded for shipment to western points.

The Muskoka and Georgian Bay Navigation Co.'s annual meeting will be held Jan. 29. It is said that the Muskoka Navigation Co., or its promoters, have taken over a majority of the stock of the M. and G.B.N. Co. from A. P. Cockburn and others, and that there are likely to be some changes in the board at the annual meeting.

The Pere Marquette Rd. is reported to be building another car ferry, a duplicate of the Pere Marquette at a cost of $400,000. It will be 350 ft. over all, 56 ft. beam, 19 ft. 6 in. deep; will be fitted with 4 tracks with a capacity of 30 freight cars, and will be propelled by twin screws. It will be operated between Ludington, Mich., and Milwaukee, Wis.

During the winter the St. Lawrence and Chicago Steam Navigation Co.'s steamers Rosedale and Algonquin are to be laid up at Owen Sound, where they will be overhauled and will be fitted with steel decks. Half-a-dozen other large steel vessels are lying up at that port in addition to a large number of small ones and tugs, representing a total value of about $2,500,000.

The report of the Commissioner of Navigation shows that of the tonnage built in the U. S. yards during the year ended June 30, 1901, 65% was built on the great lakes; where 40 vessels having an average tonnage of 3,478 tons were built. Nine steamers of an average tonnage of 2,100 were built for ocean service. Only two wooden steamers were built, their total tonnage being 3,268.

At the annual meeting of the Hamilton Steamboat Co. at Hamilton, Dec. 11, a satisfactory report was presented respecting the season's operations. Following is the official list for the current year: M. A. Kerr, President and Manager; M. Leggatt, Vice-President. Other directors: F. W. Fearman, S. Jones, G. T. Tuckett, J. W. Lamoreaux and H. B. Whitton. Secretary, Miss Abraham.

J. G. Hay, A. B. Hay, H. B. Smith, F. W. Harris, G. W. Gurnett, and J. J. Best, Owen Sound, have been incorporated under the Ontario Companies' Act as the Owen Sound Dry Dock and Shipbuilding Co., Ltd., with a capital of $40,000, to carry on the business of a dry dock, ship building, towing, dredging and wrecking Co., and incidentally the business of a navigation and transportation Co.

Clarke, Cowan, Bartlet and Bartlet, solicitors, Windsor, give notice that application will be made to the Ontario Legislature at its ensuing session for an act to enable the township of Pelee to aid, by way of loan, Colin Wigle, or some other person or persons, to establish a steamship service between Pelee

island and the main shore, and for such purpose to issue $7,000 in debentures of the township council.

The Navigation Co. of Port Stanley (Ltd.) met in St. Thomas, Dec. 12, and elected the following officers:—President, G. K. Crocker, St. Thomas; Vice-President, T. A. Browne, London; Secretary-Treasurer, A. M. Hutchinson, St. Thomas; other directors, Col. F. B. Leys, London; W. A. Day, Port Stanley; P. Stover, E. A. Smith, and J. Mallon, St. Thomas. It was decided to build a new boat at once at Port Stanley, if possible.

Hon. J. I. Tarte, Minister of Public Works, recently told a deputation representing the Toronto city council and other public bodies interested in the development of the harbor, that the Government was prepared to make Toronto harbor what it should be if the city would construct a sewerage system that would take the city sewage out of the harbor. The further improvement of the Don was a matter within the city's own jurisdiction.

C. Schrieber, Deputy Minister of Railways and Canals, recently made an inspection of the Trent valley and the St. Lawrence canals. Satisfactory progress has been made with the various works, although a number of them are still uncompleted. Very few vessels have yet been constructed to the full dimensions of the new locks on the St. Lawrence canals, most of the craft not being loaded to a greater depth than 12 ft. 6 in.

The loss of life on the great lakes during the season of 1901 was 132, against 110 in 1900; 46 in Lake Superior, 34 in Lake Huron, 22 in Lake Michigan, 11 in Lake Erie and 6 in Lake Ontario. Of the total number lost 59 were due to the foundering of vessels, 24 being lost in the sinking of the Hudson in Lake Superior, Sept 14; and 37 were lost overboard or drowned in harbors, the remainder of the casualties being due to miscellaneous causes.

An appropriation of $45,000 is being asked for from the U. S. Congress for the purpose of establishing a steel lightship at the south-east shoal, Pelee passage, Ont. Last year the Lake Carrier's Association spent $13,000 in maintaining a light at this point, and they desire a government lightship established. As it is almost entirely U.S. commerce that has to be protected, the Canadian Government does not raise any objection to the U.S. placing a lightship there.

The Mackinac Transportation Co., owned by the Duluth, South Shore, and Atlantic Ry., the Michigan Central, and Grand Rapids and Indiana Rds., has, press reports say, decided to give up its offices at Detroit, Mich., and transfer them either to St. Ignace or Mackinac City, Mich. The Detroit council proposed to assess the Co. to the extent of $300,000 on its boats, and the Co. states it will remove its head office and pay its taxes where its boats do business.

New York press reports state that Sir C. Furness during his recent visit to Canada made arrangements with the Clergue interests at Sault Ste. Marie, Ont., for the erection of an immense shipbuilding plant, to be located at Sault Ste. Marie, close to the junction of the canal and Lake Superior. Asked as to the location of a steel plant, Sir Christopher said he did not care to take the public into his confidence, and should remain dumb in regard to it for some time to come.

