PAGES

MISSING

The Canadian Engineer

WEEKLY

ESTABLISHED 1893

VOL. 17. TORONTO, CANADA, NOVEMBER 12th, 1909. No. 19

The Canadian Engineer

ESTABLISHED 1893.

Issued Weekly in the interests of the

CIVIL, MECHANICAL, STRUCTURAL, ELECTRICAL, MARINE AND MINING ENGINEER, THE SURVEYOR, THE MANUFACTURER, AND THE CONTRACTOR.

Editor—E. A. JAMES, B.A. Sc.

Business Manager—JAMES J. SALMOND

Present Terms of Subscription, payable in advance:

Canada and Great Britain:		United States and other Countries:	
One Year - -	$3.00	One Year - -	$3.50
Six Months - -	1.75	Six Months - -	2.00
Three Months -	1.00	Three Months -	1.25

Copies Antedating This Issue by Two Months or More, 25 Cents.

ADVERTISEMENT RATES ON APPLICATION.

HEAD OFFICE: 62 Church Street, and Court Street, Toronto
TELEPHONE, Main 7404 and 7405, branch exchange connecting all departments.

Montreal Office: B33, Board Trade Building. T. C. Allum, Editorial Representative, Phone M 1001.

Winnipeg Office: Room 315, Nanton Building. Phone 8142. G. W. Goodall, Business and Editorial Representative.

London Office: 225 Outer Temple, Strand, T. R. Clougher, Business and Editorial Representative, Telephone 527 Central

Address all communications to the Company and not to individuals.

Everything affecting the editorial department should be directed to the Editor.

NOTICE TO ADVERTISERS

Changes of advertisement copy should reach the Head Office by 10 a. m. Monday preceding the date of publication, except the first issue of the month for which changes of copy should be received at least two weeks prior to publication date.

PRINTED AT THE OFFICE OF THE MONETARY TIMES PRINTING CO., LIMITED, TORONTO, CANADA.

TORONTO, CANADA, NOVEMBER 12, 1909.

CONTENTS OF THIS ISSUE.

Editorials:

Status of the Engineering Profession 527
U. S. October Iron Output 527
Intercolonial Railway 528

Leading Articles:

Permanent Way of British Railways 529
Asphaltic Specifications 537
Problems in Applied Statics 540
Lightning Protection 542
Montreal Street Railway Co.'s Annual Report 541

Sanitary Review:

Treatment of Waters Polluted by Vegetable Growths 534
Separation of Solids from Sewage 534
Engineers' Library 518
Society Notes 528
Railway Orders 533
Railway Earnings 549
Construction News 550
Market Conditions 554
Engineering Societies 548

THE STATUS OF THE ENGINEERING PROFESSION.

During the past few months the British engineering journals have devoted columns to this question. Every gathering of engineers has taken time to discuss the shortcomings of the profession. Co-operation, legislation, Government examination and a closed corporation have all been urged as a solution for the real difficulties that face members of the engineering profession.

The function of the engineer covers so wide a field, from power supply to waterproofing of cement, from the purification of water supply to erecting a railroad bridge, from erecting wireless telegraph stations to designing seawalls, the interests of engineering are so diverse that reconciling and marshalling under one organization, directed by a common law and common custom will be an immensely difficult task.

In Canada, to-day, anyone may call himself an engineer without incurring any risk if he fails to possess adequate qualifications. If he has enough commercial sense and talent for organization he may easily secure the commission for large engineering work, knowing well that for small pay he can engage men of high scientific and professional attainments to work out the details. When he does this, little is heard of the venture, but the practice has grown, and now men without either engineering knowledge or the business sense to surround themselves with competent men accept work they are not fitted for. Following this is disaster. Money is wasted and the profession held up to ridicule, and everyone feels competent to criticize the engineer.

The authority of the nurse, the dentist, the doctor, or the lawyer is never questioned. They say "do this," and we do it, never doubting. But because of the failures of those calling themselves engineers the non-technical official does not hesitate to override the opinion of competent engineers.

Some day this may be remedied in part by legislation, but until that day does come the engineering societies of Canada should consider their combined duty to protect the genuine members of the profession and expose the promoter who calls himself an engineer. Money spent in exposing fake schemes and unprofessional conduct would bring good returns.

UNITED STATES OCTOBER IRON OUTPUT.

Remarkable as was the September output of iron in the United States, according to the "Iron Age" the October output will far surpass it.

The steel companies produced 1,766,162 tons in October, or 56,973 tons a day against an average of 55,361 tons in September. The merchant furnaces increased their daily rate of 24,146 tons in September.

All this means an increased activity in the foundries, rolling mills, pipe and rail mills.

A general advance in prices is looked for.

THE INTERCOLONIAL RAILWAY.

It is unfortunate that protest is being made against the new management of this road, which, for so many years, has been handled more as a political toy than a commercial enterprise.

For the twelve months ending March 31st last the Working expenses were $9,328,021
Revenue 8,527,069

Loss on operation was ..... $ 800,952

Or, in other words, it cost $1.09 to earn $1.00.

The road connects Montreal with some of the best country to the south and east, and all the way to Halifax runs through a district that is revenue producing.

The old order must not be restored. It is now free from political interference, and there is every reason to expect that the present management will operate it as a railroad existing for and by traffic.

EDITORIAL NOTES.

The Grand Trunk Pacific Railway (National Transcontinental) from Winnipeg to Superior Junction was opened on November 6th by the passing over the line of an official train.

* * * *

The C.P.R. Western Division claims the record for rapid freight car despatching. Recently a freight car was loaded at Lauder, Man., shipped to Fort William, unloaded, sent back to Lauder, loaded, and again hauled to Fort William, in six days making three trips and 1,785 miles.

* * * *

In view of the frequent discussion about the disappearance of Ontario forests, the increased spring run-off and water storage in swamps, etc., the report of the Ontario Bureau of Industries is of considerable interest. The area of land in Ontario is 141,125,120 acres. Referring to the organized districts of Ontario, the assessed acreage is 24,497,406. Of this, 14,132,061 acres are cleared, or 57.69 per cent. Of the remainder, 5,331,654 acres is woodland, 2,273,251 acres slash, and 2,760,440 acres marsh or waste land. Since 1899 the per cent. of cleared land in the assessed districts has increased from 55.91 to 57.69.

To Mr. Acton Burrows, the veteran editor of the "Railway and Marine World," we wish to extend our sympathy in his hour of great bereavement. We cannot see the darkness which he sees nor know the sorrow which he now knows. We do hope that the weeping, lowering clouds may soon pass.

PRECIPITATION FOR OCTOBER.

In British Columbia the precipitation recorded during October was generally in excess of the average. This was also the case in Eastern Quebec and the Maritime Provinces, exclusive of Southwestern Nova Scotia, where the normal value was not reached. Throughout the remaining districts of Canada, the fall, with local exceptions, was less than average, the deficiency being particularly marked in the Western Provinces where the amount was about half the average.

The table shows for fifteen stations included in the report of the Meteorological Office, Toronto, the total precipitation of these stations for the month.

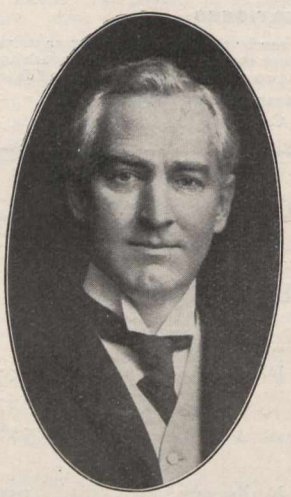
Ten inches of snow is calculated as being the equivalent of one inch of rain.

Station.	Depth in inches.	Departure from the average of twenty years.
Calgary, Alta.	0.60	+ 0.12
Edmonton, Alta.	0.30	— 0.41
Swift Current, Sask.	0.30	— 0.45
Winnipeg, Man.	0.50	— 1.11
Port Stanley, Ont.	1.20	— 1.68
Toronto, Ont.	1.14	— 1.29
Parry Sound, Ont.	4.40	+ 0.52
Ottawa, Ont.	1.10	— 1.47
Kingston, Ont.	2.10	— 0.64
Montreal, Que.	0.90	— 2.26
Quebec, Que.	2.20	— 0.98
Chatham, N.B.	6.20	+ 2.43
Halifax, N.S.	7.10	+ 1.59
Victoria, B.C.	2.30	+ 0.07
Kamloops, B.C.	0.50	+ 0.04

SOCIETY NOTES.

ENGINEERING SOCIETY FACULTY OF APPLIED SCIENCE, TORONTO UNIVERSITY.

At the last regular meeting of the Engineering Society of the Faculty of Applied Science, Toronto University, Mr. T. Kennard Thomson, M. Can. Soc. C.E., and a graduate of the class of '86, addressed the members on "Foundations for High Buildings." Mr Thomson said in part, when referring to the clearing of the ground:—



T. Kennard Thomson, M. Can. Soc. C.E.

The usual practice is to sell the old buildings to house-wreckers for a small amount, the wrecker selling as much of the material as possible at second-hand. In many of the old five or six-storey buildings the salvage value does not amount to much, while some of the newer buildings have a considerable number of iron beams and columns which bring good prices. On the other hand, in the old buildings which were put up with lime mortar many of the bricks can be removed and used over again; while in the more recent buildings, laid with Portland cement mortar, the bricks are almost entirely destroyed in the removal, that, too, being accomplished at a great expense.

In connection with difficulties in caisson work, he mentioned that in small caissons the weight of the air lock is a very considerable item, and, therefore, it is very important to have the shaft truly vertical in order to have the weights concentric with the caisson to prevent the caisson from getting out of plumb, and this is much more difficult than might be supposed, for in the first place the shafts are not always absolutely true, and are not always perpendicular to the deck when bolted on, and then hemp or other kinds

of gaskets are used at the joints, permitting, sometimes, one side to be bolted a little tighter than the other, throwing the whole out of line.

Many interesting slides were shown in connection with his work in New York, and particularly the Manhattan Life Building.

The following is the proportion of the actual cost of the various items on this building, the contractor's profit and loss item, for obvious reasons, being proportionate to each item:—

	Per cent.
Labor at site	41.6
Lumber	3.3
Fuel and oil	1.6
Hauling	5.5
Cement	6.3
Crushed stone	2.9
Sand	1.0
Steam and electricity	2.3
Supplies	6.2
General expense	.8
Shafting, etc.	2.3
Waterproofing	3.1
Caisson material and labor	23.1
	100.0

Summing the work up, we get the following proportions:—

	Per cent.
Caisson work	75.8
Excavating cellar, etc.	11.4
Concreting floor	2.1
Concreting cantilever and grillages	2.1
Waterproofing	3.1
Extra work	5.5
	100.0

* * * *

Engineers' Club of Toronto

At the meeting held last Thursday evening, Mr. A. B. Barry, president of the Club presided. The question of changing the Constitution with a view to admitting to associate membership, men who are not engineers by profession, but whose pursuits qualify them to co-operate with engineers in the advancement of professional knowledge, was discussed at some length, and the meeting finally decided to let the matter stand in abeyance until the annual meeting. A proposed amendment to clause 8, having reference to increasing the annual dues for resident members from $5 to $7.50, was also postponed. Suggestions for making the meetings more interesting were made and considered, and sundry other business transacted. Mr. Chas. B. Fox, M. A., of Wragge & Fox, civil engineers, Toronto, was admitted to membership.

* * * *

On Thursday evening, November 4th. Professor Nobbs, of McGill University, delivered an interesting lecture before Montreal members of The Canadian Society of Civil Engineers, on "The Aesthetics of Design."

Eleven persons on the average have been injured daily and one person has been killed every other day for the last three months by the Chicago street cars.

THE SERVICEABLE LIFE AND COST OF RENEWALS OF PERMANENT WAY OF BRITISH RAILWAYS.*

By R. Price-Williams (London).

Mr. Richard Price-Williams was born at Stoke Newington, London, and educated at a school at Bridgend, where he had a schoolfellow the late Sir James Douglas, the eminent engineer to the Trinity House, who constructed the Eddystone Lighthouse. Among the important posts held by Mr. Price-Williams was that of manager and constructor of Fox & Company's Bessemer steel rail works near Sheffield, and subsequently manager and part constructor of Bessemer Brothers' works at Greenwich. He served his pupilage under the late George Heald, M. Inst. C.E., and afterwards served as an apprentice at Kitson's locomotive works at Leeds. Subsequently he became a consulting engineer, designing and preparing plans, sections and estimates for the construction of the Metropolitan Outer Circle Railway and of the London & Eastbourne Railway. Later he was engaged in surveying and preparing plans and estimates for the construction of the Midland of Western Australia Railway from Perth to Geralton. Mr. Price-Williams was appointed by the Royal Commission on the Coal Supplies, in 1871, to prepare estimates of their duration, and retained by the recent Royal Coal Commission to prepare and give evidence on the same subject. He is a member of the Institution of Civil Engineers, and many years Member of Council of the Institution of Mechanical Engineers; Fellow, and for many years Member of Council, of the Royal Statistical Society; author of papers read at the Royal Statistical Society on the "Coal Question," and on the "Population of England and Wales," (1801-81); "Population of London," (1801-81); and on the "Railway Rates and Charges Acts of " 1896; also of papers on the maintenance and renewals of permanent way, rolling stock and waterworks, for each of which he was awarded a Telford (1866), (Watt 1870), George Stevenson (1902), Gold Medal by the Institution of Civil Engineers, and awarded in 1898 the Bessemer Gold Medal at the special request of Sir Henry Bessemer.

According to the Board of Trade Railway Returns (1907) there are, roundly speaking, a little over 23,000 miles of railway open for traffic in the United Kingdom, of which about 13,500 miles consist of double and more lines, and about 10,250 miles of single lines, besides which there are 14,000 miles of sidings. The total annual cost of the maintenance and renewal of the permanent way and works amounted to, roundly, eleven millions sterling, nearly 15 per cent. of the entire working expenses, which have now and for some years past reached the exceptionally high figure of nearly two-thirds (63 per cent.) of the entire railway gross receipts.

In this paper the cost of the maintenance and renewals of the permanent way of fifteen of the principal British railways, having an aggregate of 15,184 miles of railway (equivalent to about 80 per cent. of the total mileage of the railways in Great Britain), will alone be dealt with, particulars of which expenditure have been furnished during the last ten years in some valuable tables in the C Appendix to the Board of Trade Returns. From these have been obtained the data from which the results in Table V. in this paper have been compiled, giving in the case of each of these fifteen railways the expenditure in each year in wages and material, in the renewals of the permanent way, and also the average annual cost of renewal in terms per mile of railway

*Read at the Iron and Steel Institute, Great Britain.

considered—as a railway must necessarily be, whether a double or single line—as a thoroughfare for the conveyance of railway traffic. From a reference to the table in question, it will be seen that the average cost of renewals per mile varies from an average maximum of £418.18 per mile during the ten years, in the case of the London, Brighton, and South Coast Railway, to a minimum of £190.80 per mile in the case of the North British; while the tonnage of goods and minerals per mile in the latter case is just double that of the London, Brighton, and South Coast. In another case, that of the Lancashire and Yorkshire Railway, with a maximum tonnage of 41,678 tons per mile of goods and mineral traffic, the average annual cost of renewals is only £291.07 per mile, very little above the average. Again, in the case of the London and North-Western, with the large tonnage of goods and minerals of 26,493 tons per mile, the average cost of renewals is as much as £335.95 per mile, as compared with the North-Eastern Company's average of only £236.26 per mile, with its heavy tonnage of 36,004 tons per mile of goods and minerals. Next comes the London and South-Western, with its average cost of renewals much above the average—namely, £319.47 per mile, with the smallest average of 6,735 tons per mile. It is clear, therefore, that we must look for something more than the mere weight of tonnage to account for the exceptionally large cost of renewals of the permanent way of some of the principal British railways, and there is everything to indicate that it is mainly due to the greatly increased weight and speed of the passenger traffic which has occurred since the introduction of the better and much more durable material of steel rails, and partly to the increased weight and speed of the goods and mineral traffic. In this connection it will be as well to advert to the cost of the maintenance and renewal of the permanent way at the period almost immediately preceding the first introduction of Bessemer steel rails in the early 'sixties, particulars of which were furnished to the author by the chief executive of nine of the principal British railway companies at the time of the reading of his paper on the "Maintenance and Renewal of Permanent Way" at the Institution of Civil Engineers in 1866, a copy of which statement is given in the accompanying Table I. Side by side with this is given, for

Table I.—Maintenance and Renewals of Permanent Way of Nine Principal British Railways.

Railway.	1847 to 1865. Average Miles Open.	1847 to 1865. Amount of Renewals.	1847 to 1865. Average Cost per Mile.	1865 to 1875. Average Cost per Mile.	1897 to 1906. Average Miles Open.	1897 to 1906. Cost in Ten Years.	1897 to 1906. Average Cost per Mile.
L. & N. W.	755.6	1,906,859	253.36	307.53	1933.4	6,495,262	335.95
N. Eastern	662.0	867,576	131.05	232.01	1658.9	3,918,235	236.26
Midland	546.6	775,750	141.92	311.26	1455.3	5,165,796	354.96
L. & S. W.	315.6	288,661	93.59	254.41	921.5	2,943,896	319.47
Gt. Northern	276.6	392,992	141.57	299.88	928.8	2,203,875	265.91
Lanc. & Yorkshire ..	255.4	768,924	301.07	397.07	465.2	1,645,094	291.07
S. Eastern & Chatham	248.8	430,099	173.23	257.05	*618.4	2,131,896	344.74
L., B. & S. C.	180.6	219,514	121.51	239.33	448.6	1,875,982	418.18
M. S. & L. & Gt. Central	160.2	85,760	53.53	271.29	500.7	1,721,845	318.39
Total and Averages ..	3401.4	5,796,135	170.40	285.53	8930 8	28,101,881	314.66

the purpose of comparison, the average annual expenditure and cost per mile of the renewals during the first ten years from 1865 to 1875 after the adoption, or partial adoption, of steel rails, and also of the present cost of the renewal expenditure of these nine railways as obtained from the returns of the fifteen British railways alluded to.

The total cost of the renewal of these nine principal railways with iron rails during the eighteen and a-half years prior to 1865, with an average aggregate of 3,401 miles of way, only amounted to £5,796,135, and to an average of £170.40 per mile of way. It rapidly increased during the first ten years, after the first partial introduction of steel rails, to £285.53 per mile, partly owing, no doubt, to the high price then of steel rails. Notwithstanding the great subsequent reduction in the price of steel rails to a lower figure than even the best iron rails, the expenditure in the renewal of way on these nine principal railways has, however, now reached an amount of £28,101,881, and £314.66 per mile of railway, during the short space of the last ten years—a fivefold increase in amount and now double the cost per mile in renewals—the mileage of these nine railways having increased from 3,401 to 8,930.

The development of railway traffic since the introduction of steel rails has been enormous, as the few figures given in Table II. testify:—

Table II.—Railways in United Kingdom.

Years.	Miles Open.	Gross Receipts.	Working Expenses.	Net Receipts.	Passengers.	Goods and Minerals.	Carriages and Waggons.
		£	£	£	No.	Tons.	No.
1907	23,108	121,548,923	76,609,194	44,839,729	1,259,481,315	515,887,116	810,416
1860	10,433	27,766,622	13,187,368	14,579,259	163,435,678	89,857,719	195,650
Inc.	12,675	93,782,301	63,421,826	30,260,470	1,096,045,637	426,029,397	614,766

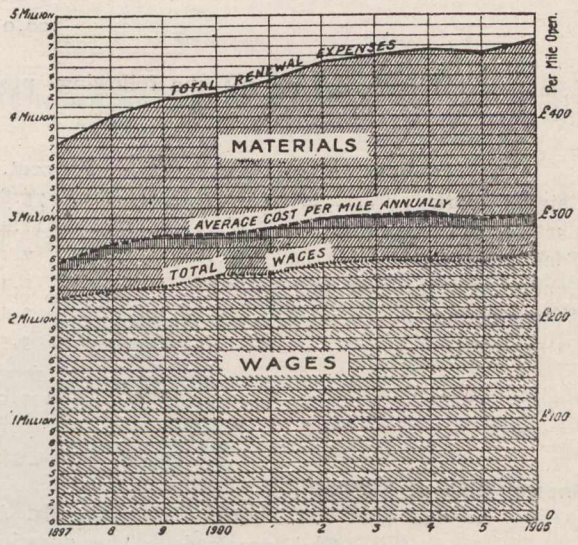


Fig. 1.—Ten Years' Permanent Way Renewals of 15 Principal British Railways.

While the mileage during the last forty-seven years has only a little more than doubled, the working expenses have increased nearly sixfold, the number of passengers carried has increased nearly sevenfold, the tonnage of goods and minerals carried has increased nearly fivefold, while the number of carriages and wagons has only increased threefold; no doubt a considerable portion of the increase of the permanent way expenses is mainly due, as already stated, to the very large increase in the weight and speed of the passenger traffic, and partly to the very large increase in the tonnage of goods and mineral traffic, and also in some degree to its somewhat increased speed.

That the much greater strength and durability of the high-class of steel material of which Bessemer steel is the type, has largely contributed to the exceptionally rapid growth, not only of railway traffic in this country, but of its trade and commerce generally, there can be no question. No more striking recognition of this could better be given than was recently so felicitously afforded by the King in the handsome tribute His Majesty paid to the late Sir Henry Bessemer,

to whose discovery of the process which bears its inventor's name he so justly attributed the remarkable development of engineering industries during the last fifty years.

This exceptionally rapid increase of railway traffic during the period in question, however, was never anticipated, even by the most sanguine believers in the new process, including the author himself, and the effect of it is, it must be admitted, somewhat to discredit the estimates then made of the capability of the steel rails enduring the destructive effects of the wear and tear of the traffic for the long periods of time anticipated. This in no way detracts from the high character of the steel material, which has at least maintained all its fine qualities, and great improvements have since been made in the process of the manufacture, and large reductions in the price of the material.