The Niagara Navigation Co.'s annual meeting was held in Toronto, Dec. 16. The manager's report, which was unanimously adopted, showed that the year's business was very satisfactory, the result being the best in the Co.'s history. The Pan-American traffic contributed largely to the earnings. The old board was re-elected as follows: President, J. J. Foy, K.C.; Vice-President, Barlow Cumberland; Manager, John Foy; Treasurer, R. H. McBride; other directors: J. B. Macdonald, E. B. Osler and W. Hendrie.

The Department of Public Works has estimated the cost of constructing a 20 ft. channel from Georgian bay to Lake Nipissing at $4,000,000. The distance would be 61 miles and the chief obstacle would be the Five Miles rapids. By the opening of this channel the grain boats would be able to discharge at North Bay, and at Callender. It is on the route of the proposed Ottawa-Georgian bay canal, in regard to which Hon. J. I. Tarte recently said that as soon as the French river scheme was completed the Ottawa part of the scheme would follow.

The Dominion Department of Marine has purchased the tug Lord Stanley for hydrographic survey work on Lake Superior. The Lord Stanley is a screw steamer, built of steel at Meadowside, Scotland, in 1899, classed in English Lloyds and registered at Quebec, her dimensions being: length, 140 ft.; breadth, 24 1/6 ft.; depth, 11 5/6 ft.; tonnage: gross, 276; net, 86. While on the way to the upper lakes the Lord Stanley put in at Toronto, where crews were changed, the crew of the Bayfield, which has hitherto been engaged in the upper lakes survey service, taking the place of the Quebec crew. When leaving the wharf, owing to a misunderstanding of the signals the vessel was driven astern instead of ahead, with the result that $300 damage was done to the wharf and $1,000 damage to the hull. Temporary repairs were effected, and the Lord Stanley proceeded to Port Dalhousie, where she will winter.

M. S. Lonergan, solicitor, Montreal, gives notice of application to the Dominion Parliament for an Act to incorporate a company under the name of the St. Joseph and Lake Huron Ship Canal Co. for the purpose of constructing a canal of not less than 14 ft. in depth from some point on the eastern shore of Lake Huron, in the county of Huron or of Lambton, to a point on Lake Erie between Rondeau and Port Burwell, with powers to effect necessary improvements in the lakes at the terminal points; to erect and lease or otherwise dispose of wharves and docks; to own and operate steamers, barges or other vessels, and to charge tolls for the use of the canal; to build rail and tram lines; to operate ferries, telegraphs and telephones, together with numerous other powers. One suggestion is to build a canal from St. Joseph's, which would be a long one and would necessitate the construction of swing bridges over at least seven lines of railway, and a second is to construct 13½ miles of canal from Lake St. Clair to Rondeau, which would require bridges to carry three or four railway lines across its course. By this latter route a saving of 79 miles between the two lakes would be effected, and relieve Detroit river of a great deal of traffic. The traffic through this river is about 40,000,000 tons a year, of which only 10% is local, the remainder being through trade.

Pacific Coast Shipping.

It is reported that a large number of men are employed in the B.C. ship-building yards, at good wages.

Three vessels, it is reported, are to be fitted out at Vancover, to engage in the whale fishing industry.

The Dominion Government is improving the channel between parts of Pender island, at the Saanich peninsula, in order to make it navigable for small steamers.

A Seattle, Wash., despatch states that the Alaska Mail Co. has been formed to run steamers between that port and Alaska next season. The Co., it is said, proposes to put 20-knot steamers on the route.

It is intended to raise the str. Goddard, which sank in a storm in Lake Laberge, Yukon, recently. She had recently been thoroughly overhauled and was uninsured.

The Pacific Barge Co., Ltd., has been incorporated under the B.C. Companies' Act with a capital of $5,000, to acquire the barge Atlas, and other barges, and to carry on business as shipowners, freighters, agents, etc.

According to an arrangement reported to have been made the str. Mainlander will in future make two trips a week between Vancouver and Puget sound ports, instead of three as at present; and the third trip will be made to Nanaimo.

The Atlin and Canadian Development Co., Ltd., has been incorporated under the B.C. Companies' Act with a capital of $1,000,000, with power among other things to own ships and to operate them for the carriage of passengers and freight.

The total amount of damages claimed in the actions being instituted against the Canadian Pacific Navigation Co. on account of injuries and deaths due to the loss of the str. Islander, amount to $190,000. The actions are being prosecuted by a firm of Seattle, Wash., lawyers.

The Pacific Mail Steamship Co., which operates transpacific and coastal steamships from San Francisco, purposes, it is reported, to extend its coastwise service to Victoria and Vancouver, B.C. Five new steamers are being built for the Co., four in Glasgow, for the coast trade.

Plans have been prepared by A. W. Robinson, M.E., of Montreal, consulting engineer to the Dominion Department of Public Works, for a dredge to be used in deepening the channel in the Arrow lake district, B.C. The machinery of the dredge will be built in the east, and the hull on Arrow lake.

With the close of navigation on the Yukon the British Yukon Navigation Co. will commence operating its stage line to Dawson. Two other companies contemplate carrying freight and passengers to Dawson by stage during the winter, so there should not be any difficulty in getting in or out of the country.

Tide tables for Victoria, B.C., and Sand heads, strait of Georgia, for 1902, with tidal differences for Esquimalt, Vancouver, New Westminster, and Baynes sound, and the current in first narrows, Burrard inlet, have been issued in pamphlet form by the Tidal Survey branch of the Department of Marine.

The U.S. Government purposes to build 12 lighthouses in Alaskan waters. Two of these, one at the Five Fingers between Juneau and Wrangel narrows, and the other on Sentinel island, are nearing completion, and a contract has been let for a third on Lincoln rock. Sites have been selected for six more of the new lights.

A company has been organized in Vancouver for the purpose of operating a line of steamers from St. Michael and Dawson, and a connecting service between Vancouver and St. Michael. Ironsides, Rannie & Campbell, who operated a line on the Stikine river, are interested in the new line. The trip from Vancouver to Dawson by this route can be made in a month, and it is said that a profit can be made by taking freight at $75 a ton.

A. Piers, General Supt. of the C.P.R. steamships, left Montreal early in Dec. for a trip to Vancouver, B.C. In the course of an interview at Winnipeg, he said the Co. had 40 steamers of different types and sizes in service. The steamer Islander was to be replaced on the Pacific Coast by a new steamer of the Manitoba type, but no contract had been placed for it. There was

ASSESSMENT SYSTEM

INDEPENDENT ORDER OF FORESTERS.

THE BEST FRATERNAL BENEFIT SOCIETY IN EXISTENCE.

Cost to Join the I.O.F.

(For $1,000 Mortuary Benefit.)		(For more than $1,000 Mort. Benefit.)	
Initiation fee (minimum)	$1 00	Cost to take $2,000 Mort. Benefit	$6 00
Certificate fee	1 00	" " $3,000 " "	7 00
Registration fee	1 00	" " $4,000 " "	9 00
Medical Examination fee	1 50	" " $5,000 " "	10 00
Total minimum cost	$4 50	Sick benefits, when required, cost extra.	

Benefits given by the I.O.F.

1.—**The Mortuary Benefit** of $500, $1,000, $2,000, $3,000 $4,000 or $5,000.

2.—**A Total and Permanent Disability Benefit** of one-half of face value of policy, with exemption from further payment of premiums or Court Dues.

3.—**An Old Age Benefit** consisting of exemption from payment of premiums and Court dues after age 70.

4.—**An Old Age Disability Benefit** of one-tenth of face value of policy payable yearly for ten years, on being declared totally and permanently disabled by infirmities of age after the seventieth birthday.

5.—**An Old Age Pension** payable during disability, which may be taken as a substitute for the Old Age Disability Benefit.

6.—**Free Medical Attendance** by Court Physician where not dispensed with by Court by-law; also trained nurses in certain cases.

7.—**A Sick Benefit** of $3 to $5 per week, subject to provisions of the Constitution and Laws of the Order; optional, and when taken costs extra.

8.—**A Burial Benefit** of $100 at death of a Pensioner.

9.—**A Funeral Benefit** of $50 at death of a member enrolled in Sick and Funeral Benefit Department.

10.—**Social and Fraternal Privileges** of the Court Room.

The Members, the Benefits, and the Surplus

At 31st December Each Year.

Year.	Total Membership.	Benefits Paid.	Total Surplus.	Surplus per Capita.	Death Rate per 1,000.
1881	1,019	$ 1,300 00	$ 4,568 55	$ 4 48	4.50
1882	1,134	12,058 86	2,967 93	2 61	11.00
1883	2,210	9,493 68	10,857 65	4 91	4.73
1884	2,558	13,914 31	23,081 85	9 01	4.23
1885	3,642	26,576 99	29,802 42	8 18	7.76
1886	5,804	28,499 82	53,981 28	9 30	4.85
1887	7,811	59,014 67	81,384 41	10 44	5.78
1888	11,800	89,018 16	117,821 96	9 98	6.43
1889	17,349	116,787 82	188,130 36	10 84	5.85
1890	24,604	181,846 79	283,967 20	11 54	5.18
1891	32,303	261,436 21	408,798 20	12 65	6.40
1892	43,024	344,748 82	580,597 85	13 49	6.25
1893	54,484	392,185 93	858,857 89	15 76	5.47
1894	70,055	511,162 30	1,187,225 11	16 94	5.47
1895	86,521	685,000 18	1,560,733 46	18 03	5.67
1896	102,838	820,941 91	2,015,484 38	19 60	5.50
1897	124,685	992,225 60	2,558,832 78	20 52	5.56
1898	144,000	1,176,125 14	3,186,370 36	22 12	5.67
1899	163,610	1,430,200 33	3,778,543 58	23 09	6.30
1900	180,717	1,545,145 64	4,483,364 44	24 81	6.53

For Further Information Respecting this Great Fraternal Benefit Society, Apply to

Oronhyatekha, M.D., S.C.R., Toronto, Ont. John A. McGillivray, K.C., S.S., Toronto, Ont.

James Marshall, 24 Charing Cross, London, Eng. A. E. Stevenson, 431 E. Sixty-Third St., Chicago, Ill.

Or Any Officer or Member of the Order.

nothing decided in regard to the proposed addition to the trans-Pacific fleet.