As the records of the Institute proceedings testify, an intimate knowledge of the constituents of the material has been obtained by chemical analysis; but what in the case of steel rails are conspicuous by their absence in all these analyses are particulars of the physical qualities of the steel, and the amount of the tonnage and of the speed of the trains to which the rails have been subject, together with an exact measure of the wear of the rail-head during a given period.

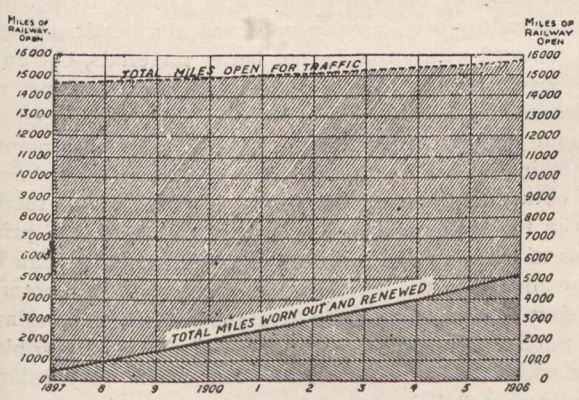


Fig. 2.—Mileage Open of 15 British Railways.

Full information on these points, together with Mr. Riley's chemical analyses and the late Mr. Kirkaldy's physical tests, are given in the author's paper read at the Institution of Civil Engineers in 1866. Several methods have been adopted for ascertaining the amount of wear of the rail-head at an early period, notably that of the late James Price, M. Inst. C.E., by means of a sort of 40-ft. turn-table, the rails of which were subjected to the wear of wheels loaded with given weights rotating at definite speeds round the 40-ft. table, which gave approximately the amount of abrasion of the rail-head and check of the rail on a circular curve. Recently two other very ingenious methods were described in papers read at the Institute—one by Dr. Stanton, and the other by Mr. Saniter; but in none of these cases is any account taken of some of the most destructive effects which rails are subject to in practice, such as that of impact, the oscillations and concussions of the train, particularly on curves, the shearing away of the rail-head metal in flakes, and other effects. The late Professor De Morgan, of London University, stated to the author that in the case of a train travelling at a great speed on a curved line, the oscillations and concussions partook of the character of a projectile fired from a curved cannon, and must be of a most destructive character.

In view of these facts, the author considers that nothing short of the actual experience derived from a careful register of the number, character, weight, and speed of the trains on those portions of a railway most severely worked will suffice to afford the requisite information.

The manufacturers of steel rails, to their great credit, have done all in their power to improve the quality and to increase the durability of the material; it behooves the railway engineer to see that this part of the business is carefully seen to. The result will, in the author's opinion, lead to large economies. No one, however, with any experience of railway working but must admit that the principal railways in this country are maintained in a thoroughly standard condition of efficiency for working the constantly increasing traffic, as is testified by the large annual amount per mile expended on maintenance and renewals.

As already stated, the working expenses of railways in the United Kingdom have now reached the exceptionally high average of nearly two-thirds of the gross receipts, whereas in 1860, the date immediately preceding the introduction of the Bessemer steel rail, the working expenses only amounted to 47 per cent. of the gross receipts, and during the previous twenty years which the author can recall, they had scarcely ever exceeded what in nearly all other great and well-administered commercial undertakings is regarded as the requisite normal expenditure of 50 per cent. It is not the purpose, however, of this paper to deal with this aspect of the question, but it is as well to bear in mind that nearly two-thirds of the total working expenses of these British railways have exclusive relation to the great iron and steel industries which supply most of the material required not only for the permanent way, but for the locomotive stock and large portions

Table III.—Ten Years' Working Expenditure of Fifteen Principal British Railway Companies, (1897 to 1906).

Class of Expenditure.	Wages.	Material.	Totals.	Per Cent.	Average Annually.
Conveyance.					
Maintenance and Renewals—	£	£	£		£
Permanent Way	24,624,096	19,134,177	43,758,273	12.30	4,375,827
Locomotive Stock	21,098,706	19,985,914	41,084,620	11.56	4,108,462
Carriages and Wagons.	17,524,413	26,519,282	44,043,695	12.38	4,404,370
	63,247,215	65,639,373	128,886,588	36.24	12,888,659
Locomotive running and Coal	50,954,022	47,511,494	98,465,516	27.68	9,846,551
	114,201,237	113,150,867	227,352,104	63.92	22,735,210
Traffic Expenses	128,322,469	.....	128,322,469	36.08	12,832,247
	242,523,706	113,150,867	355,674,573	100.00	35,567,457

of the material of the carriage and wagon stock, as will be seen from reference to Table III., all of which are purely engineering matters affecting the cost of conveyance of traffic apart from the question of the administration of a railway.

Permanent Way.

The permanent way of a railway in its widest sense, as the word itself most fittingly betokens, recognises no period of finality for its existence, so long as it continues to be the best available means for the conveyance of passengers, goods, and mineral traffic. It serves as a thoroughfare between different places and centres of traffic, and is equipped with mechanical appliances requisite for the transport of such traffic. The permanent way in this sense does not comprise merely the steel rails, sleepers, cast-iron chairs, points, crossings, and ballast, involving only an annual charge for their maintenance and renewal; but all that is essential to ensure safety and security in the conveyance of passenger and other traffic, the renewal of which, although indisputably constituting the main source of the permanent way working expenses, includes also the renewals or partial renewals rendered necessary by the natural decay of the "works of line," and other structures at much more distant periods; and the variations in the serviceable life of steel rails on different portions of the permanent way, render it impossible to determine the

Table IV.—Fifteen Principal British Railways, Ten Years' Maintenance and Renewal of Permanent Way Expenditure (1897 to 1906). Equivalent Mileage Annually Worn-out and Renewed.

Year.	Miles Open.	Wages.	Per Mile Open.	Materials.	Per Mile Open.	Total Expenditure.	Total Expenditure per Mile Open. Per Annum.	Total Expenditure per Mile Open. In Thirty Past Years.	Equivalent Miles worn out. Col. 7. / Col. 9.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
	£	£	£	£	£	£	£	£	
1897	14,609	2,208,558	151.22	1,520,225	104.09	3,728,783	255.31	7659.30	486.83
1898	14,778	2,279,977	154.34	7,784,453	120.79	4,064,430	275.14	8254.20	492.43
1899	14,811	2,333,775	157.57	1,843,111	124.44	4,176,886	282.01	8460.30	493.70
1900	14,900	2,429,384	163.04	1,794,345	120.42	4,223,729	283.46	8503.80	496.67
1901	15,043	2,434,552	161.84	1,935,507	128.66	4,370,059	290.50	8715.00	501.43
1902	15,095	2,532,418	167.76	1,983,618	131.41	4,516,036	299.17	8975.10	503.17
1903	15,264	2,587,784	169.54	2,021,299	132.42	4,609,083	301.96	9058.80	508.80
1904	15,350	2,586,205	168.44	2,085,832	135.88	4,672,037	304.36	9130.80	511.67
1905	15,527	2,586,584	166.59	2,063,201	132.88	4,649,785	299.47	8984.10	517.56
1906	15,809	2,644,859	167.30	2,102,586	133.00	4,747,445	300.30	9009.00	526.96
Totals and Averages ..	151,186	24,624,096	161.89	19,134,177	126.58	43,758,273	289.47	8684.10	5039.22

serviceable life of the permanent way except in its entirety and considered as a whole. Considered, however, in that sense, the average annual expenditure in maintenance and renewals of the permanent way, in terms per mile of railway, whether it consists of double or single lines, during a sufficiently long period of years, is in reality the real equivalent of the annual death-rate of all classes of the perishable materials which constitute the permanent way of any railway. By way of illustration a period of thirty years may be fixed as a sufficient interval of time to obtain average and reliable results of the destructive effects of the wear and tear of traffic, and of the natural decay and exceptional causes necessitating complete renewal of the materials of all kinds. As will be seen from reference to the figures in Table IV., of the results obtained in the case of the fifteen principal British railways during the last ten years, means are afforded of determining very approximately the equivalent number of miles of permanent way and works of all descriptions which have become worn out and have been required to be renewed, so as to have enabled the permanent way of the particular railway to have been maintained in a thorough condition of efficiency for continuing the ceaseless and constantly increasing traffic of British railways. All, in fact, that is required —with the data now available of the actual annual expenditure per mile of railway of these fifteen railways during the past long period of years in question, taking thirty years as a definite and reasonable maximum limit of serviceable life of all classes of materials, subject to the destructive effects of wear and tear and of decay—is to multiply each year's annual cost of renewals per mile of railway by the past thirty years' fixed period, and to divide the total amount of renewals expenditure during the last ten years by it, and we get the equivalent number of miles of railway—whether double lines or more, or partly double and single, or exclusively single lines, of each of the fifteen railways. In the aggregate this amounts in ten years to 5,039 miles of railway—or, roundly, 504 miles annually—which have become worn out and have been replaced in most, if not all, cases with stronger and better materials, and as the traffic on these railways is still rapidly increasing, it may be satisfactory to the steel-rail manufacturers in this country to know that at least that quantity of worn-out steel rails will have to be simultaneously renewed during a similar period in the future. The permanent way of a railway—in fact, in its entirety, as has already been stated—has perpetual life, and it follows that every portion of it must necessarily share it also.

The late Sir John Hawkshaw, during the discussion on the author's paper in 1866 referred to, admitted that the improvements in the permanent way had not kept pace with the requirements of the rapid growth of railway traffic. It has since certainly been greatly improved and better maintained, and renewed with stronger and better materials, but on those portions of the main lines where there are junctions, and at all intermediate stations over which trains pass at high speeds without stopping, there are the knife-edged facing points and the main line rail crossings, more especially those known as the obtuse or diamond crossings, at all of which there is a gap in the main line rail, and they are all of the primitive types of crossing and switches as at the time Sir John Hawkshaw alluded to the permanent way in 1866. It is notoriously the fact that at these main line junctions and crossings, as the published records testify, some of the most terrible railway accidents have occurred. The recent very calamitous accidents at Salisbury and Shrewsbury junctions have since directed attention to great defects and risks at junctions when trains are travelling at the high speed now attained, and to the need in such places for curves of greater radius; but that involves the adoption of longer and much more attenuated knife-edges, facing points or switch tongues, sharper-angled crossings, and bigger gaps in the main lines. A method has been devised for dispensing with the gaps in the main lines and of rolling much stronger and larger and tapered facing points, which have been highly approved of by eminent engineers, amongst others notably by the late Sir Benjamin Baker and Sir Alexander Rendel, and especially by the late Sir Henry Bessemer; the only objection made is the greater expense, and that the present types can be more cheaply constructed. With railway expenses at nearly two-thirds of the gross railway revenue, economy is most desirable, but where risk of accident and danger to life can be avoided, saving of expense, as Sir John Hawkshaw said on the occasion referred to, is false economy, to say the very least of it.

In conclusion, the author trusts that the fact that it is the business of members of this Institute to supply by far the greater portion of the material required for the renewal of the permanent way and of locomotive and wagon stock, the expenditure of which has amounted in the short period of ten years to nearly £129,000,000, may be considered some justification for drawing attention to the subject of the permanent way of British railways.

Table V.—Permanent Way Expenses. Ten Years (1897 to 1906).

Railway.	Miles Open.	Wages.	Materials.	Total.	Cost per Mile. Wages.	Materials.	Total.	Goods and Minerals Tons per Mile.
	No.	£	£	£	£	£	£	1906.
Caledonian	990.3	1,547,549	1,050,957	2,598,506	156.27	108.15	264.42	22,677
Great Central	500.7	847,972	873,873	1,721,845	156.77	161.62	318.39	45,198
Great Eastern	1116.1	1,908,770	1,470,507	3,379,277	171.02	131.76	302.78	10,727
Great Northern	828.8	1,424,090	779,785	2,203,875	171.83	94.08	265.91	22,819
Great Western	2679.6	3,248,732	3,600,453	6,849,185	121.24	134.37	255.61	16,437
Lancashire and Yorkshire.	565.2	997,461	647,633	1,645,094	176.48	114.59	291.07	41,678
London & North-Western..	1933.4	3,710,625	2,784,637	6,495,262	191.92	144.03	335.95	26,493
London & South-Western..	921.5	1,498,624	1,445,272	2,943,896	162.63	156.84	319.47	6,738
London, Brighton and South Coast	448.6	875,240	1,000,742	1,875,982	195.11	223.07	418.18	10,174
Midland	1455.3	3,069,274	2,096,522	5,165,796	210.90	144.06	354.96	30,477
North British	1278.5	1,632,015	808,570	2,440,585	127.65	63.24	190.89	21,176
North-Eastern	1658.9	2,375,556	1,542,679	3,918,235	143.26	93.00	236.26	36,004
South-Eastern & Chatham.	618.4	1,260,209	871,687	2,131,896	203.79	140.95	344.74	9,880
Taff Vale	123.1	197,053	148,760	345,813	160.07	120.84	280.91	153,860
Totals and Averages 15118.4		24,593,170	19,122,170	43,715,247	162.68	126.48	289.16	24,298

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

Copies of these orders may be secured from the Canadian Engineer for a small fee.

8476—October 26—Authorizing F. Violette, of St. Leonards, N.B., to lay and thereafter maintain a water pipe under the track of the C.P.R. near St. Leonards, N.B.

8477—October 26—Granting leave to the Manitoba Government Telephone to erect, place, and maintain its wires across the track of the C.N.R. at public crossing ½ mile north Neepawa Station, Man.

8478—October 27—Granting leave to the Wroxeter Rural Telephone Company to erect, place, and maintain its wires across the C.P.R. at Gibson Street, Wroxeter, Ont.

8479—October 27—Granting leave to the Hydro-Electric Power Commission to erect, place, and maintain its wires across the track of the C.P.R. in Township of Puslinch, County Wellington, Ont.

8480—October 27—Granting leave to the Bell Telephone Company to erect, place, and maintain its wires across the track of the C.P.R. at Joliette Sand & Gravel Company's premises, near St. Felix de Valois, P.Q., at public crossing Albert Street, St. John's, P.Q.; and at private crossing at Cache Bay, Ont.

8481, 8482, and 8483—October 27—Granting leave to the Bell Telephone Company to erect, place, and maintain its wires across the track of the C.P.R. at public crossing Albert Street, St. John's, P.Q., and at Cache Bay, Ont., also across the track of the P.M.R.R. at public crossing King Street, 100 yards east of Merlin Station, Ont.

8484—October 26—Authorizing the corporation of the town of Paris, Ont., to lay water pipe under the track of the G.T.R. where it crosses Market Street, Paris, Ont.

8485—October 19—Approving new Standard Mileage Freight Tariff of the New Brunswick Southern Railway superseding Standard Freight Mileage Tariff C.R.C. No. 1.

8486—October 19—Approving by-law of the Montreal and Southern Counties Railway authorizing W. B. Powell, general manager, to prepare and issue tariff of tolls to be charged for all traffic carried by said railway.

8487—October 15—Approving of plan, known as Part 1 of the Toronto Grade Separation, showing crossings of Dufferin, Dunn, Jamieson, Dowling, Sunnyside, and Howard Avenues and Indian Road in the western end of the city of Toronto, by the G.T.R.

8488—October 13—Rescinding Order No. 7488, dated July 9th, 1909, directing the G.T.R. to provide a night watchman at Wellington Street Crossing, Hamilton, Ont., by authorizing the G.T.R. on account of the small amount of traffic only to keep watchman on duty from 7 o'clock a.m. until 9 p.m.

8489—October 21—Directing that the maximum toll to be charged by the North American Telephone Company for any conversation not exceeding three minutes' duration, between village of Carp, and Ottawa, Ont., be reduced from twenty-five cents to twenty cents.

8490—October 19—Directing the C.N.Q.R. to construct and maintain a raceway and other openings under its track on its approved location at the Jacques Cartier River in the property of John Forman, Parish Les Ecureils, P.Q.

8491—October 26—Granting leave to the town of Claresholm, Alta., to erect, place, and maintain its wires over the track of the Calgary & Edmonton Railway, where the same crosses Centre Avenue, Claresholm, Alta.

8492—October 26—Authorizing the G.T.R. to construct, maintain, and operate branch line to and into the premises of Gardiner Bros., Sarnia, Ont.

8493—October 6—Approving location of the G.T.P.R. through the city of Fort William, Ont.

8494—October 28—Approving and sanctioning location of G.T.P.R. Branch Lines Company, Melville-Yorkton Branch, mileage 18 to 25.3, district Assiniboia, Sask.

8495—October 29—Approving and sanctioning location of the C.N.R. Goose Lake Branch, mile 117.06 to 170.49, Saskatoon westerly.

8496—October 28—Approving stress sheets of the G.T.R. Company's proposed bridge over new subway for pedestrians at Convent, near Lachine, P.Q.

8497—October 29—Authorizing the C.P.R. to construct, maintain, and operate industrial spur for Imperial Oil Company, Limited, Lethbridge, Alta.

8498—October 28—Authorizing the C.P.R. to construct, maintain, and operate industrial spur for Western Planing Mills Company, city of Calgary, Alta.

8499—October 29—Authorizing the C.P.R. to construct, maintain, and operate industrial spur for Western Canada Land & Live Stock Company, Fort William, near Neebing Station, Ont.

(Continued on page 539).

THE

Sanitary Review

SEWERAGE, SEWAGE DISPOSAL, WATER SUPPLY AND WATER PURIFICATION

TREATMENT OF WATERS POLLUTED BY VEGETABLE GROWTHS.

Recently we had the question put to us: "Whether would you advise filtration or sterilization with a particular water?" It turned out that the particular water was entirely free from pathogenic bacteria; that, in fact, the source (a small lake) was so situated that any chance of pathogenic contamination was out of the question.

The water, however, on analysis showed an excess of organic matter, the result of vegetable growths. The taste and odor of the water was extremely disagreeable, while the color was decidedly brown. Turbidity, however, was practically nil, there being little or no suspended matter.

Waters of this character are commonly met with, and are generally associated with ponds or small lakes surrounded with growth, in which the water is not subject to rapid change as between inlet and outlet.

Collected water, the result of seepage from forest surfaces, or springs forming small lakes, where the water has to pass through deep layers of decaying vegetable growth, are all marked by the above objectionable characteristics. While such water is incapable of producing any specific disease, it forms a ready medium for the growth of disease germs if admitted.

The characteristic brown color of the water is due to tannin; this also gives the astringent taste. The disagreeable odor and taste are the results of the decomposition of the vegetable growth.

Allen Hazen in "Filtration of Public Water Supplies," page 112, states: "In the removal of tastes and odors from pond or reservoir waters which are not muddy, but which are subject to the growths of low forms of plants, which either by their growth or decomposition impart to the water disagreeable tastes and odors, intermittent filtration may have a distinct advantage. In such cases there is often an excess of organic matter to be disposed of by oxidation."

The correct reply to the question asked of us is neither filtration in the ordinary meaning of the term, nor sterilization.

Filtration, in the sense of straining, is quite unnecessary, as there is practically no suspended matter requiring removal. Sterilization, in the sense of destroying disease germs, is also quite unnecessary, as there are no disease germs to destroy. The treatment required consists of:—

(a) Aeration to remove the gases of decomposition absorbed by the water.

(b) Contact with some material which will absorb the color.

(c) Nitrification and oxidation, in order to reduce the excess of dissolved organic matter.

The processes, (a), (b), and (c), can be accomplished effectually and cheaply in a combined plant consisting, first, of a method of spraying the water over the surface of a filter constructed not of sand for straining purposes, but of rough material of about ½-inch broken stone, with a top layer of about 1 ft. 6 in. of charcoal. Spraying the water will liberate the gases. The charcoal will reduce the color due to tannin, while the rough filtering material will provide a nitrifying bed, similar to that used for purification of sewage.

If the above process be carried out with proper attention given to the relation between the volume of water treated and the amount of nitrifying material, complete success can be obtained, even with very highly algæ-polluted waters.

The important point to observe in connection with the nitrifying bed is that of efficient underdrainage, and further, that the water is never delivered at a rate sufficient to saturate the material, but only at a rate allowing the water to dribble through the material in contact with air in its passage.

We have endeavored to answer the above question fully, as there appears to be a tendency at present to pay particular attention to the respective merits of sand filtration and sterilization without reference to other processes, which are just as important with certain classes of water.

Sand filtration and filtration followed by sterilization may be necessary with many classes of water contaminated with sewage when the object is the removal of disease germs. In Canada, however, we have to depend upon many sources of supply, which cannot possibly be contaminated with sewage, but, on the other hand, are charged with objectionable matter, the removal of which does not depend upon either sand filtration or sterilization.

SOME NOTES ON THE SEPARATION OF SOLIDS FROM SEWAGE AND WASTE LIQUORS.*

By James P. Norrington.

In the fifth report of the Royal Commission on Sewage Disposal it is clearly demonstrated that of all the processes for the treatment of sewage which are commonly in use to-day that which costs the least in upkeep has for its preliminary process quiescent settlement without chemicals. On the other hand, the initial cost of the tanks required is higher than all but one of the five preliminary processes compared in the report. The area of filter required, however, to follow the preliminary quiescent settlement tanks is found, as a rule, to be considerably less than with most

* Read before the Association of Municipal and County Engineers, England.

of the other processes; in other words, the greater the percentage of suspended solids removed, the larger is the volume of sewage that can be treated on the same area of filter; in fact, throughout the report the elimination of the suspended matter from sewage before allowing the flow to pass on to the filters or into a stream, or by way of storm water overflow, is considered a matter of the highest importance. Any means, therefore, which can be successfully and economically adopted for the removal of the suspended matter are well worth our consideration; if, at the same time, they facilitate the handling of the solid matter or sludge, that will also be of advantage.

The object of this paper is to bring before your notice one or two arrangements for attaining these ends which are being successfully worked on the continent and in this country.