The Vancouver News-Advertiser makes a plea for the subsidizing of a steamship service between Vancouver and Skagway. It argues that a Canadian steamship service is an indispensable condition if Canadian goods are to have a fair field in the Yukon. But it is difficult to maintain a Canadian steamship service, in that it is precluded under the U.S. navigation laws from calling at any U.S. port on the way up or down. U.S. vessels monopolize this way-port trade, and Canadian vessels have to depend entirely on the direct trade between the two ports.

The C.P.R. str. Aberdeen, on Okanagan lake, is being given a thorough overhaul, and will not be on her run again until the spring. Her place is being taken by a boat recently constructed in Toronto, shipped in sections and put together on the lake. The new boat, which has been named the York, was given a trial trip at Toronto recently. She is provided with twin screws, and her engines are of sufficient power to drive her 12 miles an hour with 100 lbs. of steam; 13.8 miles with 140 lbs. of steam, and 16 miles an hour with 165 lbs. of steam. The York, as soon as the Aberdeen resumes her run, will be taken to pieces again and transferred to Trout lake, where it is intended she will stay.

Speaking of the relations between the C.P.R. and the Canadian-Australian Steamship Co., R. Kerr, Passenger Traffic Manager of the C.P.R., says:—"We have a traffic agreement with this Co. to handle all its traffic from Vancouver. That Co. is under a contract with the Dominion Government to operate the line. Our agreement is on the same basis as the traffic agreement we make with a connecting railway company. The Canadian-Australian Steamship Co. controls all the business in Australia, New Zealand and Tasmania. Here in Canada and the U.S. we have charge, and we have also control of the business in Great Britain and the continent of Europe coming to Australia by way of Vancouver. The service will be strengthened as the traffic warrants it."

H. Darling, Transportation Manager of the British Yukon Navigation Co., in a recent interview, stated that in the early part of the season all the 15 steamers of the Co. were employed to carry freight from Whitehorse to Dawson, and after the congestion at Whitehorse had been relieved, seven steamers sufficed to keep up with the demand for space. The record trip down to Dawson from Whitehorse was made in 2 days 16 hours, and up to Whitehorse in 32 hours, while freight was delivered in Dawson usually within six days after shipment from Vancouver, B.C. Three of the Co.'s steamers were equipped, during the season of navigation, with cold storage, a cold-storage plant was installed at Skagway, and a through refrigerator service between Skagway and Dawson maintained. It is proposed next summer to test crude oil as a fuel for the steamers.

The coasting trade of Canada for the year ended June 30, 1901, was 34,444,796 tons, and the over sea trade was 26,029,808 tons. There was an increase of 813,000 tons coastwise, but a decrease of 884,287 tons over sea compared with June 30, 1900.

The minimum saloon rate has been reduced to $40, and the minimum 2nd cabin rate to $30. on the transatlantic liners running between Canada and Great Britain, and the companies have curtailed the number of sailings, so that only about half the number of vessels engaged in the trade are now operating.

F. H. Clergue, Sault Ste. Marie, Ont.; Hon. R. Mackay, Hon. A. A. Thibaudeau, G. E. Drummond, W. E. Blumhart, H. Miles. L. E. Geoffrion, Montreal; Hon. L. M. Jones, Toronto; J. R. Booth, Ottawa; and E. V. Douglas, Philadelphia, have been incorporated under the Ontario Companies' Act as the Franco-Canadian Navigation Co., Ltd., with a capital of $1,000,000, with head offices at Sault Ste. Marie, Ont., to carry on a general navigation business.

Tide tables for Halifax, Quebec, St. John, N.B., and Father Point, for 1902, with tidal differences for N.S., the Bay of Fundy, and the gulf and river St. Lawrence, and information on the currents, have been issued in pamphlet form by the Tidal Survey Branch of the Department of Marine. The extended information on the tides and currents of the St. Lawrence dependent upon the tidal differences for Quebec and Father Point is based upon the investigations of the tidal survey in 1900.

E. J. Chamberlin, General Manager of the Canada Atlantic Ry., says the reason why Portland, Me., and Boston, Mass., are attracting increasing grain shipments is because the high insurance on steamers coming to Montreal, causes a scarcity of tonnage. This season the C.A.R. took from Parry Sound 18,000,000 bush. of grain, of which 1,250,000 went to Quebec by the Great Northern Ry., 12,000,000 to Montreal, and the balance to Portland and Boston. The remedy lies in the formation of a Canadian Lloyds, or the subsidizing of a sufficient grain-carrying fleet to trade from Montreal.

The Department of Public Works is having built at the Government dockyard at Sorel, Que., a large sea-going dredge of the most modern type, intended for work in the lower St. Lawrence and the Maritime Provinces. The hull is of steel and will be of about 3,000 tons displacement. It will be self-propelling, so as to go readily from place to place, and its large capacity will enable it to complete many of the minor projects in a comparatively short time. It will be fitted with machinery capable of dredging hard as well as soft material, and will be able to work to a depth of 56 ft. The engines will be of the triple expansion type, aggregating 1,000 h.p., and the dredge will be fitted throughout in the most complete manner. It was designed by A. W. Robinson, of Montreal, consulting engineer to the Department of Public Works.

Among the Express Companies.

The Canadian Ex. Co. has opened an office at Alton, N.S.