The first of these, like many other good as well as indifferent things, comes from Germany, and is known there as the Kessel, the name probably being derived from the boiler-like shape of the apparatus. Its main feature is a vertical cylinder with an inverted cone-shaped bottom, and a cone-shaped or domed top. This is fixed on wrought-iron or brick supports above the level of the flow of sewage to be treated. The apparatus is so arranged that the flow is syphoned through this cylinder with a loss of two or three inches only in the level of the sewer. This is effected as follows:—

A manhole, or chamber, is constructed at the point on the sewer from which the sewage is taken, the floor of which is a foot or more below the invert of the sewer at this point. Into this the short leg of the syphon is brought and finishes below the invert of the sewer, so that it is always trapped.

On the opposite side of the Kessel a corresponding manhole or chamber is provided to receive the long leg of the syphon, which is trapped in a similar manner.

The invert of the outfall from this second chamber is kept two or three inches below the invert of the sewer as it enters the first manhole to ensure syphonic action.

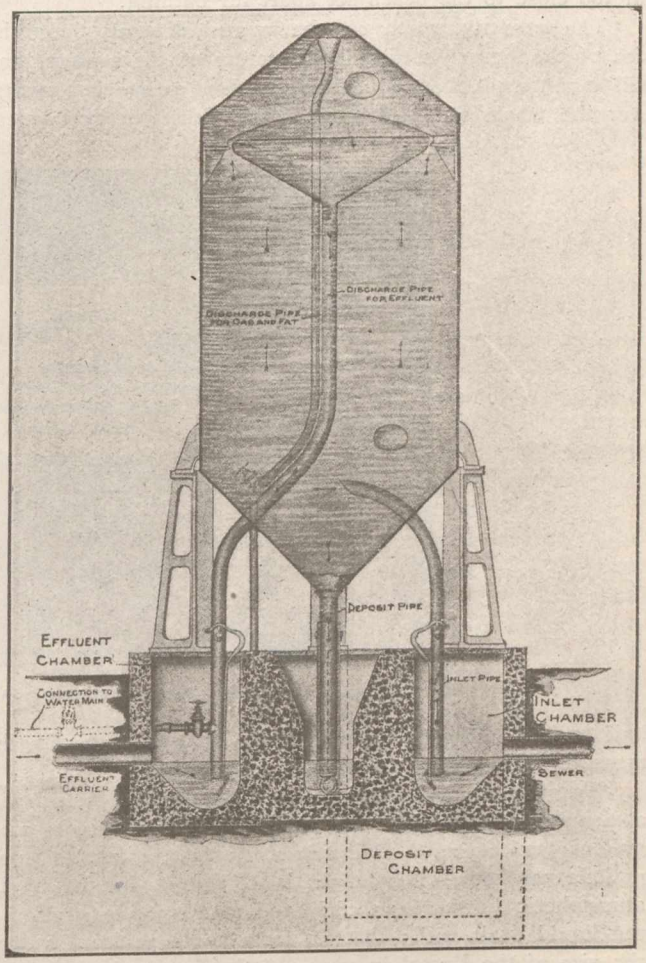
Directly below the Kessel a third chamber is provided, and into this a third pipe or leg (known as the deposit pipe), is brought from the bottom of the cone. This also is arranged so that the foot of the pipe or leg is trapped.

Reference to the accompanying diagram will make this clear, and it will be seen that the short leg of the syphon, or inlet pipe, as it is called in the diagram, passes through the cone-shaped bottom of the Kessel and finishes inside same immediately over the centre of the inverted cone, the end of the pipe being shaped so as to deflect the heavier solids in that direction. The long leg of the syphon, or discharge pipe for effluent, is also carried through the cone-shaped bottom of the Kessel up the centre of same to near the top of the cylindrical portion, where it finishes in a covered inverted cone, the greatest diameter of which approximates the internal diameter of the cylinder of the Kessel. The inlet to this cone is through a narrow slot extending the whole circumference of same, immediately below the cover. You will also notice in the diagram that there is a fourth pipe marked "Discharge pipe for gas and fat," which passes through the cone-shaped bottom, and finishes with a small cone-shaped mouth directly below the centre of the cone or dome-shaped top.

For easier manipulation all four of these pipes are fitted with valves. To ensure syphonic action through the Kessel it is necessary to first fill it with water, and for this purpose a connection to the water main is provided to one or other of the before-mentioned legs. In the diagram this is shown connected with the discharge pipe for effluent, or long leg of the syphon.

The action of the apparatus is as follows:—

The large cylinder or Kessel having first been filled with water, and the three chambers into which the legs of the syphons are conducted filled sufficiently to trap the legs, and the valves in the legs opened, syphonic action at once commences, and the sewage finding its way into the inlet chamber passes up into the Kessel. The shape of the inlet pipe, as before mentioned, deflects the solids in suspension towards the bottom of the inverted cone, and the coarser and heavier solids at once find their way through the deposit pipe into the centre chamber; the lighter solids, on the other hand, rise to the top of the Kessel, while the liquid, still carrying a large proportion of fine solids in suspension, commences to gradually rise in the Kessel. These finer solids are gradually dropped during the slow upward rise



The Kessel.

of the sewage in the large cylinder or Kessel, and before the level of the outlet connected to the long arm or discharge pipe is reached, practically all the solids in suspension have been left behind, and the effluent leaving by the discharge pipe is quite free therefrom.

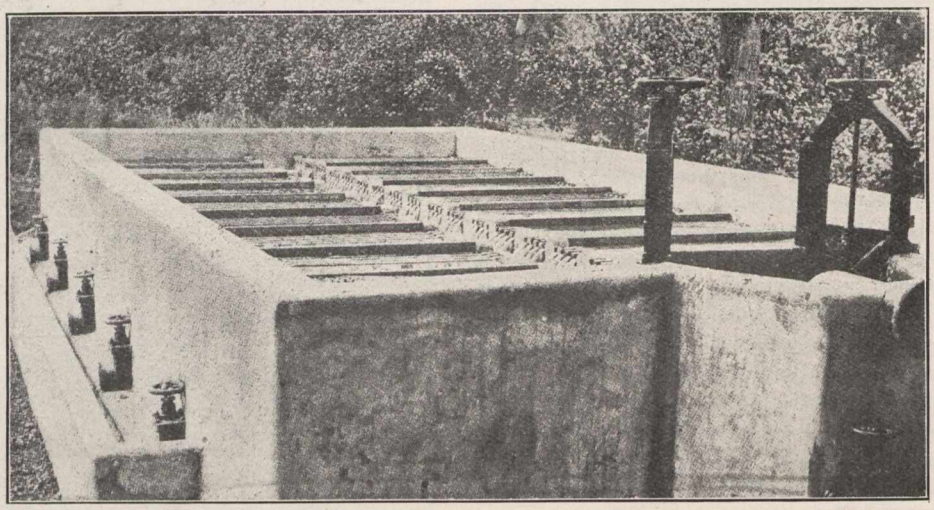
The heavier solids on reaching the bottom of the Kessel are diverted by the inverted cone-shaped bottom thereof to the central or deposit pipe, and through this into the chamber. This latter may be extended to a size sufficient to hold any desired quantity of solids. It is a curious fact that as this chamber fills with the solids, the liquid portion of the contents passes out through the same pipe by which the solids enter; consequently this chamber may be worked until the percentage of liquid left is sufficiently small to enable the solid contents to be handled with comparative ease.

The section of the suspended solids which have a less specific gravity than water accumulate on the underside of the dome cover of the Kessel, and are easily withdrawn therefrom by opening the discharge pipe for gas and fat, closing the valves in the three syphon legs and turning on the water supply.

The liquid portion, freed from solids in suspension, passes off through the effluent carrier either to filters or land. The rate of discharge through the effluent carrier is in exact proportion to the flow entering the inlet chamber. With some sewages the treatment by the Kessel is sufficient to admit of its being passed direct into a stream.

The author is also of opinion that it is desirable to treat in a similar manner all sewage where it is now discharged in a crude state into the sea, as it is scarcely possible to find any important seaside resort without a sewage outfall far too close to the beach set apart for bathing.

The quantity which can be treated depends upon the size of the Kessel used and the nature of the sewage, and will vary from a flow, which will produce an upward motion over the whole sectional area of the Kessel or cylinder of



Separator Treating 30,000 Gallons per Hour. Outside Dimensions 33 ft. by 18 ft.

half to one millimetre per second, or, put into English measure, from 1¼ to 2½ inches per minute.

To give an example of the size required, a Kessel with a diameter of eight feet would deal with from 2,000 to 4,000 gallons per hour; a diameter of 30 feet, 25,000 to 50,000 gallons per hour. The height is, of course, limited by the atmospheric pressure as compared with specific gravity of the liquid dealt with; that is, from 27 to 30 feet. Putting the size of the Kessel in terms of the flow to be treated, it should hold from 1½ to 3 hours' flow.

With regard to the results produced by this class of installation, analyses show that with waste from a paper factory, 75 to 90 per cent. of suspended matter was eliminated according to the rate of flow, whereas with slaughter-house refuse as much as 99.7 of the solids in suspension and 99.6 of fat is removed.

With an ordinary domestic sewage about 70 per cent. of the solids in suspension were removed.

These results compare very favorably with those given in the Royal Commission Report previously referred to. The best examples given of results from treatment by sedimentation tanks show a removal of about 50 per cent. of the suspended solids from tanks which hold as much as from 10 to 15 hours' flow.

The second type of separator consists in its essential features of a shallow tank, the capacity of the grit chamber being sufficient to steady the flow of sewage and admit of the grosser and heavier solids sinking and the lighter solids rising. The exit from the grit chamber to the shallow tank following it is kept well below the surface, and the flow passing forward contains only the more finely divided solids in suspension, the specific gravity of 99 per cent. of which will be found to be slightly in excess of water in almost all sewages.

In the somewhat larger area of the tank these finer solids sink to the bottom if the outlet from the tank is arranged so as to avoid any movement in the liquid, the velocity of which is sufficient to carry the finely divided solids forward with it. To put it in other or more familiar words, there must be no movement in the tank with what we should call in a sewer a "self-cleansing velocity."

The method by which this is attained in the separator now under consideration is by dividing the flow from the tank over the edges of a large number of small channels placed on the surface, all of which are set truly level the one with the other. The flow is thus divided over what may technically be said to be a very long length of weir. The velocity of the approach to the weir is so low that even the finely divided solids are left behind if their specific gravity is the least in excess of water.

In larger plants the shallow tank is divided into sections for the better regulation of the flow through same. (Plate No. 2 shows a separator of this class, capable of dealing with 30,000 gallons per hour of ordinary sewage.) Both the grit chambers and the shallow tanks are fitted with floors and draw-off pipes especially designed for the easy removal of the solids.

For continuous work this type of separator should be arranged in duplicate like that shown in the view, so that one half may be cleared of solids while the other is in action; one section should be cleared daily.

The tanks and grit chambers are both fitted with arrangements for drawing off as much as possible of the supernatant water before the solids are withdrawn.

The total capacity of an effective plant of this type may be kept down as low as half-an-hour's flow of the maximum volume to be dealt with, and such capacity divided into the two sections above referred to.

Some remarkable results have been obtained with a plant of this type at Dorchester, where at least 25 per cent. of the total volume of the sewage is brewery refuse. The proportion of suspended solids removed from the crude sewage in this manner is as high as 96.5 per cent., and at

the same time the purification effected on the albumenoid ammonia figure is 74 per cent., and on the oxygen consumed from 89.9 per cent., and that without filtration of any description.

Such results compare very favorably with those produced by many complete installations of tanks and filters. If equally good results can be obtained from a weak or dilute sewage, it appears to me that subsequent filtration or treatment of any kind is entirely superfluous.

Another very considerable advantage, especially in small town installations, is that this type of plant enables the solids or sludge to be dealt with day by day instead of allowing it to accumulate until the volume is so great that to deal with it entails the employment of a considerable amount of extra labor. Taking it day by day, a single caretaker at a small town installation can easily do all that is necessary.

It appears to the author that a type of plant which produces such results could certainly be modified to effect the purification of drinking water; at any rate, it would remove the suspended solids which give us so much trouble in the effluents from many sewage filters.

The principle involved in both these types of separators is, that after the water has done its work of transporting the polluting solids from the house to the spot where they can be dealt with, the sooner it is separated from the sewage solids the better. This is especially so in districts such as this, where, as a rule, the water supply is from chalk, and consequently hard. The amount of dissolved impurities taken up in solution by the water used for conveying the sewage will be very small with a plant of this sort, through which the whole flow passes in less than an hour, compared with a sedimentation or septic tank, the capacity of which varies from 15 to 30 hours' flow.

Another point which strongly appeals to the author is that the manurial value of the solids separated is correspondingly increased, as it has always appeared to him that the septic treatment of sewage has actually destroyed material that could far more usefully be used on the land.

Before my paper is discussed, I should like to add one or two further remarks as to the saving effected in the cost of sewage plants by "the separator" in lieu of ordinary sedimentation or septic tanks. A comparatively simple plant, with a capacity of from a half to three hours' flow of sewage, must, in the nature of things, cost considerably less than tanks holding from 15 to 30 hours' flow. Even making allowance for the additional fittings required, at least 50 per cent. of the cost of tanks would be saved in this respect alone.

Another important consideration is the comparatively small filter capacity required, and a saving may be expected on this head of 25 per cent. compared with that necessary to follow septic tanks, for example.

Taking one with the other, we may reckon that a saving of at least 30 per cent. on the whole cost of an installation might fairly be expected, and this without impairing its efficiency; but, on the other hand, rather increasing it.

Such a saving is of the first importance in any case. If, for example, the authorities of this ancient city were installing a new plant for the treatment of their sewage, it would be a saving of at least three to four thousand pounds.

At the present moment there are none of the Kessel pattern in use in England, but I have one or two photographs of German plants which will doubtless be of interest. The nearest plant of any size of the other type referred to in the paper, namely, that at Dorchester, is no doubt familiar to some of our members. In this case the addition of a "separator" rendered it possible to treat without nuisance a sewage much polluted with brewery refuse, and without otherwise enlarging the existing plant, which had hitherto been found wanting. This is an illustration of another way in which a plant of this kind may be introduced, namely, to increase the capabilities of an existing plant. With ordinary domestic sewage, the addition of either a separator or a Kessel will enable an efficient existing plant to deal with an increased volume of at least 30 per cent., and either of them occupy such a small space that there would always be room for it without purchasing additional land; a great advantage in many cases. Another use of the separator, which I have not referred to in the paper, is for sea outfalls. Either type of plant, that is, either the Kessel or the separator, would be quite sufficient without either tanks or filters, as they effectually prevent any suspended solids from going forward with the flow.

Many of you must be aware of the objectionable features that one comes across at seaside places where they are discharging crude sewage into the sea, and no doubt numerous cases of typhoid fever take place from that cause. I think that ought to be avoided.

SOME COMMENTS ON ASPHALTIC SPECIFICATIONS.

H. Tipper.*

The increasing use of asphalt and the entry into the field of a large number of producers of asphaltic, and other bituminous materials for road building, has added a great deal to the already confused state of the specifications governing this class of work. The specifications for asphalt in the paving industry, have commonly been burdened with too much description and have had too little relation to the actual requirements which would be of value in a pavement. It has been usual for each producer to issue his own specifications, primarily a description of his own material, and not necessarily a standard of quality. The result has been that the paving industry has been burdened always with tests and specifications which are not of value as a means of determining a desirable material, and which cannot be so translated. The enginering features of the situation have commonly been neglected and the specifications based upon imperial tests which have little or no value. The situation in the last few years instead of improving, has rather (with a number of additional producers in the field embracing both liquid and solid bituminous materials), become confusion worse confounded. It is evident from a very casual perusal of the different specifications issued by different producers and partially or wholly adopted by engineers, for the application of bituminous materials to roads, that the views held by different interests as to the desirable material to be used for road building purposes, are entirely divergent, and in a great many cases, absolutely contradictory. The fact is really stated most efficiently, when it is admitted that we know little or nothing about bituminous materials and the characteristics which affect their value for road building purposes. Nevertheless, we are not afraid to issue long and complicated specifications with equally complicated tests for the purpose of indicating the value of a material of which we know very little, and of the effect of which in a road we know hardly any more.

*Publicity Engineer, The Texas Co., 17 Battery Place, New York City.

A number of these tests can be cited as illustrations of the absurdity of the present method of specifying, the necessity for a reasonable amount of investigation, and a determination to drop out of the specifications, all tests which cannot show at least a reasonable relation to road building value.

It has been customary to refer to asphalt as either natural asphalt or oil asphalt. Since both asphalts which are found in deposit, and asphalts which are manufactured from the crude petroleum, are originally, (according to present theories), formed by the reduction of the oil, there would seem to be no reason for differentiating between the two, except that the asphalts which are taken from deposits have been reduced with the variations always to be found in any deposit, and are consequently not of uniform value. Whereas, the asphalt produced from the crude asphaltic petroleum can be manipulated scientifically so as to provide a uniform material in which the variations are so slight as to be negligible. To attempt, however, to say that because an asphalt has been mined or taken from a deposit, it is superior to a material manufactured from the crude petroleum, is an evident absurdity. It has always been found possible by scientific manufacture, to produce from the raw materials, a better, more uniform and more valuable product, than is possible when it is produced in the haphazard fashion of nature.

It is no uncommon thing to find in specifications for asphaltic binders for macadam road work, a reference to the percentage of dirt, etc., which will be allowed in the material, and a further percentage allowance for material not soluble in carbon bi-sulphide. Inasmuch as carbon bi-sulphide is the only solvent at present in use for extracting the bitumen from any compound, it is evident that one statement as to the allowable insoluble matter, whether dirt or anything else, would sufficiently answer the purpose and prevent the confusion which is bound to occur in the consideration of two such contradictory tests.

A high flash point and an evaporation test in which a very small percentage of material is to be allowed to evaporate at a certain temperature, (frequently 325 or 500°) when subjected to a high temperature for a period of several hours, is frequently required in specifying a binder for macadam road. The absurdity of this is readily seen when it is understood that all materials for use with macadam roads, are either liquid or semi-liquid bituminous materials, and are consequently in their initial state too soft to prove valuable binding materials, the object being to produce a material which will mix with the cold stone and afterwards change its consistency so as to set up to the proper hardness of the road. If the material, however, is a semi-liquid and will not evaporate under a high temperature for several hours, it is evident that it will not set up rapidly to the proper degree of hardness on a road under ordinary atmospheric temperatures.

In a paving cement where it is necessary that the material should not change its consistency an evaporation test of the kind mentioned, is a valuable indication of the unchangeable character of the material. In a binder for macadam road, however, the test is unnecessary and contrary to the requirements. The fact of the matter is that the residual oils while they may be reduced from the crude asphaltic petroleum, are loaded up with a heavy end consisting of tarry residues and heavy lubricants so that they contain a comparatively small percentage of the true asphalt for their body. In addition to this, the lubricants are distinctly a detriment to the necessary adhesive quality of the binder, and will not hold the stone of the road together with the same degree of strength as the materials which are made so that they are not loaded up with a heavy end.

Further tests which are frequently specified, such as the flow test and the viscosity test where these state a maximum and minimum viscosity, are evidently made without any real investigation of the subject and any proper consideration of the qualities which are necessary in a bituminous binder for macadam roads.

All these ill-considered tests and specifications which do not show the value of the material in relation to road building, and are frequently contrary to the considerations involved, are merely a burden and do not allow of the engineer securing the best possible material. When it is evident that we know little about these values, the purpose would seem to be best served by admitting as much and not by specifying where the value is not ascertained. Comparatively little attention has been paid to this subject of bituminous binders for macadam road work until the last few years, and in the absence of any knowledge on the subject, it seems to have been customary to take the specifications issued by producers of different materials and use them as a basis when their value is still to be discovered.

The same thing is true in a lesser degree in the specifying of asphalt for paving purposes. It has been customary, and is still customary, in a good many cities, to specify the refined asphalt and the flux, frequently specifying the origin of these materials, when as every engineer knows, the material which enters into the pavement and which it is really valuable and necessary to test, is the asphaltic cement which may, or may not be made with asphalt and flux as it can be made at the proper consistency without the use of flux if it is scientifically manufactured from the crude petroleum.

The introduction into asphaltic specifications, particularly for binder macadam roads, of tests which have no translatable relation to road value, and which cannot be supported on assumptions other than the merest theory, has made an investigation of the practical requirements necessary. The question is one of elimination rather than of anything else, and by consideration of the tests demanded in various specifications, it appears that for the most part they are either unnecessary or of little value.

After the elimination of the unnecessary specifications and the consideration of the proposition from a practical standpoint, the following specifications together with the qualities which they are intended to define, were suggested by Dr. Albert Sommer, in the early part of this year, and are given here as an attempt to reduce the specifications for asphaltic binders for Macadam road building to only such requirements as can at present be considered as of value in the practical construction of macadam roads.

Further discussion of these will doubtless be necessary, and it is invited in the hope that such discussion will result finally in some agreement as to the necessary qualities in an asphaltic binder and the elimination of much in the present specifications which is of dubious value:

(A) It shall contain as much as possible of asphalt of suitable consistency for building the road.

(B) It shall be as fluid as possible in order to enable it to be properly applied by the method proposed.

(C) For this reason all products must be eliminated "a priori" which would increase the viscosity without increasing the percentage of asphalt.

(D) A compound, therefore, must be chosen which has been made from a solid asphalt by using a rather light flux. The flux shall contain no lubricating or paraffine oils and shall be used only as a carrier. It should either evaporate or seep into the stone or mineral aggregate upon application, thus making the compound set up rapidly after it is on the road.

That cold stone will be applied in most cases seems to be a foregone conclusion. For this reason a solid asphalt will in most cases be out of the question. No matter, however, what mixing methods should be finally decided upon, at any rate a satisfactory asphaltic material must comply with the above requirements.