The Canadian Ex. Co. has closed its office at Brunner, Ont,

The Canadian Ex. Co. has opened offices at St. Bazile, St. Moise, St. Monique, St. Wencelas and Sayabec, Que.

Invoices for the use of the U.S. customs authorities must be signed with pen and ink, thus prohibiting the use of rubber stamps for endorsements, etc.

The Dominion Ex. Co. has extended its service on the Canadian Northern Ry. from Beaudette, Minn., to Fort Frances, Ont., with offices at Barwick, Brentwood, Emo, Fort Frances, La Vallee, Rainy River, and Stratton.

The Western Ex. Co. has extended its service on the Minneapolis, St. Paul and Sault Ste. Marie Ry's. Missouri river line between Wishek, N.D., and Pollock, S.D., with offices at Venturia, N.D.; Artas, Herrie and Pollock, S.D.

The Canadian Ex. Co. has reported to the Chief Game Warden for Ontario, that it transported 2,372 carcases, representing 236,637 lbs. of venison, during the recent open season for deer. The weight of venison carried in 1900 was 161,312 lbs.

The Dominion Ex. Co. is issuing a new express money order, series E. It is printed on plain white paper, watermarked Dom. Exp. Co.; is much plainer to read, has fewer blanks to be filled up; and by a rearrangement of the check amount on the margin, the jagged edge noticeable in the old form is done away with.

The Canadian Ex. Co. will remove from its present quarters on St. Francois Xavier st., Montreal, to the new G.T.R. general offices on McGill street, when they are completed next spring. The Vice-President and General Manager and his staff will have their offices on the ground floor, and the Co. will also use a portion of the basement.

R. H. Curtis, heretofore chief clerk in the Superintendent's office of the Dominion Ex. Co., at Montreal, has been appointed General Superintendent of the Newfoundland Ex. Co., which is owned by the Reid Newfoundland Co. and operates on that Co.'s railway and steamers. Heretofore the express business of the Reid Newfoundland Co. was operated by the freight department.

The Canadian Ex. Co. has extended its service over the Sydney and Louisburg Ry. A circular issued by Traffic Manager Coyne, of the S. & L. Ry., states that the railway company's baggage masters will act as express agents on the trains and the station agents as express agents at the stations. Offices have been opened at Bridgeport, Caledonia, Dominion, Glace Bay, Louisburg and Morien.

The Canadian and the Dominion Ex. Co.'s and all U.S. express companies, have discontinued the use of transfer envelopes for C.O.D.'s and collections received from or transferred to connecting companies, and in their place the original envelopes are forwarded through to destination with their contents, to facilitate the work at transfer points, to avoid delays in preparing fresh invoices, and to avoid loss through instructions being incorrectly transcribed from the original invoices.

At the recent annual meeting of the Canadian Manufacturers' Association the following resolution was passed on motion of J. P. Murray, of Toronto, and referred to the Railway and Transportation Committee to be carried forward to the Government: "Whereas, the present ocean steamship service being most inadequate for carrying the freight of Canadian industries from Canadian ports to its destination across the sea; and whereas the Governments of Canada have expended very large sums of money, given away extensive tracts of land and granted great privileges in the building of railways and canals necessary to bring freight to tidewater; and whereas Canadian ports are suffering for want of a satisfactory ocean freight carrying service, be it resolved that the Canadian Government be memorialized to give such encouragement, whether by bonus on tonnage or otherwise, to the building in Canada of ocean steamships as shall warrant capital entering into this industry."

Telegraph and Cable Matters.

The Commercial Cable Co. has declared its usual quarterly dividend of 1¾%, together with a bonus of 1%, payable Jan. 2.

The contract for the building of 75 miles of telegraph line from Alberni, B.C., to Clayoquot, has been awarded by the Minister of Public Works to T. D. Conway for $6,400.

Suggestions are being freely made for installing apparatus for wireless telegraphy on board steamers on the great lakes, with a view of their being kept in touch with the shore during their trips.

The U.S. cable between Skagway and Juneau, Alaska, which was laid in Aug., 1901, was only in operation a few days before it broke. The cable was 124 miles in length, and was laid in three days. Repairs are being made.

The Commercial Pacific Cable Co. has awarded the contract for the first section of its cable from San Francisco to Honolulu, to the Silvertown (Eng.) Cable Manufacturing Co. From Honolulu the cable will be extended to Manila.

An additional 1,000 miles of wire is being strung on the western sections of the C.P.R. telegraph lines. This addition will take place mainly on the Western Manitoba lines, and the new heavy wire being strung through to Nelson via the Crow's Nest Pass.

The Commercial Cable Co. has completed the laying of its fourth cable between the U.S. and England, the route followed by this one being from New York, via the Azores Islands, to Waterville, Ireland. All the other cables are landed in America at Canso, N.S.

The Telegraphers' Union wishes to have a minimum of $50 a month fixed as the wages of telegraphers employed by the railway companies in Canada, and is reported to be making a move in that direction. The C.P.R. now pays a minimum of $45, and the G.T.R. $38 a month. The I.C.R. is also lower than the C.P.R.

A cable has been laid across the Detroit river by the Postal Telegraph Co., between Windsor and Detroit, the Canadian end being just below the Michigan Central Ry. Co.'s slip. The cable is 3,000 ft. long, and weighs 20 tons. This cable is part of the Postal Telegraph Co.'s new circuit to connect New York with San Francisco.