As to specifications which are in accordance with the above suggestions, the following is a sample:—

A Specification Proposed for a Macadam Binder of 80 Per Cent. Asphaltic Contents.

(1) It shall be soluble in bisulphide of carbon to not less than 99.5 per cent.

(2) It shall be soluble in carbon tetrachloride to not less than 99.5 per cent. (Solubility in tetrachloride indicates absence of so-called "carbenes" which are always an indication that the asphalt has been overheated).

(3) When heated to a temperature not exceeding 500° F. until 20 per cent. are evaporated, the residuum shall have a penetration of not more than 10 mm. when tested with a No. 2 needle, weighted with 100 grs. at 77° F. on the Dow machine.

(4) The compound shall be sufficiently liquid at working temperatures so that when tested in an Engler viscosimeter at 212° F., 50 cubic centimeters shall not take more than 200 seconds to flow out.

(5) The solid contents of this material should consist only of asphalt and the consistency of the residue shall not be due to any other solid substance, such as paraffine. The paraffine scale of the total compound shall not exceed 1 per cent. Paraffine scale is to be determined by destructive distillation of the entire compound to coke, and determination of the paraffine scale in the distillate by the Holde method.

(6) The asphaltic binder shall not contain any dirt or water, but shall consist of pure bitumen only. Tar or substances recovered from acid sludge shall not be admitted.

RAILWAY ORDERS.

(Continued from page 533).

8500—October 29—Authorizing the C.P.R. to construct, maintain, and operate industrial spur for Muirhead & Company, Fort William, Ont.

8501—October 26—Granting leave to the British Columbia Electric Railway Company, Limited, to erect, place, and maintain its wires across right of way of the C.P.R., north end of Cambie Street, Vancouver, B.C.

8502—October 13—Authorizing the corporation of the village of Glencoe, Ont., to erect, place, and maintain the electric light wires of the Glencoe Municipal Electric Lighting Plant across the track of the G.T.R. on Main Street in said village.

8503—October 26—Granting leave to the Shawinigan Water & Power Company to change the location of its line at a point where it now crosses the St. Maurice Valley Railway near Three Rivers, P.Q.

8504—October 19—Directing that upon the installation of new telephone system by the Bell Telephone Company in the Russell House, Ottawa, Ont., a charge of ten cents for each connection from such system with the Ottawa Exchange subscribers be charged.

8505—October 28—Approving Passenger Tariff, C.R.C., No. 1, of the Montreal & Southern Counties Railway.

8506—October 29—Authorizing the corporation of the city of Peterborough, Ont., to lay and thereafter maintain water main under the track of the Lakefield branch of the G.T.R. at Ant-im Street, said city.

8507—October 28—Authorizing Kate S. Massiah, of St. Jerome, P.Q., to lay and thereafter maintain water pipe under the track of the C.N.Q. Railway one mile east of Lachute, P.Q.

8508—October 29—Extending the time within which the Grand Trunk Railway Company, (until November 10th, 1909), may appeal to the Supreme Court of Canada from Order No. 7613 of the Board, directing that said railway provide station accommodation at or near the point where the company's line from the city of Hamilton to Niagara Falls cross townline between Townships Clinton and Louth, Ont.

8509—October 28—Authorizing the C.P.R. to construct, maintain, and operate industrial spur to the flour mills of Messrs. Pfeffer Bros., Milverton, Ont.

8510—October 27—Granting leave to the Parish of Notre Dame du Lac, P.Q., to construct a highway across the tracks of the Temiscouata Railway Company to connect with road in the village to the Government wharf.

8511—October 30—Approving change in location of the C.P.R. Company's station at Bissett, Ont.

8512—November 2—Approving Standard Passenger Tariff C.R.C. No. 10, of G.T.P. Railway, cancelling Standard Passenger Tariff C.R.C. No. 2.

8513—October 16—Directing that the rate charged by the G.T.R. for moving grain in car load from the company's elevator at Point Edward to the King Milling Company's mill at Sarnia, be reduced to one and a half cents per hundred pounds.

8514—November 2—Amending Order No. 8239, giving the C.N.R. permission to cross with its tracks the tracks of the G.T.P. Railway at or near Riley, Alta., by substituting for the word "principal" where it occurs in the 15th line of the recital, and the fourth line of clause 1 of said Order, the word "Fourth."

8515—November 2—Authorizing the G.T.P. Railway and the Edmonton & Slave Lake Railway Company to operate their trains over crossing at Section 15, Township 53, Range 25, west 4th Meridian, district Edmonton, Alta., without being brought to a stop.

8516—November 2—Recommending to the Governor-in-Council for sanction by-law No. 7 of the Brandon and Saskatchewan Railway Company re spitting in cars and on railway premises.

8517—October 27—Directing the C.P.R. to protect crossing of Main Street by a watchman between the hours of six o'clock a.m., and 7 o'clock p.m., daily, at Farnham, P.Q.

8518—October 29—Authorizing the C.P.R. to construct, maintain, and operate branch line for ballast purposes from its main line in the N.W ¼ Sec. 2, Tp. 13, R. 3, west principal meridian, Manitoba.

8519—October 29—Approving and sanctioning deviation in location of C.P.R. Company's Motherlode Branch, B.C.

8520—October 29—Approving and sanctioning location of G.T.P. Railway Company's line from mileage 289 to mileage 347.346, Willow River, Cariboo District, B.C.

8521—October 29—Approving and sanctioning change of location of the C.P.R. Company's main line from mileage 95.60 to mileage 132.18 from McLeod, B.C.

8522—October 22—Granting leave to the National Transcontinental Railway to construct undercrossing, under public crossing, 2 miles easterly from Quebec Bridge.

8523—October 29—Granting leave to the Manitoba Government Telephones to erect, place, and maintain its wires across the track of the G.T.R. at public crossing two and one-half miles east of Gervais, Man.

(Continued on page 541).

PROBLEMS IN APPLIED STATICS.

T. R. Loudon, B.A.Sc.

This series of problems began in the issue for the week, October 22nd, 1909. It is assumed that the reader either has an elementary knowledge of the subject of Statics, or is in a position to read some text on such theory.

Find the stress in the remaining members LG, GB, EF, and FG.

These stresses may be found by first considering the point BPLG, and then the point GLDEF.

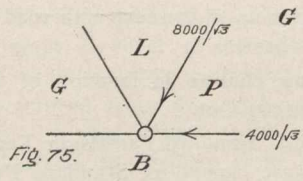


Fig. 75.

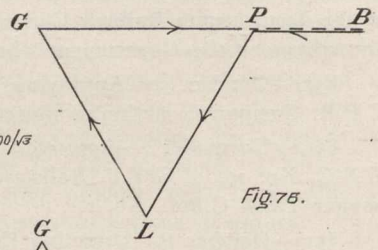


Fig. 76.

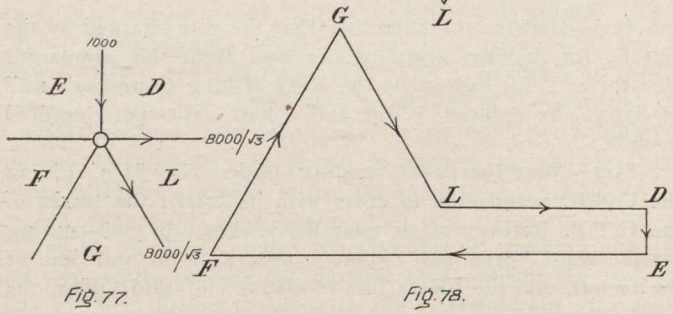


Fig. 77. Fig. 78.

Fig. 75 represents the condition at the point BPLG, In drawing the Vector Polygon for this point it is found that the line GB (Fig. 76) coincides for part of its length with the line BP already drawn. In order to help the reader, the portion of GB which would coincide with BP has been shown by a dotted line. The diagram reads:

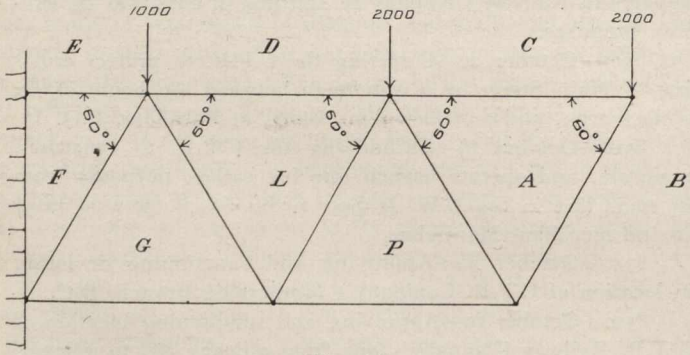


Fig. 67.

BP, PL, LG, and GB. From this it is seen that the member LG is in tension $8{,}000/\sqrt{3}$ pounds and the member GB in compression $12{,}000/\sqrt{3}$ pounds.

Figs. 77 and 78 are, respectively, the Statical Diagram and Vector Polygon for the point GLDEF. The member EF is in tension $17{,}000/\sqrt{3}$ pounds and the member FG in compression $10{,}000\sqrt{/3}$ pounds.

To Construct a Stress Diagram.

In the last problem a new Vector Polygon was constructed for each set of forces being considered. If these diagrams are drawn to a suitable working scale, they spread over a considerable area, and also, in transferring magnitudes to a new line, there is the liability of an error which may or may not be cumulative in its effect throughout the problem. It is possible, however, to condense these diagrams and at the same time restrict the liability to error in magnitudes by drawing what the writer chooses to call a **Continuous Vector Diagram**, or, as it is often referred to, a **Stress Diagram.**

It may be pointed out that it will help to simplify the problem if the reader will construct, on a loose sheet of paper, the Vector Polygons (Figs. 69, 71, 73, 76, and 78), using the same scale of forces in each case. These polygons may then be referred to in drawing the following diagram. The reader must bear in mind that **the same scale of forces will be used throughout the following problem:—**

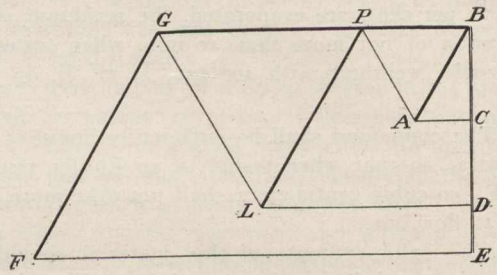


Fig. 79.

Considering the Statical Diagram (Fig. 68), it is seen that the triangle BCA (Fig. 79) may be taken as a Vector Polygon for the forces acting at the point BCA of the truss (Fig. 67). Instead of placing sense marks on this polygon to indicate how the forces act, a thin line is used to represent that the force CA is a tensile force, a thick line to indicate that the force AB is a compressive force, and a double thin line to denote that the force BC is due to a load. This system of representing tensile and compressive forces and loads will be adhered to throughout the problem.

Taking next the point BAP, it is seen from the Statical Diagram (Fig. 70) that the force BA is a compressive force. Referring to Fig. 79, it is found that there is already drawn a line which may represent this compressive force, provided the letters at the extremities of this line be read the proper way to correspond with the sense of the force as shown on the Statical Diagram; namely, the thick line BA. The lines AP and PB complete the Vector Polygon for this point. AP, being a tensile force, is represented by a thin line, and PB, being a compressive force, by a thick line.

Acting at the point PACDL are three known forces, PA, AC, and CD, as shown in the Statical Diagram (Fig. 72). It is seen that the thin lines PA and AC (Fig. 79) are so constructed that they may represent the tensile forces PA and AC. From C (Fig. 79) is drawn a double line CD to represent the force CD due to the load. The lines DL and LP represent, respectively, the unknown forces DL and LP. If sense marks were placed on the diagram, DL and LP would be found to be tensile and compressive forces, respectively, as indicated by the thin and thick lines. The diagram for this point reads PA, AC, CD, DL, and LP.

From the Statical Diagram for the point BPLG (Fig. 75) it is seen that the two forces BP and PL are compressive forces. They may, therefore, be represented by the thick lines BP and PL (Fig. 79) since these lines

are properly constructed to represent their magnitudes and directions. The Vector Polygon for the point is completed by the lines LG and GB, the diagram reading BP, PL, LG, and GB.

The reader is advised to construct the remainder of the diagram for the point GLDEF for himself. The diagram when drawn should read, GL, LD, DE, EF, and FG.

Doubtless, the reader will see that the construction of this Stress Diagram is merely a process of piecing together the Vector Polygons for the various points of the truss.

It should be noticed that the lines of the Stress Diagram, since they have no sense marks placed on them, really represent the magnitude of the stress in the various members; e.g., the line LG represents the stress in the member LG.

RAILWAY ORDERS.

(Continued from page 539).

8524—October 29—Granting leave to the Consolidated Telephone Company to erect, place, and maintain its wires across the track of the G.T.R. about two miles north of Inglewood Junction, Ont.

8525 and 8526—October 29—Granting leave to the Bell Telephone Company to erect, place, and maintain its wires across the track of the C.P.R. at public crossing on North Street, Sault Ste. Marie, Ont., and near Bennington Station, Ont.

8527--October 29—Authorizing the corporation of the city of Ottawa, to lay and thereafter maintain tile pipe sewer under the track of the O. & N. Y. Railway on Gladstone Avenue, Ottawa, Ont.

8528—October 29—Authorizing the municipality of the town of Maple Creek, Saskatchewan, to maintain a sewer pipe under the track of the C.P.R. in sail town of Maple Creek, Sask.

8529—October 29—Granting leave to the C.P.R. to construct plank highway crossing at station 2880.16, mile 54.5 on Brandon section of its main line of railway.

8530—November 2—Directing the C.P.R. to provide and construct a suitable highway crossing where the company's railway crosses the extension northerly of Simpson Street, Sault Ste. Marie, Ont.

8531 and 8532—October 20—Granting leave to the corporation of the city of Fort William, Ont., to cross with a single track the track of the Mount McKay & Kakabeka Falls Railway at Yonge Street until May 1st next, in Fort William, Ont. That said crossing be protected by watchman day and night.

8533—October 22—Dismissing application of the city of Calgary for the construction of subways carrying 14th St. W., and 11th St. W., under the tracks of the C.P.R.

8534—October 22—Dismissing application of the residents of Bowell, Alta., for order directing the C.P.R. to establish station and permanent agent at Bowell, Alta.

8535—October 22—Determining the character of the work, and protection, at the crossing of the spur of the C.P.R. over the tracks of the Calgary Street Railway at Second Street East, Calgary, Alta.

8536—October 22—Directing that the city of Calgary and the C.P.R. Company construct a subway to carry First Avenue East under the tracks of the Railway Company at Calgary, Alta.

8537—October 22—Dismissing application of the C.P.R. for approval of location of station at Grassy Lake, Alta., and further directing that the C.P.R. submit new plans for station.

8538—November 2—Authorizing the Manitoulin & North Shore Railway Company to construct a bridge over Vermillion River, 18 miles west of Sudbury, Ont.

8539—November 3—Granting leave to the C.P.R. to open for the carriage of traffic portion of its line of railway known as the Lethbridge-Macleod Grade Revision, mile 0 to 31.4.

MONTREAL STREET RAILWAY COMPANY REPORT FOR THE YEAR ENDED 30th SEPT., 1909.

The Montreal Street Railway, of which Hon. L. J. Forget is president, and W. G. Ross, managing-director, has an exclusive franchise to operate street railway in Montreal, Que., until 1922. They operate 138 miles of track. The population of Montreal is about 380,000.

The gross earnings increased during the year ending September 30th, 1909, $197,406.06, or 5.37 per cent., the operating expenses $96,625.11, or 4.48 per cent., the net earnings $100,780.95, or 6.63 per cent.

The gross earnings continue to show satisfactory increases. The per cent. of expenses to gross earning is 58.20 against 58.69 per cent. for the previous year.

The company again refuse to pay a portion of the city's accounts for snow removal, claiming the work was done in a wasteful manner. The snow fall according to the McGill University records were nearly two (2) feet less than the previous year, but notwithstanding this the city claims to have expended the sum of $208,435.75, an increase over the previous year of $5,901.37, and an increase over two years ago of $77,799.08, with 20.2 inches less snow fall. The increase in street mileage during this latter period was one mile, which at the average cost would only amount to $4,222.48.

The following statistical statement gives comparative figures since 1900.

It will be noticed that the car earnings per passenger decreases as the total number of passengers carried increased.

STATISTICAL STATEMENT

	1909	1908	1904	1900
Gross Earnings	$3,874,838.51	$3,677,432.45	$2,463,824.70	$1,769,904.78
Operating Expenses	2,255,019.20	2,158,394.09	1,510,997.90	992,925.11
Expenses % of Earnings	58.20	58.69	62.37	56.34
Net Earnings	1,619,819.31	1,519,038.36	952,826.80	776,979.67
Passengers Carried	95,376.373	90,746.032	60,281,834	43,362,262
Car Earnings per passenger	3.96c.	3.96c.	4.00c.	4.06c.
Transfers	32,285,208	30,343,113	17,915,242	13,194,971
Total passengers carried	127,661,581	121,089,145	78,197,076	56,557,236
Car Earnings per passenger total carried	2.96c.	2.97c.	3.09c.	3.12c.

LIGHTNING PROTECTION.*

By J. V. E. Titus, Second Vice-President Electric Service Supplies Company.

The term "lightning" is now used in a general way to describe surges of potential of a value high enough to approach the danger point. With this viewpoint lightning may be subdivided into two great branches, viz., internal, disturbances caused by switching, short circuits, grounds, etc.; and external, or more properly speaking, cloud lightning.

The most common phenomenon of external lightning is manifested as the induced static or "bound" charge, and that, by the way, is practically all that has to be contended with in low voltage circuits, such as railway lines. To illustrate, consider any overhead line insulated from ground; suppose a positively charged thunder cloud passes over it. The ground below the cloud assumes an electro-static charge opposite to that of the cloud above, as does also the line, and furthermore, the charge assumed by the line is higher than that of the ground, since it projects above it. A flash between cloud and cloud, or between cloud and ground, equalizes the potential existing between them, and requires a change of potential distribution on the line.

This equalization of potential between cloud and ground leaves a free charge on the line, which manifests itself now as an abrupt impulse or wave travelling along the line with the approximate velocity of light, 186,000 miles per second. These waves have frequencies corresponding to the discharge frequency of the cloud, and amount to thousands of cycles per second. Reaching an end of the line, they suffer reflexion either from resistance or otherwise, and give rise to complex phenomena.

On a line not connected to ground, some provision must be made to supply leakage for waves like these, otherwise the potential will rise until the insulation is punctured.

High e.m.f.'s are caused in a system by means of electro-magnetic induction, since the cloud discharge is a current, and sets up an opposing e.m.f. in any parallel conductor.

The phenomenon known as direct stroke perhaps occurs very infrequently on a system. In case the discharge does strike the line, it is quite possible that small damage to apparatus will result, owing to the choking effect of the line on such an abrupt discharge. The e.m.f. will on this account build up very suddenly, and probably jump to the pole and ground itself that way. Shattered insulators and splintered poles are the result. Supposing, however, that the discharge does take place near some apparatus, or that sufficient passes along the line to enter the station; in such cases protection will sometimes only be obtained at the loss of the arresters, which then certainly will have paid for themselves many times over.

The early lightning arresters, therefore, were crude affairs, and but few of the early ideas have survived. Originally, efficiency in discharging the circuit was the prime requisite, and the other essential to a successful lightning arrester, namely, durability, has come by a process of development.

A majority of the users of lightning arresters to-day do not realize that just about one-half of the efficiency and just about one-half of the durability depends upon the manufacturer and the lightning arrester itself, and the other half depends upon the user, in the way he installs it, and the care he takes of it after it is installed.

To-day the most progressive roads make it a practice to inspect lightning arresters at least three times per year, preferably in the spring, just before the first lightning storms occur, and while the earth is still moist with the winter rains; another inspection is made in mid-summer when the earth is dry, and at the time when the most severe storms usually occur. This inspection is probably the most important, as it enables one to find out whether the ground connection is as good as it should be after the surface of the earth has become thoroughly dry. The last inspection is made in the fall, after the storms are over for the season. At that time such arresters as have been damaged may be taken down and repaired or replaced.

Particularly at the spring inspection should the connections to rail be investigated. Frequently the connecting wires become frozen in the earth and the vibration of the rails breaks off the wires. Arresters having no visual means of operation are better tested by employing tell-tale papers —the size of the puncture serving in a measure to check up the condition of the arrester and the ground. By employing this plan of a series of inspections, the cost is kept down to a minimum, and the efficiency of the installation is properly maintained.

In installing lightning arresters, and particularly in the method of providing ground connections, there is a woeful lack of standard practice. Until the last year or two the ground connection has usually been made by burying a copper plate or coil in the earth, with which the ground side of the arrester is connected by means of a copper wire. As an original installation this makes an ideal connection, but such grounding has probably caused as many lightning arrester troubles as any other one element.

In most soils copper rapidly corrodes, and usually the resultant salts form a coating around the conductor that is practically an insulator, thereby introducing in the discharge path a high impedance. This not only impairs the discharging efficiency of the installation, but with some types of lightning arresters prevents the flow of sufficient current following the discharge to operate the circuit opening device.

The argument has been advanced that such resistance in a ground path is of but small importance, because such a ground connection being of large cross-section, offers a multitude of tiny paths or outlets over which the discharge will escape to earth. The fallacy of this argument is apparent when one considers the impedance that is offered a sudden rush of lightning by even a normal amount of resistance. It is quite as important that the ground path be of low ohmic resistance as that the lightning arrester itself should be. Any ground connection must discharge freely or the desired protection against very sudden rushes of lightning will not be secured.

The use of galvanized iron pipe for ground connections has been recommended for the last year or two with the very best results. In soils that will permit, the pipe may be driven to a sufficient depth to reach permanent moisture. This method of connecting lightning arresters by means of iron pipe insures the greatest possible durability at a reassonable first cost. Its chief advantage lies in the fact that iron pipe corrodes very slowly in practically all soils, and the resultant salts are fairly good conductors. Even after the pipe has completely wasted away the usual oxide provides a good conductor, unless, of course, it becomes broken. An effort should always be made to secure genuine iron pipe, and in its absence, the best grade of galvanized steel pipe.