Andrew Carnegie, who is an old telegrapher, has suggested that a pension fund for telegraphers should be started, and promises to give a considerable sum as a nucleus if a satisfactory scheme can be arranged. He also purposes to found a town in New Jersey where telegraph operators can acquire homes for themselves on easy payments.

The total length of the Dominion Government telegraph line from Quebec to Chateau Bay is 1,840 miles, of which 340 miles were built in 1901. It was rushed forward in order to have it completed by the time the cable across the Strait of Belle Isle was laid, and, consequently, may have to be strengthened to withstand heavy winter weather.

The cable across Northumberland strait, connecting Prince Edward Island with the mainland, owned by the Anglo-American Cable Co., broke early in Dec., and the telegraph steamer Minia is overhauling it. The cable was one of the first laid on the continent. An effort is being made to have a wireless telegraph apparatus installed between Cape Traverse, P.E.I., and Cape Tormentine, N.B.

During the construction of the Dominion Government telegraph line to the Yukon, considerable opposition was offered to the laying of the "medicine wire" by the Indians. One of their main grievances against the line was that the wire was strung over the totem poles and the graveyards, but all difficulties were got over by giving the natives a few shocks, which made them determined to let the line alone.

Reports of continued interruptions in the Yukon telegraph line between Ashcroft, B.C., and Dawson, Yukon, continue to arrive. An officer of the line says this is accounted for by the heavy falls of snow and rain, followed by frost, which prevail before the regular winter sets in. The strain of this on the wire is too great, causing breaks; and the drifts along the trail prevent the men getting out to make repairs as promptly as they should do.

A temporary land-cable telegraph line is being laid from Fort Egbert, on the International boundary between Yukon and Alaska, 91 miles from Dawson, to Valdez, Alaska, by the U.S. authorities. At Fort Egbert connection will be made with the Dominion Government telegraph line from Ashcroft, B.C. It is intended to string a permanent wire next spring.

The charges for commercial messages to Dawson, Yukon, by the Dominion Government line are $5.50 for 10 words from Toronto, the C.P.R. receiving $1 for sending the message to Ashcroft, B.C., and the Government $4.50 for transmitting over the line to Dawson. The Toronto Globe says:—"This tariff would certainly appear to be open to revision," and suggests that a rate of $2 for 10 words would be ample. The Government should act on the suggestion of its chief organ.

W. Marconi's experiments with his wireless telegraphy in Newfoundland, have resulted in his obtaining signals from his station at the Lizard, Cornwall, Eng., a distance of 1,700 miles. Balloons were used to suspend the vertical wire, at a height of about 800 ft., and a special code of signals had been agreed on to be used at a given time, which signals were received at intervals by Mr. Marconi. The inventor will return to England to further improve his apparatus in the light of the discoveries made. The Anglo-American Telegraph Co., which has a monopoly of cable privileges in Newfoundland until 1904, has, it is reported, applied for an injunction preventing Mr. Marconi from proceeding any further with his experiments on the island, as his invention is likely to interfere with its rights. Pending a settlement of this question, further experiments will be made from a point in Nova Scotia.

General Telephone Matters.

The Valley Telephone Co., Wolfville, N.S., has increased the rental of telephones from $15 to $20.

It is stated that the high charges proposed to be made by the British post-office department for the use of the new telephone service being installed in London, is developing great opposition.

The Marysville, B.C., Townsite and Development Co., recently incorporated under the B.C. Companies' Act, has among its various other powers the right to operate a telephone system.

The New Brunswick Telephone Co.'s long distance line between St. John and St. Stephen, N.B., about 100 miles, was completed Nov. 21. It follows the main road from St. John to Lepreaux, and thence is carried along the shore.

The Eastern Telephone Co. is building a new exchange on Pitt street, Sydney, N.S., to replace the one recently burned. It is to be a three story building, with the general offices on the second floor and the operating room on the third.

A number of Buffalo, N.Y., men, describing themselves as the Ontario Telephone Co., purpose making another application to the Toronto city council for a franchise to enable them to install an independent telephone system in that city.

Recent experiments made with the loud-speaking telephone have demonstrated that it can be successfully used on board vessels even in the most violent storm, and instruments are being placed on board most of the vessels of the German navy.

Counsel has advised the St. John, N.B., corporation that the New Brunswick Telephone Co. has not the right under its charter to lay underground conduits, and a committee was instructed to arrange with the Co. for the laying of these conduits on the basis of the granting of 10 free telephones for the use of the city offices.

The Bell Telephone Co. has arranged to give Wingham, Ont., an all-night service, and has arranged with the town council to furnish a telephone fire alarm system. An instrument will be placed in the house of each fireman, the chief of the brigade, the chief of police, and in the town hall, all of which will be called up simultaneously in case of fire.

In connection with the figures recently published showing the number of telephones in use in Toronto and various U.S. cities, it is pointed out that at Neepawa, Man., there are 129 telephones to a population of 1,418, or 1 telephone to each 11 inhabitants. The rates at Neepawa are $20 for a business and $10 for a house telephone a year. The system is operated by the municipality.

An underground conduit system is being laid in Sydney, N.S., by the Eastern Telephone Co. from the new exchange in Pitt Street. Work on the branch conduits will be commenced in the spring, and it is expected that by the end of the year there will scarcely be a telephone pole left in the city. J. D. Briggs, of the Nova Scotia Telephone Co., Halifax, N.S., is in charge of the work.