* Abstract of paper presented as Appendix E, report of Committee on Power Distribution, American Street and Interurban Railway Engineering Association.

There are several reasons for a rail of the same static potential at all times. Great care is usually taken to have these conditions, but on many systems, particularly large interurban properties where rock ballast is used, the rail may be of other potential than the earth at many points.

Unless the rails and the ground are of the same potential there is every possibility of a discharge from the rail puncturing the windings of the motors of a car that is passing, and going to earth via the car, the trolley wire and the arrester on the adjacent pole. There has been advanced most unmistakable evidence that many car motors are burned out in exactly this way.

In choosing a system of lightning protection compromises have to be made. The air gap must be adjusted for some point between normal voltage of the system and what we may call the danger voltage at which the insulation of the system is imperiled. The first consideration, therefore, is that an arrester must have an air gap small enough to come between these limits.

A reason why the simple air gap is unsatisfactory as a lightning arrester is that on a grounded circuit every discharge will necessarily produce a dead short circuit between line and ground. This means not only a loss of energy, but severe and dangerous strains on the apparatus supplying the current. Something must be found that will limit the flow of dynamic current to such a degree that these severe strains and the resulting dangers are avoided, but in limiting this flow of dynamic current we must be careful not to limit or seriously impede the discharge of abnormal voltages.

To solve this problem, resistance, in series with the air-gap, at once suggests itself. The requisites, then, of a satisfactory lightning arrester appear to be:—

(1) A medium, such as an air-gap, which breaks down on a voltage low enough to insure protection to apparatus.

(2) A resistance of a value sufficient to prevent grounding and the consequent strains on apparatus, but not so high as to impede to any appreciable extent the free passage of the more heavy discharges.

(3) Some positive automatic means of interrupting the relatively small flow of normal current following the discharge.

Users are heard even to-day expressing the opinion that a lightning arrester is good for but one discharge. If that were true, then a fuse in series with an air-gap would be the ideal arrester, because it would be entirely efficient for its one discharge, and would be inexpensive. Results, however, have proven quite differently with the more modern types of lightning arresters now on the market.

A large part of the failures of the older forms of lightning arresters, employing a low series resistance and some form of circuit-opening device, was due to an increase of resistance of the resistance rod itself. These rods were usually made of some combination of carbon or graphite with kaolin. Due to the action of the discharge in some cases, and to an apparent ageing process in others, these rods kept on increasing their resistance while in service.

There are resistance rods on the market to-day, however, that entirely overcome this trouble, as after four years' service absolutely no increase of resistance is shown. These rods are composed of a combination of a special grade of carborundum, kaolin, and a high percentage of metallic conducting material, properly fluxed at an extremely high degree of heat in the firing kilns.

Modern arresters are so designed that the discharge has practically a straight path to earth. They overcome many of the troubles of the older forms, due to an insufficient surface distance on the arrester base, between parts of opposite potential.

Many arrester failures are due to the use of iron boxes. An iron box offers an inductive effect to a discharge, and this effect becomes very marked as the frequency of the oscillations increases. Often the discharge jumps around the insulating bushings surrounding the leading-in wires, the normal current follows, and establishes a serious short circuit. Wooden or asbestos lumber boxes are greatly to be preferred; the former are cheaper than iron and quite durable, while the latter have their fireproof qualities to recommend them. For car service asbestos lumber boxes should always be used, as any lightning arrester, unless properly fireproofed, may burn out and hazard valuable apparatus.

If arresters are properly designed to meet service conditions; if they are properly installed and frequently inspected to see not only that the arresters themselves are in good condition, but that the ground connections are likewise, users may reasonably expect several years' service from an equipment of the present-day lightning arrester.

If tell-tale papers be put in the gaps of lightning arresters it will be a matter of considerable surprise to note the number of discharges taken. If this practice is continued for a period of two or three years, it will enable railway operators to determine where discharges most frequently occur, and at these points arresters may be installed more frequently and better results thereby secured.

As a sample of what has been accomplished by careful inspection, one of the large interurban roads in the centre of the lightning belt of Indiana has shown a total loss of lightning arresters of less than two per cent. of the entire equipment per year for three years. This company inspects its arresters frequently, and the saving of lightning arresters due to this inspection, together with the increased protective efficiency of their arrester equipment, has more than paid for the inspection.

Another company, located in practically the same territory, operating at 1,200 volts d.c. since 1906, has lost or had partially damaged in the past three years, a total of but six arresters out of 225 originally installed, and during that time has lost absolutely nothing in the way of equipment. On this property frequent and careful inspections are the rule.

The foreging statements refer throughout to lightning protection of direct current circuits. A large part is equally pertinent in relation to alternating current circuits. The design of alternating current lightning arresters has presented very different but quite as difficult problems as direct current railway circuits.

The characteristics of alternating current are taken advantage of very nicely in practically all modern types of a.c. lightning arresters. The use of several air-gaps in series, where the current flow is limited to certain values by various means, results in the failure of the arc in the gaps, when the current wave passes through zero. In some forms of a.c. arresters this action is supplemented by shunting some of the gaps with a series of resistance; in others, a circuit-breaker cuts off the flow of normal current, if for any reason the air-gaps fail to respond promptly.

There is no more fitting conclusion than to remark that the price of satisfactory lightning protection is proper installation and inspection. The manufacturers to-day may be said to have done very well with this problem, as is evidenced by highly satisfactory general results. But these satisfactory results are secured only when the operating companies co-operate by giving the arrester installation the proper care.

ENGINEER'S LIBRARY

THE CANADIAN ENGINEER'S MONTHLY INDEX OF CIVIL ENGINEERING LITERATURE.

The purpose of this monthly index is: To inform engineers and contractors of the literature published on those subjects in which they are especially interested, the character of the article and the journal in which it appeared. **We do not index in this section articles that appear in The Canadian Engineer.**

Periodicals containing articles indexed, should be ordered direct from the publishers.

LIST OF PERIODICALS INDEXED.

Canadian Society of Civil Engineers Proceedings.–(Can. Soc. C. E. Proc.), Montreal, Can., m., 4 x 7 in., 50 cents.

Canadian Cement and Concrete Review.—(Can. Cem. and Con. Rev.), Toronto, Ont., m., 9 x 14, 15 cents.

Contractor.—(Contr.), Chicago, Ill., bi.-w.; 7 x 10 in., 20 cents.

Engineering—Contracting.—(Eng.-Cont.) Chicago, Ill., w.; 9 x 12 in., 10 cents.

Engineering News.—(Eng. News), New York, N.Y., w.; 10 x 14 in., 15 cents.

Engineering Magazine.—(Eng. Mag.), New York, N.Y., 7 x 10 in., 25 cents.

Machinery.—(Mach.), New York, N.Y., m., 7 x 11 in., 20 cents.

Municipal Journal and Engineer.—(Mun. Jl. and Eng.), w., New York, N.Y., 9 x 12, 10 cents.

Municipal Engineering Magazine.—(Mun. Eng. Mag.), Indianapolis, Ill., m., 7 x 10 in., 25 cents.

Power and Engineer.—(Pow. and Eng.), New York, N.Y., w.; 9 x 12 in., 5 cents.

Railway Age Gazette.—(R. R. Age Gaz.), New York, w.; 8 x 11 in., 15 cents.

Surveyor, The.—(Sur.), London, Eng., w.; 6 x 11, 10 cents.

Engineering.—(Engr.), London, Eng., w.; 12 x 15 in., 15 cents.

POWER AND LIGHT.

Power House, Rock Island R.R. Shops.*—Six pages. Pow. and Eng., Oct. 19, 1909. Describes building, coal plant, boiler-house, etc.

Value of a Water Power.*—Two pages. Pow. and Eng., Oct. 12, 1909. Simple methods for making an estimate of the available power.

Measuring Flow of Water*.—Six pages. Pow. and Eng., Oct. 5, 1909. Measuring water by Venturi meter and weir. Construction and theory.

Choosing a Motor.*—Four pages. Pow. and Eng., Oct. 26, 1909. Views of two experienced engineers on advisable features of construction, speeds, windings and ratings of direct-current motors.

Speed of Electric Motor.—Four pages. Pow. and Eng., Nov. 2, 1909. An elementary explanation of the principal methods used to vary the speed of a shunt-wound motor running on a two-wire circuit.

*Illustrated.

ROADS AND PAVEMENTS.

Destructive Effect of Motor Traffic on Macadam Roads.—One page. Eng.Cont., Oct. 20, 1909. The result of tests on the causes of destruction, with special attention to motor traffic.

Street Grades.*—Three pages. Mun. Jl. and Eng., Oct. 20, 1909. Tells of the system of establishing street grades in New York.

Cost of Hauling.*—Four pages. Cont., Nov. 1, 1909. Gives detailed costs of hauling in Ohio of wagons, first, by traction engines, and second, by two-horse wagons.

RAILWAYS.

Consolidated Locomotives.*—Four pages. R.R. Age, Oct. 15, 1909. Details of the Walschaerts valve gear on Lackawanna R.R.

Tonnage Formula for Train Loads.—One page. R.R. Age, Oct. 22, 1909. "Adjusted tonnage" method of calculating train loads.

Signals.*—Four pages. R.R. Age, Oct 8, 1909. Describes the new signals at Providence on the New York, New Haven and Hartford.

Signals.*—Five pages. R.R. Age, Oct. 8, 1909. System in the new tunnels of the Hudson and Manhattan.

Locomotive Tractive Effort.—Two pages. R.R. Age, Nov. 5, 1909. Formula and table used on the Southern Railway for obtaining quickly the tractive effort of locomotives.

CONCRETE AND REINFORCED CONCRETE.

Cost of Reinforced Concrete Pile Dyke.*—One page. Eng.-Cont., Oct. 20, 1909. Gives cost of dyke built on the Missouri River.

Viaduct of Concrete.*—Three pages. Contr., Oct. 15, 1909. Details of reinforced concrete bridge in California.

Reinforced Concrete Columns.*— One page. Eng., Sept. 24, 1909.

SEWERS, SEWAGE AND WATERWORKS.

Brooklyn Water System.*—Two pages. Contr., Oct. 15, 1909. Describes how excavation was done by drainage excavators.

Louisville Sewerage Improvements.*—Two pages. Eng. News., Oct. 14, 1909. Gives details of sewer dimensions, etc.

Cost of Laying Water Pipe.—Half page. Eng.-Cont., Oct. 13, 1909. Gives cost of work in Cleveland, Ohio.

Filters.*—Two and a half pages.—Mun. Jl. and Eng., Oct. 6, 1909. Describes the filters in use at Rock Island, a town with a population of 28,000.

MISCELLANEOUS.

Gas Producer for Low-grade Fuel.*—One page. Pow. and Eng., Oct. 19, 1909. Describes the Deutz gas producer.

Liability Insurance for Contractors.—One page. Contr., Oct. 15, 1909. The article outlines the advantage to contractors of insurance.

Rolling of Special Sections of Iron and Steel.*—One page. Eng. News, Oct. 7, 1909.

Direction Marks for Maps.*—One page. Eng. News, Oct. 7, 1909. The article gives a series of different designs used for marking direction on plans.

Cost of Drainage Work.*—Five pages. Eng. Cont., Oct. 13, 1909. Method of drainage and cost in Illinois.

Stresses Produced by Shocks.—One and a half pages. Mach., Oct., 1909.

Shafts for Turbines.—Two pages. Eng., Sept. 24, 1909. Shafts for turbine vessels.

Some Causes of Belt Failures.*—Two and a half pages. Mach., Nov., 1909.

* Illustrated.

BOOK REVIEWS.

Books reviewed in these columns may be secured from the Book Department, Canadian Engineer, 62 Church Street, Toronto.

Concrete, Plain and Reinforced, by Frederick W. Taylor, D. Sc., and Sanford E. Thompson, M. Am. Soc. C. E. Published by The Renouf Publishing Company, Limited, Montreal, Que.; John Wiley & Sons, 43 East Nineteenth Street, New York; and Chapman & Hall, Limited, London, England. Price $5.00 net.

This is a second revised and enlarged edition brought up to date. It is over one hundred pages larger than the first edition, and contains special chapters by R. Feret, W. B. Fuller, F. P. McKibben, and S. B. Newberry, which include some of the very latest designs and information.

While either plain or reinforced concrete are in themselves subjects of considerable magnitude, nevertheless in this volume, which contains upwards of eight hundred pages of readng matter, there is sufficient room to deal exhaustively with both. Concrete contractors and engineers throughout America are sufficiently conversant with the names of Sanford E. Thompson and Frederick W. Taylor as to accept this book on the strength of their names as authors. It is most complete. Every branch of the subject has received such attention as it merits in the eyes of those practically engaged in concrete work. Unimportant subjects and antiquated methods and designs have been kept in the background. Concrete engineers and builders will find but little in this large volume that cannot be found of practical value in the construction work of to-day.

Some new ideas have been introduced in the make up of this edition that will facilitate its use as a text and reference book on concrete. The arrangement of the chapters has evidently been made with this in view as a logical order has not been followed throughout. The first 250 pages are more or less elementary, but they are most complete and subjects of the utmost importance, such as tests, specifications, choice of cements, etc., have been dealt with at some length. Numerous tables of weights and volumes will be found exceedingly useful. Chapter 1 is of special interest in so far as it points out many of the essentials of concrete construction and warnings against the most serious errors that have frequently been made in field. The greater portion of the book deals with present day methods for all manner of concrete work and is most complete. It would be impossible to cover this portion of the book unless at great length as eighteen chapters have been donated by the authors to this section, as well as several appendices. The last chapter contains a comprehensive list of valuable books and articles relating to the various subjects referred to as well as the names of authors, arranged alphabetically. This book is one of the most comprehensive that have come to our notice. It is up-to-date and most practical.—A. E. U.

Principles of Reinforced Concrete Construction, by F. E. Turneaure, Dean of the College of Engineering, University of Wisconsin, and E. R. Maurer, Professor of Mechanics, University of Wisconsin. Published by Renouf Publishing Company, Limited, Montreal, and John Wiley & Sons, New York. Price $3.50 net.

This book treats principally with the theoretical side of reinforced concrete construction and its application to miscellaneous structures, such as arches, dams, retaining walls, etc., as well as buildings generally. It appeals more to the engineering student and technical reader rather than the practical builder and contractor. The first six chapters in particular deal exhaustively with the theoretical side of the subject. The last five chapters however, deal with the application of the principles outlined in the former chapters and will, in themeslves, be found instructive though incomplete in cases where the technicalities of the subject are of little interest to the reader or difficult of interpretation. In brief, chapters I. to VI. treat of the theory of the subject and the results of experiments. The remaining chapters treat of the use of reinforced concrete in various forms of structures. The entire work is replete with tables and diagrams necessitating a careful study. Without a thorough knowledge of the principles of mechanics, it is doubtful whether the reader would be able to apply the principles as narrated, underlying the design of reinforced concrete. The theoretical chapters of the book treat with the properties of concrete, of reinforcing steel and of concrete and steel in combination, stresses in beams, tests of beams and columns, working stresses and general constructive details, as well as numerous formulae, diagrams and tables. This book is the second edition, revised and enlarged by over one hundred pages, which include the result of recent important experiments that will be found of interest.—A. E. U.

Concrete, by Edward Godfrey. Published by the author at Monongahela Bank Building, Pittsburg, Pa. Pages, 450. Size, 4 x 6. Leather. Price, $2.50.

This book was written to point the way to sound engineering in concrete, by enunciating the principles thereof and by laying bare the falsity of much that passes for good engineering. The aim was to teach, not by example, but by laying stress on the principles that should govern in all design.

There are four general divisions to the book. First, some 180 pages given to information relative to the materials used in making concrete and reinforced concrete.

Second, some 75 pages consisting of articles by the author published in engineering journals, together with letters of criticism, on beams, and slabs, columns and footings, and retaining walls.

The third section of 155 pages takes up beams and slabs again, the arch, foundations, shear of concrete and its bearing on the design of beams, the columns, dams and their design and the design of domes, vaults and conical coverings.

The last section consists of cuts showing piers, small arches, culverts, etc., as illustrating current practice.

Any man anxious to be well informed on concrete and reinforced concrete design will find much in this book that assist in making him familiar with this subject as well as giving him confidence in design.

Calculators, by the Dodge Manufacturng Company, Mishawaka, Ind. Price 25 cents.

This calculator is well made and nicely encased in leather. It has six scales and by its aid one can quickly

calculate the pulley speed, power that may be transmitted, size of pulley or belt required, size of shafting and power certain sizes will transmit. Altogether a most useful calculator.

Welding and Cutting Metals by Aid of Cases or Electricity, by Dr. L. A. Groth, Consulting Engineer. 267 pages, 5½ x 8¾. Price 10/6, or $2.50 net. Published by Archibald Constable Company, Ltd., London, England.

As pointed out in the preface of this book, welding is used to a far greater extent than is generally supposed. Reliable data as to either the relative values of alternative welding processes, or welded unions as compared to joints effected by other means, are difficult to procure, especially if such information is desired in a hurry. That the author of the book has recognized this fact, is very evident from the careful attention to accuracy exhibited throughout the various chapters.

The description of the historical development of the present day manufacture of the various gases used in welding is extremely complete. This, together with the pages devoted to the theory and practice of the various welding methods and the construction of blow pipes suitable for the use of gases in welding, constitute three very interesting chapters both from the standpoint of the engineer and the manufacturer.

The electrical and "Thermit" processes, together with aluminium welding, the accomplishment of which is so difficult, are thoroughly gone into, the dangers and advantages of the different methods being very intelligently pointed out.

The most valuable portion of the book from the engineering standpoint is that devoted to the welding of sheet iron and steam boilers. In the discussion, is given a large amount of certified information from various engineers and directors of works as to the relative reliability of welded as compared with cast iron pipes. Passing to the subject of welding steam boilers, many details of actual cases in which welding has been aplied both in constructing new and in repairing old boilers are given. The necessity of employing only experienced men on such work is clearly shown.

The chapter on cutting metals by either gases or by electrical means needs no comment. It is in keeping with the preceding pages.

The remainder of the book is taken up with the description of accidents that have happened in welding practice and the resultant legislation relative for the manufacture of gases and their subsequent use.—T. R. L.

A Study of the Open Hearth, by Harbison-Walker Refractories Company, Pittsburgh.

It would seem rather a presumption to call this book a "Study" of the open hearth furnace. It is, in fact, a synopsis of open hearth practice. There are six chapters embracing the construction of open hearth furnaces, Acid and Basic; and their operation; fuels used, recarbonization; and a concise description of special processes.

The book, extremely well bound in pocket size, (6½ ins. x 4 ins.) would be of value to any salesman who has to do with iron and steel products, in as much as it would give him a grasp of the manufacture of Open Hearth steel and thereby enable him to more intelligently handle his wares. —T. R. L.

Applied Statics, by T. R. Loudon, B. A. Sc. Published by The Canadian Engineer Press, 62 Church Street, Toronto, Ontario. Size 6 x 9. Pages 100. Price $1.00.

The author in preparing this text had apparently two objects in view. First, to treat the subject so that the reader could follow every step in the discussion, and second, to apply the theory to practical problems.

The first few chapters are taken up with the theory of the subject and the matter is dealt with clearly and very fully. The remaining chapters deal each with some particular subject; method of sections; the beam; shearing forces; pulley systems; friction and wind pressure.

In the issue of the Canadian Engineer, October 22nd, Mr. Loudon commenced a series of problems applying the theory he has discussed in this book. These problems will continue for the next five months and together with this text should provide the young engineer, anxious to review or work up his mathematics, an excellent programme of study.

PUBLICATIONS RECEIVED.

"Fuel Tests with Illinois Coal."—By L. P. Breckenridge and Paul Diserens, issued by the Engineering Experiment Station of the University of Illinois as Circular No. 3. It consists of a compilation of data relating solely to the coals of the State of Illinois, selected from the complete reports of the Government investigations on the fuels of the United States. Copies of circular No. 3 may be obtained gratis on application to W. F. M. Goss, Director of the Engineering Experiment Station, University of Illinois, Urbana, Illinois.

Direct and Alternating Current Testing.—By Frederick Bedell, Ph.D., Professor of Applied Electricity in Cornell University, assisted by Clarence A. Pierce, Ph.D.; 300 pp., 6 x 9; cloth, $2, net. Published by D. Van Nostrand Company, 23 Murray, and 27 Warren Streets, New York City.

Concrete.—By Edward Godfrey, structural engineer for Robert W. Hunt & Company. 500 pp., pocket size, leather cover. Price, $2.50 net. Published by the author, Pittsburg, Pa.

Proceedings of the First Meeting of the Illinois Water Supply Association, held at the University of Illinois, February 16th and 17th, 1909; 200 pp., 6 x 9. Published by the Society, Urbana-Champaign, Ill.

Principles of Reinforced Concrete Construction.—By Mr. F. E. Turneaure, Dean of the College of Engineering, University of Wisconsin, and Mr. E. R. Maurer, Professor of Mechanics, University of Wisconsin; second edition; 430 pp., 6 x 9; $3.50. John Wiley & Sons, publishers, New York, U.S.A.; Chapman & Hall, Limited, London, Eng.

A Treatise on Concrete: Plain and Reinforced.—By Frederick W. Taylor, M.E., Sc.D., and Sanford E. Thompson, S.B., M. Am. Soc. C.E., second edition; 800 pp., 6 x 9; price, $5. John Wiley & Sons, publishers, New York City, U.S.A.; Chapman & Hall, London, England.

A Treatise on Masonry Construction.—By Ira Osborn Baker, B.S., C.E., D. Eng., Professor of Civil Engineering, University of Illinois; tenth edition, 6 x 9, 746 pages, 100 tables and 244 illustrations; cloth, $5, net. John Wiley & Sons, publishers, New York City; Chapman & Hall, Limited, London, Eng.

Field and Office, and **Railroad Curves and Earthwork,** two books.—By C. Frank Allen, S.B., Mem. Am. Soc., C.E., Professor of Railroad Engineering in the Massachusetts Institute of Technology; 4th edition, 220 pp., gilt edges, pocket size, leather bound, $2 each. Spon & Chamberlain, publishers, 123 Liberty Street, New York, U.S.A.

Report of the Chief Engineer of the Board of Estimate and Apportionment of the city of New York, U.S.A., for 1908. 400 pages, 6 x 10. Mr. Nelson P. Lewis, chief engineer.

The Recognition of Minerals.—By C. G. Moore, M.A., F.I.C., with monographs on geology, ore deposits, etc., by Donald A. MacAlister, Assoc., R.S.M., F.G.S., 250 pp., 6 x 9; cloth, $1.85. Published by the Mining Journal, 46 Queen Victoria Street, London, E.C., England.

Efficiency as a Basis for Operation and Wages.—By Harrington Emerson, 175 pp., 6 x 9, cloth. The Engineering Magazine, publishers, New York, U.S.A.

Power Railway Signalling.—By H. Raynar Wilson, late of the L. & Y., and Midland Railways of England, 350 pages, 9 x 12; cloth, $7.25. Published by The Railway Engineer, 3 Ludgate Circus Buildings, London, E.C., England.

Secondary Stresses in Bridge Trusses.—By Mr. C. R. Grimm, C.E., M. Am. Soc. C.E., 6 x 9, 150 pages, 60 illustrations, and 13 numerical examples. Cloth, $2.50. John Wiley & Sons, publishers, New York. Renouf Publishing Company, 61 Union Ave., Montreal, agents for Canada.

Irrigation Engineering.—By Herbert M. Wilson, C.E., M. Am. Soc. C.E., Chief Engineer, United States Geological Survey, 650 pp., 6 x 9, and 38 full page plates, and 195 figures; cloth, $4. John Wiley & Sons, publishers, New York, U.S.A.; Renouf Publishing Company, 61 Union Ave., Montreal, Que.

Practical Testing of Gas and Gas Meters.—By C. H. Stone, B.S., M.S., chief inspector of gas, Public Service Commission, Second district, New York, 350 pages, 6 x 9; numerous illustrations. John Wiley & Sons, publishers, New York, U.S.A.; Renouf Publishing Company, Montreal.

Structural Details or Elements of Design in Heavy Framing.—By Henry S. Jacoby, Professor of Bridge Engineering, Cornell University, 375 pp., 6 x 9, and 40 illustrations, $2.25 net. John Wiley & Sons, publishers, New York, U.S.A.; Renouf Publishing Company, Montreal.

Report of the Sanitary State of the City of Montreal, also an account of the operations of the Board of Health and the Vital Statistics for the year 1908, by Dr. Louis Laberge, Medical Officer of Health. 107 pp., 6 x 9 pub. doc.

Proceedings of the first annual general assembly of the Architectural Institute of Canada, held in Ottawa on the 28th, 29th and 30th September, and 1st October, 1908. 140 pp., 6 x 9. Alcide Chausse, M.S.A., Secretary, P.O. Box 259, Montreal, Que.

The Bridges of New York.—By Mr. T. Kennard Thomson, M. Can. Soc. C.E., Consulting Engineer, 50 Church Street, New York City. 70 pages, 6 x 9, well illustrated.

CATALOGUES.

Foundry Facings.—A booklet of handy size has just been issued by the Joseph Dixon Crucible Company, Jersey City, N.J., descriptive of foundry facings. Much valuable information on the proper use of facings is given, and the listings, which include prices, will be of interest to the purchasing agent.

Corrugated Steel Sheet Piling.—The uses of this material are illustrated and described in a folder issued by the Wemlinger Steel Piling Company, 11 Broadway, New York City. Information concerning work in which the piling is used, including the construction of bridge piers, coffer dams, sewer trenches, waterworks, subways, etc., will be gladly forwarded on application.

The Peerless "Pickup" Hand Sweepers are described and illustrated in a book just issued by the Barron & Cole Company, 127 Franklin St., New York City. The machine is used on streets, in parks and factories, on railroad platforms, etc. Many good recommendations are given, and the volume is worthy of consideration from municipal authorities interested in the street cleaning problem.

Road-making Machinery is described in a booklet entitled "Cheaper and Better Roads." Published by the Baker Manufacturing Company, Fisher Building, Chicago, Ill., it tells how to cheapen expenses in grading, ditch digging, drainage work, irrigation, and a host of other things in which the highway and municipal engineer are interested.

How to Mix and Place Concrete for Five Cents a Cubic Yard is the title of a publication distributed by the Nims Concrete Machinery Company, 127 Franklin Street, New York City. Instances are cited in which the cost of concrete work was extremely low, while an interesting article on the Actual Cost of Mixing and Placing Concrete in a Dam is also included.

The Milburn Light.—An improved gas light, generated from acetylene, and used by contractors, railways, mining companies, foundries, lighthouses and dockyards—is the subject article in a book published by the Alexander Milburn Company, of Baltimore, Md., U.S.A. Particulars as to its cost are given, together with illustrations showing its adaptability.

Modern Street Railway Lamps are described in Bulletin 5B, issued by the engineering department of the National Electric Lamp Association, 4411 Hough Ave., Cleveland, Ohio.

Gas Engines for electric lighting, pumping and general power purposes are described and illustrated in an interesting booklet prepared by the Bruce-Macbeth Engine Company of Cleveland, Ohio. Comparative fuel costs of different kinds of power, including that produced by the steam engine and the gas engine, are given, while there are also much other data that will interest the engineer and purchasing agent who is connected with municipal and private plants in which this kind of machinery is used.

Road-making Machinery.—Contractors and township supplies, and high-grade traction and portable engines are described by Messrs. Sawyer and Massey Company, Limited, of Hamilton, Ontario, in a booklet with which we have been favored. Municipal engineers and the members of boards of works of town and city councils will find in this publication descriptions of some of the best road-making equipment manufactured in Canada.

Engine Indicators.—The Trill Indicator Company, of Corry, Pa., has just issued an attractive 44-page booklet describing their various types of indicators. This book also describes the Faultless Reducing Motion, Trill Planimeter, and Indicators for high pressure and ammonia work. Besides the description of the apparatus, interesting discussions are given on numerous cards and the causes of various unusual curves pointed out. A method is also given for drawing adiabatic and saturation curves.

Electrical Machinery.—Bruce, Peebles & Company, Edinburgh, Scotland, send an interesting series of catalogues describing induction motors, continuous current motors, alternators, continuous current dynamos, motor-converters, and special machinery.

Gas Engine Tests.—The Colonial Engineering Company, 222 St. James Street, Montreal, Que., in their booklet, Cost of Power, give interesting information as to what the power user should pay for light, heat and power. They also give the results of several tests made on their engines.

Buckets, Orange Peel and Clam Shell.—The Hayward Company, 50 Church Street, New York, have in the most substantial and modern design these two styles of buckets. They also make buckets to special designs, and the Hayward bucket will handle any digging problem.

ENGINEERING SOCIETIES.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—413 Dorchester Street West, Montreal President, George A. Mountain; Secretary, Professor C. H. McLeod.

QUEBEC BRANCH—
Chairman L. A. Vallee; Secretary, Hugh O'Donnell, P.O. Box 115, Quebec. Meetings held twice a month at Room 40, City Hall.

TORONTO BRANCH—
96 King Street West, Toronto. Chairman, J. G. G. Kerry; Secretary, E. A. James, 62 Church Street, Toronto. Meet last Thursday of the month.

MANITOBA BRANCH—
Chairman, H. N. Ruttan; Secretary, E. Brydone Jack. Meets first and third Fridays of each month, October to April, in University of Manitoba, Winnipeg.

VANCOUVER BRANCH—
Chairman, Geo. H. Webster; Secretary, H. K. Dutcher, 40-41 Flack Block, Vancouver. Meets in Engineering Department, University College.

OTTAWA BRANCH—
Chairman, C. R. Coultee, Box 560, Ottawa; S. J. Chapleau, Box 203.

MUNICIPAL ASSOCIATIONS.

ONTARIO MUNICIPAL ASSOCIATION.—President, Mr. George Geddes, Mayor, St. Thomas, Ont.; Secretary-Treasurer, Mr. K. W. McKay, County Clerk, St. Thomas, Ontario.

UNION OF ALBERTA MUNICIPALITIES. — President, H. H. Gaetz, Red Deer, Alta.; secretary-treasurer, John T. Hall, Medicine Hat, Alta.

UNION OF NOVA SCOTIA MUNICIPALITIES.—President, Mr. A. E. McMahon, Warden, King's Co., Kentville, N.S.; Secretary, A. Roberts, Bridgewater, N.S.

UNION OF SASKATCHEWAN MUNICIPALITIES.—President, Mayor Hopkins, Saskatoon; Secretary, Mr. J. Kelso Hunter, City Clerk, Regina, Sask.

CANADIAN TECHNICAL SOCIETIES.

ALBERTA ASSOCIATION OF ARCHITECTS.—President, R. Percy Barnes, Edmonton; Secretary, H. M. Widdington, Strathcona, Alberta.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.—President, Charles Kelly, Chatham, Ont.; Secretary, W. A. Crockett, Mount Hamilton, Ont.

CANADIAN CEMENT AND CONCRETE ASSOCIATION.—President, Peter Gillespie, Toronto, Ont.; Vice-President, Gustave Kahn, Toronto; Secretary-Treasurer, Alfred E. Uren, 62 Church Street, Toronto.

CANADIAN ELECTRICAL ASSOCIATION.—President, N. W. Ryerson, Niagara Falls; Secretary, T. S. Young, Canadian Electrical News, Toronto.

CANADIAN FORESTRY ASSOCIATION.—President, Thomas Southworth; Secretary-Treasurer, King Radiator Company, Toronto; Secretary, James Lawler, 11 Queen's Park, Toronto.

CANADIAN INDEPENDENT TELEPHONE ASSOCIATION.—President, Dr. W. Doan, Harrietsville, Ont.; Secretary, F. Page Wilson, Toronto.

CANADIAN MINING INSTITUTE. — Windsor Hotel, Montreal. President, W. G. Miller, Toronto; Secretary, H. Mortimer-Lamb, Montreal.

CANADIAN RAILWAY CLUB. — President, H. H. Vaughan; Secretary, James Powell, P.O. Box 7, St. Lambert, near Montreal, P.Q.

CANADIAN STREET RAILWAY ASSOCIATION.—President, D. McDonald, Manager, Montreal Street Railway; Secretary, Acton Burrows, 157 Bay Street, Toronto.

CANADIAN SOCIETY OF FOREST ENGINEERS.—President, Dr. Fernow, Toronto; Secretary, F. W. H. Jacombe, Ottawa.

CENTRAL RAILWAY AND ENGINEERING CLUB.—Toronto, President, C. A. Jeffers; Secretary, C. L. Worth, 409 Union Station. Meets third Tuesday each month except June, July, August.

DOMINION LAND SURVEYORS.—Ottawa, Ont. Secretary, T. Nash.

EDMONTON ENGINEERING SOCIETY. — President, Dr. Martin Murphy; Secretary, B. F. Mitchell, City Engineer's Office, Edmonton, Alberta.

ENGINEER'S CLUB OF TORONTO.—96 King Street West. President, A. B. Barry; Secretary, R. B. Wolsey. Meeting every Thursday evening during the fall and winter months.

INSTITUTION OF MINING AND METALLURGY.—President, Edgar Taylor; Secretary, C. McDermid, London, England. Canadian Members of Council:—Profs. F. D. Adams, J. B. Porter, H. E. T. Haultain, and W. H. Miller, and Messrs. W. H. Trewartha-James and J. B. Tyrell.

MANITOBA LAND SURVEYORS.—President, George McPhillips; Secretary-Treasurer, C. G. Chataway, Winnipeg, Man.

NOVA SCOTIA SOCIETY OF ENGINEERS, HALIFAX.—President, S. Fenn; Secretary, J. Lorne Allan, 15 Victoria Road, Halifax, N.S.

ONTARIO PROVINCIAL GOOD ROADS ASSOCIATION.—President, W. H. Pugsley, Richmond Hill, Ont.; Secretary, J. E. Farewell, Whitby, Ont.

ONTARIO LAND SURVEYORS' ASSOCIATION.—President, Louis Bolton; Secretary, Killaly Gamble, 703 Temple Building, Toronto.

ROYAL ARCHITECTURAL INSTITUTE OF CANADA.—President, A. F. Dunlop, R.C.A., Montreal, Que., Hon. Secretary, Alcide Chaussé, 5 Beaver Hall Square, Montreal, Que.

WESTERN CANADA RAILWAY CLUB. — President Grant Hall; Secretary, W. H. Rosevear, 199 Chestnut Street, Winnipeg, Man. Second Monday, except June, July and August, at Winnipeg.

AMERICAN TECHNICAL SOCIETIES.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS (TORONTO BRANCH).—W. H. Eisenbeis, Secretary, 1207 Traders Bank Building.

AMERICAN MINING CONGRESS. — President, J. H. Richards; Secretary, James F. Callbreath, Jr., Denver, Colorado.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.—President, John P. Canty, Boston & Maine Railway, Fitchburg, Mass.; Secretary, T. F. Patterson, Boston & Maine Railway, Concord, N.H.

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION.—President, Wm. McNab, Principal Assistant Engineer, G.T.R., Montreal, Que.; Secretary, E. H. Fritch, 962-3 Monadnock Block, Chicago, Ill.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—Secretary, C. W. Hunt, 220 West 57th Street, New York, N.Y. First and third Wednesday, except July and August, at New York.

AMERICAN SOCIETY OF ENGINEERING-CONTRACTORS. — President, George W. Jackson, contractor, Chicago; Secretary, Daniel J. Haner, Park Row Building, New York.

(Continued on page 50.)

RAILWAY EARNINGS AND STOCK QUOTATIONS

NAME OF COMPANY	Mileage Operated	Capital in Thousands	Par Value	EARNINGS Week of Nov. 7 1909	EARNINGS Week of Nov. 7 1908	STOCK QUOTATIONS TORONTO Price Nov. 5 '08	Price Oct. 28 '09	Price Nov. 4 '09	Sales Week End'd Nov. 4	MONTREAL Price Nov. 5 08	Price Oct. 28 '09	Price Nov. 4 '09	Sale Week End'd Nov. 4
Canadian Pacific Railway	8,920.6	$150,000	$100	$2,113,000	1.688.000	173¾	184½ 183¾	184½	30	175	174½	183¾ 183½	184½ 184	980
Canadian Northern Railway	2,986.9	.....	.....	340 300	256,900	.....	.....	.....	.....	.....	.....	.....	.....	.....
*Grand Trunk Railway	3,536	226,000	100	902,197	837,226	.....	..... *1st. pref. 108½, 3rd pref. 57½, ordinary 23½	.....	.....	.....	.....	.....	.....	.....
T. & N. O.	334	(Gov. Road)	.....	.....	.....	.....	.....	.....	.....	200	199½	207½ 202	209 208½	788
Montreal Street Railway	138.3	18,000	100	74,794	68.578	.....	104 123 122¾	123⅜	99		105⅝	123½ 122⅝	124½ 123½	3803
Toronto Street Railway	114	8,000	100	75,053	68,482	170	168 183	182½	52		169	.....	.....	.....
Winnipeg Electric	70	6,000	100	.....	.....									

* G.T.R. Stock is not listed on Canadian Exchanges These prices are quoted on the London Stock Exchange.

RAILWAY EARNINGS FOR OCTOBER.

Company	Month of Oct., 1909	Month of Oct., 1908	Increase	Jan. 1 to Oct. 31, 1909	Jan. 1 to Oct. 21, 1908	Increase
Canadian Pacific Railway	$9,684,000	$7,349,000	$2,335,000	$66,956,860	$56,130,000	$10,826,860
Canadian Northern Railway	1,384,200	1,172,700	211,500	8,154,660	7,272,800	881,860
Grand Trunk Railway	4,043,361	3,786,170	257,191	33,523,441	31,949,954	1,573,487
Temiskaming & N. O. Railway	161,366	91,276	70,090	1,244,222	689,242	554,980
Montreal Street	305,652	280,059	25,593	2,947,579	2,776,613	170,966
Toronto Street	332,453	306,456	25,997	2,916,217	2,652,079	264,138
London Street	19,047	18,210	837	198,156	193,376	4,780
Totals	$15,930,079	$13,003,871	$12,926,208	$115,941,135	$101,664,064	$14,277,071

No minus signs are required in the accompanying table. Which means that the earnings of Canada's most important railways continue to increase. This is probably the best indication of the trend of progress that can be cited. Continually for the past few months have records been broken by our biggest road—the Canadian Pacific. As the reader will observe, the figures for the month of October alone, when compared with returns for the same period a year ago, show an increase of nearly two and a half million dollars, while the difference between the figures relating to the first ten months of this year and last year represents nearly eleven million dollars. In no other way is the story of Canada's march of progress better told.

While the statistics affecting the T. & N. O., the Canadian Northern and the Grand Trunk are encouraging, the figures giving the increase of the latter have, on several occasions, been larger. Comparing returns for the past two months, it will be seen that increases are general with the exception of the Toronto and Montreal Street Railways, whose earnings for September were augmented by the Canadian National Exhibition of Toronto and Old Home week celebrations at Montreal.

HAMILTON STREET RAILWAY

Hamilton.—Street Railway earnings for the last quarter amounted to $101,239.40, the largest in the history of the company. This is attributed largely to the improved service, since the reconstruction work on James and Barton street was completed this year. A comparison of the earnings for the first three-quarters of this year and the corresponding periods last year is interesting.

	1908.	1909.
March	$ 64,281.58	$ 68,260.47
June	78,373.03	82,453.14
September	93,260.03	101,239.40
Total	$235,915.64	$251,933.01

RAILWAY EARNINGS.

We were unable to give the earnings of the following railways for the last week of October with the figures relating to the other roads which we published on page 520 of our issue per last week:—

	1909.	1908.	Increase.
Grand Trunk	$1,321,050	$1,287,065	$33,985
T. & N. O.	54,588	31,404	23,184

Appended is a statement which contains figures relating to the past two months:—

	October, '09.	Sept., '09.
C. P. R.	$9,684,000	$8,148,000
C. N. R.	1,384,200	1,076,000
G. T. R.	4,043,361	3,959,004
T. & N. O.	161,366	153,217
Montreal St.	305,652	307,489
Toronto St.	332,453	379,581
London St.	19,047	24,645
	$15,930,079	$14,047,936

EDMONTON STREET RAILWAY.

The month of October just past saw the completion of the first year of actual operation of Edmonton's municipal street railway. The number of passengers carried on the street cars increased steadily throughout the year, and October crowned them all with 242,666 passengers carried, and a net revenue realized of $10,224. The increase in the number of passengers over the preceding month of September was 22,018. The increase in revenue was $617 taken in during the month of November $9,607.

RAILWAYS AND CANALS OF CANADA.

(Expenditure on Construction for Past Year.)

The annual report of the Department of Railways and Canals, issued on Tuesday, shows a total capital expenditure on railways during the past fiscal year of $29,414,227, of which $24,892,422 was on the National Transcontinental Railway.

On canals the capital expenditures were $1,873,868. These expenditures bring the total capital expenditure to the present time on railways up to $215,148,689 and on canals to $95,331,742.

The statement of receipts and expenditures of the Intercolonial Railway during the year shows that, as compared with the preceding twelve months, there was a decrease in the gross earnings of $646,489.07, of which $83,189 was in passenger traffic and $551,942 in freight traffic. A comparison of the working expenses for the same period shows an increase of $124.41 per mile of railway and ten cents per train mile.

The traffic through the several canals of the Dominion for the season of 1908 amounted to 17,502,820 tons, a decrease of 3,040,819 tons, as compared with the previous year.

CONSTRUCTION NEWS SECTION

Readers will confer a great favor by sending in news items from time to time. We are particularly eager to get notes regarding engineering work in hand and projected, contracts awarded, changes in staffs, etc. Printed forms for the purpose will be furnished upon application.

TENDERS.

Newfoundland

ST. JOHNS.—Canadian manufacturers of railway materials have another opportunity to tender for a valuable contract in Newfoundland. Mr. J. E. Ray, Canadian Trade Commissioner at St. John's, reports to the effect that the Reid Newfoundland Company are building a branch railway 100 miles in length. Work on the permanent way has just commenced under 2,000 men, but the rails will not be laid until next spring. Manufacturers of steel rails, bridges and railway materials should apply to H. D. Reid, The Reid Newfoundland Co., St. Johns, Newfoundland.

Quebec.

ARTHABASKA.—The secretary-treasurer of the council of the County of Arthabaska will receive up to Thursday, December 9th, tenders for the construction of a steel bridge on the Becancour River, between the municipalities of St. Louis of Blandford and the township of Stanfold. Louis Lavergne, secretary-treasurer.

HULL.—Tenders will be received until Monday, 6th December, 1909, for pumping equipment. R. W. Farley, City Engineer. (Advertisement in the Canadian Engineer.)

MONTREAL.—Tenders will be received up to Wednesday, December 1st, on 1,000 h.p. water tube boilers, 200 lbs. pressure for The Saraguay Electric & Water Co. Mr. Chas. Brandeis, C.E., Montreal.

MONTREAL. — Tenders will be received up to noon, Wednesday, 17th November, for the construction of Police and Fire Stations combined, corner of Mountain Avenue and Marechal Street, Mount Royal Ward, and corner of Third Avenue and Masson Street, Rosemount, St. Mary's Ward. The plans and specifications may be seen at the office of Mr. L. R. Montbriant, architect, 230 St. Andre Street. L. O. David, City Clerk.