The Nova Scotia Telephone Co. is promoting the installation of long distance telephones in Halifax, and is making certain increases of rates in consequence. The house rate where the occupant has not also a business telephone is increased $2 a year; the business rate for the new telephones is $5 a year extra; but no charge is to be made for the new equipment to those who have both business and house telephones.

The Bell Telephone Co.'s charges in Ottawa have been $40 for an office telephone and $30 for a house connection, or $25 a year for the latter on a 3 year contract. A $5 a year increase is being charged on both house and office connections, and a reduction of $5 a year is given to those using the two instruments who sign a three years' contract. The Co. claims it has the right to make this increase as it has installed a metallic service.

The Rat Portage town council sought to have G. A. McCrossen, manager of the Citizens Telephone and Electric Co. of that town committed to jail for refusing to answer certain questions relating to the value of the Co.'s property and its profits, in connection with the town council's action against the Co. to prevent it increasing rates. The court decided against the corporation, and on appeal to the divisional court this decision was upheld.

The Nova Scotia Telephone Co. has secured the consent of the New Glasgow council to erect poles on certain streets for the purpose of extending its long distance wires through to the Strait of Canso, where connection will be made with the long distance line to be built by the Eastern Telephone Co. from Sydney. J. A. Winfield, acting manager of the N.S.T. Co., says the work of construction will be commenced in the spring and will be completed by the summer.

In connection with the telephone installation on the C.P.R. Royal train it may be noted that the Pennsylvania Rd. recently equipped with telephones an inspection train for a trip over its line, one instrument being in the President's car, and the other in the directors' car. A useful development of this idea would be to have a telephone connection between the cars and the driver, and between the train and the town system during stops at stations. The steamers of the French-Transatlantic line are all equipped with telephones, and while they are lying at the wharves in New York and Havre, connection is made with the city systems.

The Purchasing Agents' Guide

To the Manufacturers of & Dealers in Steam & Electric Railway, Steamship, Express, Telegraph & Telephone supplies, &c.

Accident Insurance
Travelers' Insurance Co.....Montreal

Aerated Waters
E. L. Drewry.....Winnipeg.

Air Brakes & Fittings
Westinghouse Mfg. Co.....Hamilton, Ont.

Ales
E. L. Drewry.....Winnipeg.

Anchors
Rice Lewis & Son.....Toronto.

Axles
Rhodes, Curry & Co.....Amherst, N.S.

Babbit
Rice Lewis & Son.....Toronto.

Blankets & Bedding
The Hudson's Bay Company.....

Block & Tackle
Rice Lewis & Son.....Toronto

Boat Fittings & Hardware
Rice Lewis & Son.....Toronto.

Boiler Covering
Mica Boiler Covering Co.....Montreal.

Boilers
Polson Iron Works.....Toronto.

Bolts
Rice Lewis & Son.....Toronto.

Brake Shoes
F. E. Came.....Montreal.

Bridge Numbers
Acton Burrows Co.....Toronto.

Buckets
Rice Lewis & Son.....Toronto.

Cables, Electric
The Wire and Cable Co.....Montreal.

Carpets
The Hudson's Bay Company.....

Cars
Rhodes, Curry & Co.....Amherst, N.S.

Car Wheels
Rhodes, Curry & Co.....Amherst, N.S

Castings
Rhodes, Curry & Co.....Amherst, N.S.

Chains
Rice Lewis & Son.....Toronto.

Cross Arms, Top Pins & Side Blocks
The Firstbrook Box Co.....Toronto.

Curtains
The Hudson's Bay Company.....

Cuts
Acton Burrows Co.....Toronto.

Door Signs
Acton Burrows Co.....Toronto.

Dry Goods
The Hudson's Bay Company.....

Electric Car Route Signs
Acton Burrows Co.....Toronto.

Electric Trucks
Baldwin Locomotive Works..Philadelphia, Pa.

Electric Wires
The Wire and Cable Co.....Montreal.

Enameled Iron Signs
Acton Burrows Co.....Toronto.

Engines, Stationary & Marine
Polson Iron Works.....Toronto.

Engraving
Acton Burrows Co.....Toronto.
Toronto Engraving Co.....Toronto.

Express Office Signs
Acton Burrows Co.....Toronto.

Fencing
Page Wire Fence Co.....Walkerville, Ont.

Ferry Signs
Acton Burrows Co.....Toronto.

Flags
Rice Lewis & Son.....Toronto.
The Hudson's Bay Company.....

Foghorns
Rice Lewis & Son.....Toronto.

Furniture
Office Specialty Mfg. Co. Toronto & Montreal.

Gates
Page Wire Fence Co.....Walkerville, Ont.

General Supplies
The Hudson's Bay Company.....

Grain Elevators
John S. Metcalfe Co.....Chicago, Ill.

Groceries
The Hudson's Bay Company.....

Half Tones
Acton Burrows Co.....Toronto.

Hand & Push Cars
F. E. Came.....Montreal.

Hardware
Rice Lewis & Son.....Toronto.
The Hudson's Bay Company.....

Headlights
N. L. Piper Railway Supply Co.....Toronto.

Hose
Rice Lewis & Son.....Toronto.