QUEBEC.—Tenders will be received until Tuesday, the 30th November, for the building of the substructure of the Quebec Bridge. The general specification and form of tender will be ready about November 20th; but in the meantime contractors are invited to visit the office of the Quebec Bridge Board of Engineers, Canadian Express Building, Montreal, for the purpose of securing preliminary information to enable them to submit tenders for this work. L. K. Jones, secretary, Department of Railways, and Canals, Ottawa.

Ontario.

BURLEIGH FALLS.—Tenders will be received up to Tuesday, 16th November, for the works connected with the construction of a concrete dam at Burleigh Falls, on the Trent Canal. L. K. Jones, secretary, Department of Railways and Canals, Ottawa.

DUNNVILLE.—Tenders will be received until Thursday, November 18th, for constructing a system of sanitary sewers comprising about 18,000 lineal feet of tile sewers. the contractor to furnish all materials therefore. The entire work is to be completed on or before August 31st, 1910. Robert Bennett, Mayor; J. W. Holmes, town clerk; Willis Chipman, chief engineer, 103 Bay Street, Toronto.

FLETCHER.—Tenders will be received until 15th November, 1909, at noon for the contruction of drainage work in the township of Tilbury East, according to the report, plans and specifications of J. J. Newman, C. E., said work being as follows:—For enlarging and improving a part of the outlet of No. 2 and No. 3 Government drains in said Township and making embankments on each side of same estimated cost $9,960. Alex. Farquharson, Clerk.

LONDON.—Tenders will be received until Wednesday, November 10th, for underground conduit and cable system for electric light and power supply. Tenders are also invited until November 22nd on the transformers, motor generator set, voltage regulators, switchboards, lightning protectors, instruments, arc and incandescent street lighting systems, and other electrical apparatus. Address, Mr. E. I. Sifton, Electrical Engineer, City Hall.

OWEN SOUND. — John Harrison & Sons Company, Limited, of this town are advertising for tie timber. They will pay high prices for Tamarac and Cedar, 7½ inches or over at the top; 8 feet lengths or multiples.

OTTAWA.—Tenders will be received until Thursday, November 25th, for the packing of material and supplies for points along the Yukon Telegraph line between Quesnelle and Atlin, in the course of the season of 1910, 1911, and 1912. Forms of tender and specification may be obtained and form of contract seen on application to Mr. J. T. Phelan, Superintendent of Government Telegraphs, Vancouver, B.C.; Mr. William Henderson, District Superintendent Government Telegraphs, Victoria, B.C.; and from the Government Telegraph Agents at Ashcroft, B.C.; Quesnelle, B.C.; Hazelton, B.C.; and Telegraph Creek, B.C. Napoleon Tessier, secretary, Department of Public Works, Ottawa.

TORONTO.—Tenders will be received up to Tuesday, November 16th, for steam fire-engines and life-saving machines. Joseph Oliver, Mayor, Chairman Board of Control.

TORONTO.—Tenders will be received until Wednesday, November 24th, for pole line supplies. Specifications may be seen at the Electrical Department. Jos. Oliver, (Mayor), Chairman, Board of Control. (Advertisement in the Canadian Engineer.)

TORONTO.—Tenders will be received until Monday, November 22, for additions and alterations to the Toronto General Post Office. Plans may be seen at the office of Mr. Thomas Hastings, clerk of works, Customs Buildings, Toronto; N. Tessier, secretary, Department of Public Works, Ottawa. (Advertised in the Canadian Engineer.)

TORONTO.—Tenders for electric wiring in the branch library on the north-west corner of Gerrard Street and Broadview Avenue will be received up to Thursday, November 25th. E. S. Caswell, Secretary-Treasurer, Toronto Public Library.

TORONTO.—Tenders for steam fire engines and life-saving machines will be received up to noon Tuesday, November 16th, Mr. Jos. Oliver, (Mayor), Chairman, Board of Control.

Manitoba.

HARTNEY.—Tenders will be received up to December 6th, at 5 p.m., for the construction of a pile bridge across the Souris river on section 25—5—25, near Lauder. Plans and specifications may be seen at my office in Hartney. T. B. Woodhull, secretary-treasurer, Municipality of Cameron.

WINNIPEG.—Tenders are invited by the Board of Control for the construction of numerous sewers. M. Peterson, secretary; Col. Ruttan, city engineer.

WINNIPEG.—Tenders are invited until Thursday, November 18th, for 100 six-inch fire hydrants, for the domestic waterworks system. Colonel Ruttan, City Engineer; M. Peterson, secretary, Board of Control.

WINNIPEG.—Tenders will be received for drainage, requiring approximately the removal of over 200,000 cubic yards of material, up to noon of Monday, the 22nd of November. Arthur Stewart, 323 Main Street.

Saskatchewan.

REGINA.—Tenders will be received up to Monday, November 15th, for the construction of two reinforced bridge abutments for a highway traffic bridge, to be constructed over the Notekeu creek. F. J. Robinson, Deputy Commissioner, Department of Public Works.

British Columbia.

NORTH VANCOUVER.—Tenders are invited until Thursday, November 18th, by Alexander Phillip, clerk of the municipality for $30,000 general, $17,474 local improvement, and $15,000 water district debentures.

REVELSTOKE.—Tenders will be received until November 15th, for 1,130 feet wooden pipe, continuous stave,

in place; concrete dam and gate house, containing about 5,000 yards, and for 4,000 barrels Portland cement. Smith, Kerry & Chace, engineers, Winch building, Vancouver, B.C., and at Calgary, Alta., where further particulars may be obtained.

VANCOUVER.—A twenty-mile ditch system is being constructed for the Quesnelle Hydraulic Gold Mining Company, in the Cariboo Mining district by Messrs. Burr & Ferguson, civil and hydraulic engineers, 216 Loo Building Vancouver, who are in the market for supplies required in connection with the construction of dams, tunnels, ditches, flumes, pipe lines, etc., and invite manufacturers of such material to forward them descriptive literature.

CONTRACTS AWARDED.

Nova Scotia

HALIFAX—Tenders for supplying three thousand feet of 2½-inch hose, three hundred feet of chemical hose and some suction hose were not considered by the board of works, at their recent meeting, because the specifications called for a four-year guarantee and the tenders submitted were only on the basis of a three-year guarantee.

Quebec.

MONTREAL.—A contract was awarded for paving work to Laurin & Leitch, by the St. Louis Council.

MONTREAL.—The Water Committee awarded a contract to Messrs. Muir and Son, for 12,000 tons of Old Mines Sydney soft coal at $3.65 per ton. This is the lowest figure the city has paid for a long time.

Ontario.

OTTAWA.—The Government has formally awarded the contract for the construction of the Kippewa dam to Morrow and Beattie, of Peterborough. The work is to cost $26,210. The dam will create in Lakes Temiskaming and Kippewa reservoirs for the conservation of waters for distribution during the summer months.

ORILLIA.—Mr. J. A. MacIlwraith will lay 20-inch cast iron pipe from the corner of King and Front Streets, into the pumping station, at 83c. a foot, the town to supply the pipe.

PORT ARTHUR. — Tenders for the construction and equipment of a power station in connection with Hydro-Electric Power Commission, to cost approximately $60,000, are in the hands of the commission and will probably be considered at an early date.

HAMILTON.—A new supplied wagon for the fire department will be furnished by J. D. Patterson & Company, for $165.

SARNIA.—P. Corrigan & Company, have been awarded a contract for the construction of the Durand Street sewer, at $6,927.73. Fred. Wales offered to do the work for $6,827.73.

TORONTO.—On page 521 of last week's issue we announced the award of contracts for 16 sixteen-inch stop valves and 2 check valves for water mains. The Canada Foundry Company were given the contract for the check valves at $74.27, while Mr. Matthew Warnoch received the order for 16 stop valves at $93.50 each. Other tenders were:—

Stop Valves.	Check Valves.
$100.25 each	$130.25 each
99.00 "	*125.00 "
95.40 "	81.41 "
245.00 "	75.00 "
146.26 "	85.00 "

*Flange ends, $95 each.

TORONTO.—The City of Toronto received the following tenders for electrical apparatus for the waterworks, particulars of which were given on page 42, of the Canadian Engineer for October 15th:—

No	Section "F."	Alternative "F. 1."	Altern'tive "F. 2."	Section "G."	Section "H."	"F.," "G." & "H." comb'd
1	61,450	Add $ 250	Add $865	43,975	17,460	.....
2	74,184	Deduct 2006	" 1,061	49,951	14,347	.....
3	75,465	" 7000	" 1,000	50,170	16,585	.....
4	56,319	Add 2840	" 1,695	40,674	13,257	107,756
5	83,036	" 3422	" 1,599	47,379	10,730	140,145
6	72,750	" 2650	" 1,350	48,100	16,060	.....

It will be observed that only two tenders were submitted for sections "F.," "G.," and "H" combined, viz., tenders No. 4 and 5. No. 4, the tender of the Canadian Westinghouse Company was accepted. The next lowest tender for section "F." and "G." is No. 1, of the Dick, Kerr Company of England, submitted by the Canadian representatives—Chapman & Walker, Toronto. Tender No. 5, containing the lowest individual price on section "H.," is that of the Lancashire Dynamo & Motor Company of England.

TORONTO.—Contracts were awarded on Wednesday for eighteen pumps which will be installed in connection with the waterworks extensions. Section A, awarded to Jens Orten Boving, London, England, $14,800, was for four pumps with a capacity of 13,500,000 gallons each, for the main pumping station. The highest tender was $52,200. Section B, John McDougall, Caledonian Iron Works, Montreal, $11,703, was for two pumps with a capacity of 5,000,000 gallons, for the high-pressure fire system at the main pumping station. The highest tender was $35,000. Section C, Jens Orten Boving, $6,500, was for four pumps with a capacity of 16,000,000 gallons each, for the high-level pumping station. The highest tender was $24,000. Section D, John McDougall, Caledonian Iron Works, $7,385, was for four pumps with a capacity of 6,500,000 gallons each, for the high-level pumping station. The highest tender was $18,400. Section E, Canadian General Electric Company, $4,822, was for four pumps with a capacity of 1,500,000 gallons each, for the Island pumping station. The highest tender was $14,500.

WESTON.—On page 522 last week we gave the names of the successful tenderers in connection with the waterworks here. This week Mr. George B. Maark was awarded the contract for the filtration basin, at $2,675. The unsuccessful tenderers were John F. Connoly, $2,900, and J. H. McKnight, $2,700.

Saskatchewan.

MOOSE JAW.—Coal for power plant contract was awarded to J. H. Wellington at $5.30 a ton f.o.b., Moose Jaw. Other bidders were:—Pioneer Lumber Company, $5.10; Hitchcock & McCulloch, $5.10 and $6.05; McLean-Hodge Company, $5.40 and $5.35; C. W. Milestone, $5.40. All prices were f.o.b. cars, Moose Jaw, where all firms tendering are located.

RAILWAYS.

Ontario

PORT COLBORNE.—It is thought that the construction of the electric line from Port Colborne to Welland will be completed by January.

OTTAWA.—The C. P. R. company will seek authority to build a line of railway from a point on its Pheasant Hills branch at or near Asquith, Sask., northwesterly for a distance of twenty miles.

SIMCOE.—A resolution was passed at a recent meeting of the town council to grant permission to Brantford-Port Dover Electric Railway to construct a line through the town of Simcoe.

TORONTO.—Word was received at the Toronto offices of the Grand Trunk Pacific this week that the section of the new line between Wainwright and Edmonton, Alta., will not be ready for through traffic till the spring. The road is in order, but the Railway Commission has refused to allow through trains to run, until the line has been properly fenced all the way. Contractors are rushing the work, but there are several months' work yet to be done.

FORT WILLIAM. — Master mechanics of the entire C. P. R. system held their annual meeting here on November 5th and 6th. Among those attending were representatives from the Atlantic to Pacific, including Vancouver, Calgary, Halifax, Montreal and Toronto. The meeting was held to discuss and devise ways and means for the betterment of the mechanical department.

PORT ARTHUR.—The C.N.R. will erect new sheds and a 40-stall round-house here.

Manitoba.

WINNIPEG.—The final location surveys for the Hudson Bay railway from the Pas Mission north are being pushed forward rapidly and at the present time 20 miles of the railway are ready for the contractors. No matter which terminal is selected on the bay, either Churchill or Nelson, the first 200 miles follow the same route, and it is expected that this will

be proceeded with in the spring. In the meanwhile plans for the bridge across the St. Boniface will be proceeded with and the contract for its construction will probably be let as soon as they are ready.

BRANDON.—It is stated here, on reliable authority, that the C.P.R. has decided to build a new line from Birtle to Brandon, via Hamiota, and that work will begin as soon as possible.

Saskatchewan.

PRINCE ALBERT.—A party of engineers and surveyors arrived in the city this week, completing the survey of the proposed line of the G. T. P. from Watrous, Sask., to Prince Albert. The party has been working on the survey for the last eight weeks and report that the new line will be easy to build. Watrous is 100 miles directly south of here and the proposed road will follow almost a direct route to this city. The line will cross the south branch of the Saskatchewan, eighteen miles from here and will follow along the south bank, entering the city and crossing the C.N.R. tracks at the roundhouse. It will be run parallel with the C.N.R. through the city, the route being surveyed along the edge of the hill.

Alberta

STETTLER.—Steel-laying operations are being carried on by the C. P. R. east of here, and it is expected that this section of the road will be completed shortly.

British Columbia

NELSON.—The immediate construction of an important stretch of railway in the Boundary country is announced. The portion of the line which will be built in the next three months will be a spur from Hartford Junction to the Athelstan and Jackpot mines of the Wellington camp. The contract for this section of line has been awarded by the C.P.R. to W. P. Tierney & Co. This will be the commencement of what will eventually be a 15 or 20-mile line, passing through one of the richest sections of the Boundary. On the completion of the three-mile stretch, the work will probably be carried forward to the remaining portion of the line.

CEMENT—CONCRETE.

Quebec.

MONTREAL.—In connection with the reorganization of the Canada Cement Company the superintendents of the several mills have been retained as follows:—William O'Neil, of the International Company, at Hull, Irwin Kohler, of the Lehigh, at Belleville; D. M. Butchart, at Owen Sound; S. R. Preston, at the Vulcan; Fred Kilbourn, of the Lakefield at Montreal, and W. H. E. Bravender, at Calgary, and others in like position. Mr. A. C. Tagge has been appointed chief superintendent, and H. L. Doble, chief accountant of the company. H. A. Clarke is in charge of transportation, and other similar appointments will be made in a few days.

LIGHT, HEAT, AND POWER.

Quebec

MONTREAL.—The second reading was given by the City Council to a by-law authorizing the corporation to establish a municipal lighting plant. The idea is that the city shall light the streets by utilizing the power derived from burning garbage.

Ontario.

PORT ARTHUR. — By a vote proportioned at almost three to one Port Arthur ratepayers decided to accept the agreement made with the Ontario Hydro-electric Commission for the delivery of power. The total vote was smaller than expected, standing at 425 to 169.

COLLINGWOOD. — This municipality will shortly install a producer gas plant. It is expected that the machinery will be shipped from the Old Country some time this week.

TRENTON.—Messrs. Moore & Scollan of 47 King St. West, Toronto, have been called in by the municipality of Trenton, to advise in connection with a by-law to grant a franchise to the Trenton Electric and Water Power Company.

PRESTON.—On Tuesday and Wednesday, October 26th and 27th, the engineers and others interested in the supply of Niagara power to various Ontario municipalities met in the council chamber of the town hall. Mr. R. A. Ross presided. The question of rates for lighting was discussed, but no decision was reached, and the matter will come up again at a meeting to be held in Toronto on November 16th and 17th. A law for the inspection of all electric wiring was recommended, and the Legislature will be urged to pass such legislation. Tenders on 13,000 volt insulators were received and accepted, and the secretary was instructed to write to the various municipalities and ask them to file their orders for equipment. The superintendent of the Galt, Preston, and Hespeler Railway furnished complimentary tickets to the engineers and invited them to visit the towns of Waterloo, Berlin, Preston, Hespeler and Galt which are reached by their railway. In the evening a banquet was tendered the engineers at the Delmonte Hotel.

Manitoba

WINNIPEG.—A recent report made by Smith, Kerry & Chace to the city council says that the contractors are making good progress on the civic power plant at Point du Bois. On the transmission line the concrete footings for towers are complete with the exception of about 12, between the Brokenhead river and Bird's Hill. About 25 footings in all have been put in. Forty-nine miles of telephone line have been completed.

British Columbia.

NELSON.—One of the most important private enterprises being carried on in the interior is that of the Bull River Falls Power & Light company in the Fort Steele district. An immense flume is now almost completed which will give at lowest water about 10,000 horse-power. The company proposes to supply light and power to all the towns in the Pass country from Michel and eastward to Moyie. A connection from the falls town with Jaffray by electric railway is also contemplated. This may eventually be extended to Fort Steele and Cranbrook.

FINANCING PUBLIC WORKS.

New Brunswick.

ST. JOHN.—Bonds amounting to $6,500 will be issued by the municipality to cover the cost of laying water mains in Milford.

Quebec.

MONTREAL.—Until November 15th, tenders are invited by J. A. Gauthier, secretary of the Commission of Catholic Schools of Outremont, for an issue of debentures amounting to $50,000.

Ontario.

GUELPH.—Debentures aggregating $50,000 will probably be advertised for sale at an early date. The issue was sanctioned two years ago by the ratepayers, for Niagara power purposes.

Manitoba.

BRANDON.—A by-law to provide for improvements to the north approaches of the city, involving an expenditure of $10,000, is being considered by the City Council.

SWAN RIVER.—The ratepayers have carried a $15,000 by-law for the purchase of lighting plant, fire engine, weigh scales, etc.

SEWERAGE AND WATERWORKS.

Saskatchewan

YELLOW GRASS.—The completion of the construction of the waterworks system, being installed by the town, is now in sight. The laying of the mains will be finished this week. The machinery for the pumping station at the supply wells is expected every day. The central power station is practically completed. and ready for operation.

Quebec

MONTREAL.—Mr. William Perry, hydraulic engineer, has just completed several interesting installations of waterworks machinery. These include a new plant for the Montreal Light, Heat & Power Company, pumping plant for the water supply of the Royal Victoria Hospital, and for Willetts, Limited, Chambly Canton, Que., a water supply delivering three thousand gallons a minute.

Ontario.

HAMILTON. — City Engineer Macallum is preparing plans for extensions to the waterworks system, to provide water for newly annexed districts of the city. Fire Chief Ten Eyck and the city engineer will also report on a scheme for fire protection which has been asked for by residents of the east end mountain top. The work of cleaning out the filtering basins has been completed.

WELLAND.—The city council have approved of the

water commission's scheme to build a new eight-inch main.

Manitoba.

BRANDON.—The sanitary committee have recommended the extension of the sewer outlet, and the city engineer will prepare an estimate of the cost of the work.

PERSONAL NOTES.

MR. W. E. FOSTER has been appointed assistant solicitor for the Grand Trunk Railway, with headquarters at Montreal.

MR. G. E. MASON, of the Lancashire Dynamo & Motor Company, Trafford Park, Manchester, England, has opened an office in the Peterkin Building, Bay Street, Toronto.

MR. E. R. FARIBAULT, of the Geological Survey Staff, has accepted the post of Superintendent of Mines for the Quebec Government.

MR. WILLIAM MURDOCH, city engineer, of St. John, N.B., has also been appointed director of Public Works in that municipality.

MR. ALLEN WATERS succeeds Mr. N. H. Brydson as city engineer of Nanaimo, B.C. Mr. Brydson, it will be remembered was recently appointed assistant city engineer of Victoria, B.C.

MR. E. P. FEATHERSTONHAUGH, professor of electrical engineering in the University of Manitoba, was called in by the City of Winnipeg to give expert evidence with reference to the production of electrical energy used to operate the cars of the Winnipeg Electric Railway.

MR. A. F. TOWNSEND, for the past three years manager of the C. B. Electric Co., at Sydney, has resigned to take charge of an important branch office of Stone & Webster, in New England. Mr. H. C. Foss, of the S. & C. B. Railway Co., will succeed Mr. Townsend and will manage both Companies.

OBITUARY.

MR. JOHN W. PATERSON, president of the Paterson Manufacturing Company, Toronto, died at Mobile, Ala., on November 6th, 1909.

MR. B. J. COGHLIN, of the B. J. Coghlin Company, Montreal, Que., died at Montreal November 10th, 1909. Mr. Coghlin was particularly well-known to the mercantile trade of Canada, being agent for some of the large steel rail firms, and also connected with the Montreal Spring and Axle Works.

MARKET CONDITIONS.

Montreal, November 10th, 1909.

It would seem that the trade in pig-iron in the United States has shown some falling off since the first of November. Of course, the October trade was enormous so that the present lull does not mean that there is dullness, a large tonnage still changing hands. The tone of the market, however, is naturally a little less strong than previously and it might be that in some instances top figures are not being demanded. The volume of business in finished steel products is as large as ever. The main drawback to trade for the balance of this year, is the congestion at the mills. Apparently, some of the largest interests are now open to do business for delivery for the first quarter of 1910. Some 18,000 tons of fabricated structural steel have been contracted for already this month and there is enquiry for at least 60,000 tons more. Railway work has been conspicuous, but additional orders for rails and rolling stock are pending for 1910 delivery. In October, the merchant blast furnaces of the country made pig-iron at a greater rate than shown in any previous month in the history of the industry, although they barely passed the previous high record. At the same time, the steel works were making pig-iron at a rate of 3,000,000 in excess of their rate which made previous records in 1907.

There has been a considerable turn-over on the Glasgow pig-iron warrant market, this week. American cables, according to advices dated the end of October, were less bullish and the price of Cleveland warrants eased off, but later cables were better, and with few sales the price rose again about 6d. Shipments from Middlesboro continue to improve and the increase in store is consequently comparatively small.

In the local market the tone is steady, after the alterations of a week ago. Merchants seem to have a different view on the subject of steel plates, which were previously easy in tone, it being now considered that the market stands a very fair chance to advance within a short time. This remark applies to bars and structural steel and many other lines of finished and semi-finished products, the tone being firm throughout. Some merchants cannot quite understand why advances have not taken place before this, their belief being that there is no necessity to any longer accept the prices which have prevailed for such a long time past. The demand for pig-iron is apparently quite satisfactory and is fully up to production.

Following are this week's quotations:—

Antimony.—The market is steady at 8 to 8¼c.

Bar Iron and Steel.—The market promises to advance shortly. Bar iron, $1.85 per 100 pounds; best refined horseshoe, $2.10; forged iron, $2; mild steel, $1.85; sleigh shoe steel, $1.85 for 1 x ⅜-base; tire steel, $1.00 for 1 x ⅜-base; toe calk steel, $2.35; machine steel, iron finish, $1.90; imported, $2.20.

Boiler Tubes.—The market is steady, quotations being as follows:—1½ and 2-inch tubes, 8¼c.; 2½-inch, 10c.; 3-inch, 11¼c.; 3½-inch, 14 1-2c.; 4-inch, 18 1-2c.

Building Paper.—Tar paper, 7, 10, or 16 ounces, $1.80 per 100 pounds; felt paper, $2.75 per 100 pounds; tar sheathing, 40c. per roll of 400 square feet; dry sheathing, No. 1, 30 to 40c. per roll of 400 square feet; tarred fibre, 55c. per roll; dry fibre, 45c. (See Roofing; also Tar and Pitch).

Cement.—Canadian cement is quotable, as follows, in car lots, f.o.b., Montreal:—$1.30 to $1.40 per 350-lb. bbl., in 4 cotton bags, adding 10c. for each bag. Good bags re-purchased at 10c. each. Paper bags cost 2½ cents extra, or 10c. per bbl. weight.

Chain.—Prices are as follows per 100 lbs.:—¼-inch, $4.90; 5-16-inch, $4.40; ⅜-inch, $3.70; 7-16-inch, $3.50; ½-inch, $3.25; 9-16-inch, $3.20; ⅝-inch, $3.15; ¾-inch, $3.10; ⅞-inch, $3.05; 1-inch, $3.05.

Coal and Coke.—Anthracite, egg, stove or chestnut coal, $6.75 per ton, net; furnace coal, $6.50, net. Bituminous or soft coal: Run of mine, Nova Scotia coal, carload lots, basis, Montreal, $3.85 to $4 per ton; cannel coal, $9 per ton; coke, single ton, $5; large lots, special rates, approximately $4 f.o.b., cars, Montreal.

Copper.—Prices are strong at 14 to 14¼c.

Explosives and Accessories.—Dynamite, 50-lb. cases, 40 per cent. proof, 15c. in single case lots, Montreal. Blasting powder, 25-lb. kegs, $2.25 per keg. Special quotations on large lots of dynamite and powder. Detonator caps, case lots, containing 10,000, 75c. per 100; broken lots, $1; electric blasting apparatus:—Batteries, 1 to 10 holes, $15; 1 to 20 holes, $25; 1 to 30 holes, $35; 1 to 40 holes, $50. Wire, leading, 1c. per foot; connecting, 50c. per lb. Fuses, platinum, single strength, per 100 fuses:—4-ft. wires, $3; 6-ft. wires, $3.54; 8-ft. wires, $4.08; 10-ft. wires, $5. Double strength fuses, 4-ft., $3.75; 6-ft., $4.29; 8-ft., $4.83; 10-ft., $5.37. Fuses, time, double-tape, $6 per 1,000 feet; explohmeters, fuse and circuit, $7.50 each.

Galvanized Iron.—The market is steady. Prices, basis, 28-gauge, are:—Queen's Head, $4.10; Colborne Crown, $3.85; Apollo, 10¾ oz., $4.05. Add 25c. to above figures for less than case lots; 26-gauge is 25c. less than 28-gauge, American 28-gauge and English 26 are equivalents, as are American 10¾ oz., and English 28-gauge.

Galvanized Pipe.—(See Pipe, Wrought and Galvanized).

Iron.—The outlook is strong. The following prices are for carload quantities and over, free on dock, Montreal, prompt delivery; No. 1 Summerlee, $20.50 to $21; selected Summerlee, $20 to $20.50; soft Summerlee, $19.50 to $20; Clarence, $18.25 to $18.50; Midland or Hamilton pig is quoted at $20 to $20.50 per ton for No. 1 f.o.b., cars at point of production, No. 2 being $19.50 to $20, and No. 3 $19 to $19.50 for delivery during the next six months. It is said Dominion and Scotia companies are not quoting prompt delivery. Carron No. 1, $20.50 to $21; Carron special, $20 to $20.50.

Laths.—See Lumber, etc.

Lead.—Prices are about steady at $3.55 to $3.65.

Lead Wool.—$10.50 per hundred, $200 per ton, f.o.b., factory.

Lumber, Etc.—Prices on lumber are for car lots, to contractors, at mill points, carrying a freight of $1.50. Red pine, mill culls out, $18 to $22 per 1,000 feet; white pine, mill culls, $16 to $17. Spruce, 1-in. by 4-in. and up, $15 to $17 per 1,000 ft.; mill culls, $12 to $14. Hemlock, log run, culls out, $13 to $15. Railway Ties; Standard Railway Ties, hemlock or cedar, 35 to 45c. each, on a 5c. rate to Montreal. Telegraph Poles: Seven-inch top, cedar poles, 25-ft. poles, $1.35 to $1.50 each; 30-ft., $1.75 to $2; 35-ft., $2.75 to $3.25 each, at manufacturers' points, with 5c. freight rate to Montreal. Laths: Quotations per 1,000 laths, at points carring $1.50 freight rate to Montreal, $2 to $3. Shingles: Cedar shingles, same conditions as laths, X, $1.50; XX, $2.50; XXX, $3.

Nails.—Demand for nails is better and prices are firmer, $2.40 per keg for cut, and $2.35 for wire, base prices. Wire roofing nails, 5c. lb.

Paints.—Roof, barn and fence paint, 90c. per gallon; girder, bridge, and structural paint for steel or iron—shop or field—$1.20 per gallon, in barrels; liquid red lead in gallon cans, $1.75 per gallon.

Pipe.—Cast Iron.—The market is unsettled and uncertain, as dealers are compelled to meet competition from all sources. Prices are easy and approximately as follows:—$31 for 6 and 8-inch pipe and larger; $32 for 5-inch and 4-inch at the foundry. Pipe, specials, $3 per 100 pounds. Gas pipe is quoted at about $1 more than the above.

Pipe.—Wrought and Galvanized.—Demand is much better and the tone is firm, though prices are steady, moderate-sized lots being: ¼-inch, $5.50 with 63 per cent. off for black, and 48 per cent. off for galvanized; ⅜-inch, $5.50, with 59 per cent. off for black and 44 per cent. off for galvanized; ½-inch, $8.50, with 69 per cent. off for black, and 59 per cent. off for galvanized. The discount on the following is 72½ per cent. off for black, and 62½ per cent. off for galvanized; ¾-inch, $11.50; 1-inch, $16.50; 1¼-inch, $22.50; 1½-inch, $27; 2-inch, $36; 2½-inch, $57.50; 3-inch, $75.50; 3½-inch, $95; 4-inch, $108.

Plates and Sheets.—Steel.—The market is steady. Quotations are: $2.20 for 3-16; $2.30 for ⅛, and $2.10 for ¼ and thicker; 12-gauge being $2.30; 4-gauge, $2.15; and 16-gauge, $2.10.

Rails.—Quotations on steel rails are necessarily only approximate and depend upon specification, quantity and delivery required. A range of $30.50 to $31 is given for 60-lb. and 70-lb.; 80-lb. and heavier, being $30; rails, per gross ton of 2,240 lbs., f.o.b. mill. Re-laying rails are quoted at $27 to $29 per ton, according to condition of rail and location.

Railway Ties.—See lumber, etc.

Roofing.—Ready roofing, two-ply, 70c. per roll; three-ply, 95c. per roll of 100 square feet. Roofing tin caps, 6c. lb.; wire roofing nails, 5c. lb. (See Building Paper; Tar and Pitch; Nails, Roofing).

Rope.—Prices are steady, at 9c. per lb. for sisal, and 10½c. for Manila. Wire rope, crucible steel, six-strands, nineteen wires; ¼-in., $2.75; 5-16, $3.75; ⅜, $4.75; ½, $5.25; ⅝, $6.25; ¾, $8; ⅞, $10; 1-in., $12 per 100 feet.

Spikes.—Railway spikes are firmer at $2.45 per 100 pounds, base of 5½ x 9-16. Ship spikes are steady at $2.85 per 100 pounds, base of ⅝ x 10-inch, and ⅝ x 12-inch.

Steel Shafting.—Prices are steady at the list, less 25 per cent. Demand is on the dull side.

Telegraph Poles.—See lumber, etc.

Tar and Pitch.—Coal tar, $3.50 per barrel of 40 gallons, weighing about 500 pounds; roofing pitch, No. 1, 70c. per 100 pounds; and No. 2, 55c. per

100 pounds; pine tar, $8.50 per barrel of 40 gallons, and $4.75 per half-barrel; refined coal tar, $4.50 per barrel; pine pitch, $4 per barrel of 180 to 200 pounds. (See building paper; also roofing).

Tin.—Prices are unchanged, at 32½ to 33c.

Zinc.—The tone is steady, at 6 to 6¼c.

* * * *

Toronto, November 11th, 1909.

In building materials of a universal kind activity continues. Bricks, broken stone, lime, sewer pipes, are all moving well; even cement is taking on a more satisfied tone since writers for the press have begun to demonstrate that the merger is going to be a blessing in disguise and will ensure a regular supply at a fixed price. The price of hard coal has advanced, as our quotations show, soft coal continues as before. Coke is higher, as a result of much increased activity in iron and steel output in the United States, and the supply is no longer abundant. Metals continue at last week's quotations, all iron and steel prices being firm.

The following are wholesale prices for Toronto, where not otherwise explained, although for broken quantities higher prices are quoted:—

Antimony.—Demand active and price higher at $9.25 per 100 lbs.

Axes.—Standard makes, double bitted, $8 to $10; single bitted, per dozen, $7 to $9.

Bar Iron.—$1.95 to $2, base, per 100 lbs., from stock to wholesale dealer. Market well supplied.

Boiler Plates.—¼-inch and heavier, $2.20. Boiler heads 25c. per 100 pounds advance on plate. Tank plate, 3-16-inch, $2.40 per 100 lbs.

Boiler Tubes.—Orders continue active. Lap-welded, steel, 1¼-inch, 10c.; 1½-inch, 9c. per foot; 2-inch, $8.50; 2¼-inch, $10; 2½-inch, $10.60; 3-inch, $12.10; 3½-inch, $15; 4-inch, $18.50 to $19 per 100 feet.

Building Paper.—Plain, 30c. per roll; tarred, 40c. per roll. Demand is only moderate.

Bricks.—Business is very active, price at some yards $9 to $9.50, at others, $9.50 to $10 for common. Don Valley pressed brick move also freely. Red and buff pressed are worth $18 delivered and $17 at works per 1,000.

Broken Stone.—Lime stone, good hard, for roadways or concrete, f.o.b., Schaw station, C.P.R., 60c. per ton of 2,000 lbs., 1-inch, 2-inch, or larger, price all the same. The demand has been active for some weeks, and supply not equal to it; feeling is upward. Broken granite is selling at $3 per ton for good Oshawa.

Cement.—Manufacturers' prices for Portland cement are $1.35 without bags, or $1.65 including cotton bags for car lots on board car, Fort William or Port Arthur; the price at Toronto is $1.30 without bags, or $1.70 with bags. Smaller dealers get $1.35 to $1.40 per barrel without bags, in load lots, delivered in town. Demand is fairly steady.

Coal.—Retail price for Pennsylvania hard, $7.25 net, steady. This price applies to grate, egg, stove, and chestnut; only pea coal is cheaper, namely, $6.00. These are all cash, and the quantity purchased does not affect the price. Soft coal is in good supply, American brokers have been covering the ground very fully. In the United States there is an open market for bituminous coal and a great number of qualities exist. We quote. Youghiogheny lump coal on cars here, $3.70 to $3.80; mine run, $3.60 to $3.75; slack, $2.65 to $2.85; lump coal from other districts, $3.40 to $3.70; mine run 10c. less; slack, $2.50 to $2.70; cannel coal plentiful at $7.50 per ton; coke, Solvey foundry, which is largely used here, quotes at from $5.75 to $6.00; Reynoldsville, $4.90 to $5.00; Connellsville, 72-hour coke, $5.50.

Copper Ingot.—The market continues as before stated, price being $13.85 to $14.05, and the demand normal.

Detonator Caps.—75c. to $1 per 100; case lots, 75c. per 100; broken quantities, $1.

Dynamite, per pound, 21 to 25c., as to quantity.

Roofing Felt.—An improvement in demand of late, no change in price, which is $1.80 per 100 lbs. Much is being now used for lumber camps.

Fire Bricks.—English and Scotch, $30 to $35; American, $25 to $35 per 1,000. The demand is steadv.

Fuses.—Electric Blasting.—Double strength 4 feet, $4.50; 6 feet, $5; 8 feet, $5.50; 10 feet, $6. Single strength, 4 feet, $3.50; 6 feet, $4; 8 feet, $4.50; 10 feet, $5, per 100 count. Bennett's double tape fuse, $6 per 1,000 feet.

Iron Chain.—¼-inch, $5.75; 5-16-inch, $5.15; ¾-inch, $4.15; 7-16-inch, $3.95; ½-inch, $3.75; 9-16-inch, $3.70; ⅝-inch, $3.55; ¾-inch, $3.45; ⅞-inch, $3.40; 1-inch, $3.40, per 100 lbs.

Iron Pipe.—Repeat quotations of last week, as follows:—Black, ¼-inch, $2.03; ⅜-inch, $2.25; ½-inch, $2.63; ¾-inch, $3.28; 1-inch, $4.70; 1¼-inch, $6.41; 1½-inch, $7.70; 2-inch, $10.26; 2½-inch, $16.39; 3-inch, $21.52; 3½-inch, $27.08; 4-inch, $30.76; 4½-inch, $38; 5-inch, $43.50; 6-inch, $56 Galvanized, ¼-inch, $2.86; ⅜-inch, $3.08; ½-inch, $3.48; ¾-inch, $4.43; 1-inch, $6.35; 1¼-inch, $8.66; 1½-inch, $10.40; 2-inch, $13.86, per 100 feet.

Lead.—Prices steady outside. This market is steadier, and demand quiet, at $3.75 to $3.85 per 100 lbs.

Lime.—Retail price in city 35c. per 100 lbs. f.o.b., car; in large lots at kilns outside city 22c. per 100 lbs. f.o.b. car without freight. Demand is good.

Lumber.—Prices continue steady, and city demand still active. We quote dressing pine $32.00 to $35.00 per M; common stock boards, $26 to $30; cull stocks, $20; cull sidings, $17.50; Southern pine dimension timber from $30 to 45, according to size and grade; finished Southern pine according to thickness and width, $30 to $40. Hemlock in car lots, $16.50 to $17; spruce flooring in car lots, $22 to $24; shingles, British Columbia, $3 to $3.10; lath, No. 1, $4.25; No. 2, $3.75; for white pine, 48-inch; for 32-inch, $1.60.

Nails.—Wire, $2.35 base; cut, $2.60; spikes, $2.85 per keg of 100 lbs.

Pitch and Tar.—Pitch, demand moderate, price so far unchanged at 70c. per 100 lbs. Coal tar fairly active at $3.50 per barrel.

Pig Iron.—There is fair activity and prices are maintained. Clarence quotes at $20.50 for No. 3; Cleveland, $20.50 to $21; in Canadian pig, Hamilton quotes $19.50 to $20 per ton. Producing plants are everywhere busy, and there is considerable business in prospect for 1910.

Plaster of Paris.—Calcined, New Brunswick, hammer brand, car lots, $2; retail, $2.15 per barrel of 300 lbs.

Putty.—In bladders, strictly pure, per 100 lbs., $2.25; in barrel lots, $2.05. Plasterer's, $2.15 per barrel of three bushels.

Ready Roofing.—Dealers report a large demand, the prices being as before, per catalogue

Roofing Slate.—Most of the slate used in Canada comes now from Pennsylvania or Maine, the Canadian supply being slender and mostly from the Rockland quarries of the Eastern Townships in Quebec. There is a great variety of sizes and qualities, so that it is difficult to indicate prices. But No. 1 Pennsylvania slate 10x16 may be quoted at $7.25 per square of 100 square feet, f.o.b., cars, Toronto; seconds, 50c. less. The demand continues active; competent roofers are scarce.

Rope.—Sisal, 9½c. per lb.; pure Manila, 12½c. per lb., Base.

Sewer Pipe.—

	4-in.	6-in.	9-in.	10-in.	12-in.	24-in.
Straight pipe per foot	$0.20	$0.30	$0.65	$0.75	$1.00	$3.25
Single junction, 1 or 2 ft. long	.90	1.35	2.70	3.40	4.50	14.65
Double junctions	1.50	2.50	5.00	....	8.50	.....
Increasers and reducers	....	1.50	2.50	....	4.00	.....
P. traps	2.00	3.50	7.50	....	15.00	.....
H. H. traps	2.50	4.00	8.00	....	15.00	.....

Business steady; price, 73 per cent. off list at factory for car-load lots; 65 per cent. off list retail. Small lots subject to advance.

Steel Beams and Channels.—Quiet.—We quote:—$2.50 to $2.75 per 100 lbs., according to size and quantity; if cut, $2.75 to $3 per 100 lbs.; angles, 1¼ by 3-16 and larger, $2.50; tees, $2.80 to $3 per 100 pounds. Extra for smaller sizes of angles and tees.

Steel Rails.—80-lb., $35 to $38 per ton. The following are prices per gross ton, for 500 tons or over; Montreal, 12-lb. $45, 16-lb. $44, 25 and 30-lb. $43.

Sheet Steel.—We do not alter prices as yet; 10-gauge, $2.50; 12-gauge, $2.55; American Bessemer, 14-gauge, $2.35; 17, 18, and 20-gauge, $2.45; 22 and 24-gauge, $2.50; 26-gauge, $2.65; 28-gauge, $2.85. Quite a good demand exists, and there is prospect of higher prices.

Sheets Galvanized.—Apollo Brand.—Sheets 6 or 8 feet long, 30 or 36 inches wide; 10-gauge, $2.90; 12-14-gauge, $3.00; 16, 18, 20, $3.10; 22-24, $3.25; 26, $3.40; 28, 3.85; 29, $4.15; 10¾, $4.15 per 100 lbs. Fleur de Lis—28-gauge, $4; 26, $3.80 per 100 lbs. Demand very active.

Tank Plate.—3-16-inch, $2.40 per 100 lbs.

Tool Steel.—Jowett's special pink label, 10½c. Cammel-Laird, 16c. "H.R.D." high speed tool steel, 65c.

Tin.—The feeling in tin is firm, and the price 32 to 33c. per lb.

Wheelbarrows.—Navvy, steel wheel, Jewel pattern, knocked down, $21.60 per dozen; set up, $22.60. Pan Canadian, navvy, steel tray, steel wheel, $3.30 each; Pan American, steel tray, steel wheel, $4.25 each.

Zinc Spelter.—A very active movement continues, and a large business is being done. Price very firm at $5.75 to $6 per 100 lbs.

CAMP SUPPLIES.

Beans.—Hand picked, $2; prime, $1.85; Rangoon, $1.80.

Butter.—Dairy prints, 21 to 22c.; creamery rolls, 25 to 26c.

Canned Goods.—Peas, $1.00 to $1.50; tomatoes, 3s, 85c. to 95c.; pumpkins, 3s, 80 to 85c.; corn, 75 to 85c.; peaches, 2s, white, $1.50 to $1.60; yellow, $1.90 to $1.95; strawberries, 2s, heavy syrup, $1.90 to $1.95; raspberries, 2s, $1.90 to $1.95.

Cheese.—No old cheese on hand; new cheese, large, 12¾c.; twins, 13c.

Coffee.—Rio, green, 10 to 12½c.; Mocha, 21 to 23c.; Java, 20 to 31c.; Santos, 11 to 15c.

Dried Fruits.—Raisins, Valencia, 5½ to 6c.; seeded, 1-lb. packets, fancy, 7½ to 8c.; 16-oz. packets, choice, 7 to 7½c.; 12-oz. packets, choice, 7c.; Sultanas, good, 5 to 6c.; fine, 6 to 7c.; choice, 7 to 8c.; fancy, 8 to 9c.; Filiatras currants, 6½ to 7c.; Vostizzas, 8½ to 9c.; uncleaned currants, ¼c. lower than cleaned. California Dried Fruits,—Evaporated apricots, 14 to 15c. per lb.; prunes, 60s to 70s, 7 to 7½c.; 90s to 100s, 6½c.; evaporated apples, 9½c.

Eggs.—New laid, 25 to 26c. per dozen, in case lots.

Lard.—Scarce and higher. Tierces, 16c.; tub, 16¼c.; pails, 16½c. per lb.

Molasses.—Barbadoes, barrels, 37 to 45c.; Porto Rico, 45 to 60c.; New Orleans, 30 to 33c. for medium.

Onions.—$1.25 a bag.

Potatoes.—Best, 75c. a bag.

Pork.—Market uncertain. Short cut, $27.50 per barrel; mess, $26, nominal; no stock here.

Rice.—B grade, 3½c. per lb.; Patna, 5¼ to 5¾c.; Japan, 5¼ to 6c.

Salmon.—Fraser River, talls, $2; flats, $2; River Inlet, $1.55 to $1.75.

(Continued on page 42).