Illustrations
Acton Burrows Co.....Toronto.

Iron
Rice Lewis & Son.....Toronto.

Iron Signs
Acton Burrows Co.....Toronto.

Japans
McCaskill, Dougall & Co.....Montreal.

Lager Beer, &c.
E. L. Drewry.....Winnipeg.

Lamps & Lanterns
The Hudson's Bay Company.....
Rice Lewis & Son.....Toronto.
N. L. Piper Railway Supply Co.....Toronto.

Launches
Polson Iron Works.....Toronto.

Life Insurance
Independent Order of Foresters.....Toronto.
Travelers' Insurance Co.....Montreal.

Linoleum and Floor Coverings
The Hudson's Bay Company.....

Locomotives (Compressed Air)
Baldwin Locomotive Works..Philadelphia, Pa.

Locomotives (Electric)
Baldwin Locomotive Works..Philadelphia, Pa.

Locomotives (Steam)
Baldwin Locomotive Works...Philadelphia, Pa.
Canadian Locomotive Co.....Kingston, Ont.

Locomotives (Rack)
Baldwin Locomotive Works..Philadelphia, Pa.

Lubricators
Rice Lewis & Son.....Toronto.

Machine Tools
John Bertram & Sons Co.....Dundas, Ont.

Matches
The Hudson's Bay Company.....

Milepost Numbers
Acton Burrows Co.....Toronto.

Mohair
The Hudson's Bay Company.....

Numbers
Acton Burrows Co.....Toronto.

Oakum
Rice Lewis & Son.....Toronto.
The Hudson's Bay Company.....

Oils
Galena Oil Co.....Franklin, Pa.
The Imperial Oil Company.....
The Queen City Oil Company.....Toronto.
Signal Oil Company.....Franklin, Pa.

Office Signs
Acton Burrows Co.....Toronto.

Pipe Covering
Mica Boiler Covering Co.....Montreal.

Plushes
The Hudson's Bay Company.....

Pneumatic Tools
F. E. Came.....Montreal.

Porter
E. L. Drewry.....Winnipeg.

Portland Cement
Rice Lewis & Son.....Toronto.

Printing
The Hunter, Rose Co.....Toronto.
The Mail Job Printing Company.....Toronto.

Pumps
Rice Lewis & Son.....Toronto.

Rails (New)
James Cooper.....Montreal.
J. J. Gartshore.....Toronto.
Rice Lewis & Son.....Toronto.

Rails (for relaying)
James Cooper.....Montreal.
J. J. Gartshore.....Toronto.

Rail Saws
F. E. Came.....Montreal.

Rope
Rice Lewis & Son.....Toronto.
The Hudson's Bay Company.....

Scales
The Gurney Scale Company....Hamilton, Ont.

Semaphore Arms
Acton Burrows Co.....Toronto.

Shafting
Rice Lewis & Son.....Toronto.

Shipbuilders' Tools & Supplies
Rice Lewis & Son.....Toronto.

Ships
Polson Iron Works.....Toronto.

Shovels
James Cooper.....Montreal.
The Hudson's Bay Company.....
Rice Lewis & Son.....Toronto.

Signal House Numbers
Acton Burrows Co.....Toronto.

Signals
N. L. Piper Railway Supply Co.....Toronto.

Signs
Acton Burrows Co.....Toronto.

Snow Ploughs
Rhodes, Curry & Co.....Amherst, N.S.

Spikes
Rice Lewis & Son.....Toronto.

Station Name Signs
Acton Burrows Co.....Toronto.

Steamboats
Polson Iron Works.....Toronto.

Steamboat Signs
Acton Burrows Co.....Toronto.

Steam Shovels
James Cooper.....Montreal.

Steel
Rice Lewis & Son.....Toronto.

Steel Castings
F. E. Came.....Montreal.

Switch Targets
Acton Burrows Co.....Toronto.

Switches
F. E. Came.....Montreal.

Telegraph and Telephone Wires
The Wire and Cable Co.....Montreal.

Telegraph Office Signs
Acton Burrows Co.....Toronto.

Telephone Office Signs
Acton Burrows Co.....Toronto.

Tobacco and Cigars
The Hudson's Bay Company.....

Toilet Paper
The Hudson's Bay Company.....

Tools
Rice Lewis & Son.....Toronto.

Track Jacks
Duff Manufacturing Co.....Allegheny, Pa.
A. O. Norton.....Coaticook, Que.

Track Tools
F. E. Came.....Montreal.
James Cooper.....Montreal.
Rice Lewis & Son.....Toronto.

Tramway Equipment
J. J. Gartshore.....Toronto.

Trucks
Rice Lewis & Son.....Toronto.

Varnishes
McCaskill, Dougall & Co.....Montreal.

Vessels
Polson Iron Works.....Toronto.

Waste
Rice Lewis & Son.....Toronto.
N. L. Piper Ry. Supply Co.....Toronto.
The Queen City Oil Co.....Toronto.

Wheelbarrows
James Cooper.....Montreal.
Rice Lewis & Son.....Toronto.

Window Blinds
The Hudson's Bay Company.....

Wines and Liquors
The Hudson's Bay Company.....

Wire & Wire Rope
Rice Lewis & Son.....Toronto.
The Wire and Cable Co.....Montreal.

Yachts
Polson Iron Works.....Toronto.