PAGES

MISSING

The Canadian Engineer

WEEKLY

ESTABLISHED 1893.

VOL. 19. TORONTO, CANADA, OCTOBER 20, 1910. No. 16.

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.
Advertising Manager.—A. E. Jennings.

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, Ont. Telephone, Main 7404 and 7405, branch exchange connecting all departments.
Montreal Office: B33, Board of Trade Building. T. C. Allum, Editorial Representative, Phone M. 1001.
Winnipeg Office: Room 404, Builders' Exchange Building. Phone M. 7250. 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. Friday preceding the date of publication, except in cases where proofs are to be mailed to distant points, for which due time should be allowed.

Printed at the Office of The Monetary Times Printing Company, Limited, Toronto, Canada.

Index to Contents:

TECHNICAL EDUCATION, UTILITY SCHOOLS, ARTISAN SCHOOLS.

The Royal Commission on Technical Education has for some months been taking evidence, gathering information, assimilating and systematizing the recommendations placed before them, so that they may present a clear and useful report that will be satisfactory to the labor man, the employer of labor, and the educationalists of the nine Provinces of Canada.

The chairman of the Commission has for years been a leader in the departments in which he is working, and he stands out clearly as a leader of this Royal Commission. He doubtless has in his own mind definite ideas as to what is expected of the Commission and of what he hopes to accomplish, but as yet we fail to see evidences of the grasping of that ideal, either by the public or by the witnesses that foregather to enlighten the Commission.

Educational training of any kind to be successful must have that element of commercialism, a demand, before there will be results that are valuable. The demand for technically trained men is being well met by the applied science faculties of our Canadian universities. Students seeking technical training will enter these departments in sufficient number just so long as the course outlined prepares men for the different branches of engineering. These courses will be prepared with this end in view just so long, and only so long, as the professors in the departments are not only teachers but engineers. Our applied science faculties yet fail in filling the part they should play in our educational system, unless the heads of departments are more familiar with what should be taught than how to teach. Teaching is one of the most noble and honorable professions, requiring patience, tact and judgment; but it is also true that you can secure ten men who can teach successfully for the one who has the foresight and vision and leadership that makes it possible for him to prepare a well-balanced curriculum and to inspire the student so that he feels each subject in the particular line of work which he is preparing himself for is absolutely necessary. Suggestions in the matter of technical education which may come from the Commission, although applicable at the time of the preparing of the report may in one year have so little direct bearing upon the then present educational matters as to appear absurd. The one report on this question that the Commission may safely make is that the professors in the engineering colleges must be men with a commercial instinct.

Some have suggested that the purpose of the Commission was to devise a proper system of utility schools. "Utility Schools," like "adequate protection," may have a very broad interpretation, and it might be as well to class them at once as Artisan Schools. It is very true that the trade unions do not appear to favor schools where boys and girls may learn trades, but it does appear that we have growing up a large number of young men and women who have failed to secure a book education, and to whom a book education would be of little profit. Why, then, not have artisan schools, the principal aim of which might be to make good workmen and better citizens and broader men?

It is not so much evidence that the Commission have to meet as a situation, and it is not so much information and recommendations that Canada requires as a reasonable solution—not printed and circulated broadcast—but presented to young Canada by a man who possesses leadership and personal magnetism such as will develop the individuality of the young worker and train him to take that interest in the conditions which he faces as will retain for him his individuality.

ONTARIO'S MINES AND MINERAL OUTPUT.

The output of the mines and minerals of Ontario for the year 1909, is summarized by Mr. Thomas W. Gibson, Deputy Minister of Mines for Ontario, in his statistical review in the report of the Bureau of Mines for 1910.

The value of the mines output for the year 1909 was almost $33,000,000, but, had the refined value been taken, the entire output would have been valued at something like $37,000,000.

One very noticeable statement is that the value of the metallic output exceeds by 70 per cent. the non-metallic products. In the year 1905, for the first time, the metalliferous substances took the lead until it has reached the present large proportion. Over the 1908 output the metals have increased 37 per cent. and the non-metals 13 per cent.

Silver is the chief item of increase, the value being $3,327,892, or 36 per cent.; next comes pig iron, increase $1,910,689, or 43 per cent.; then nickel, $924,739, or 49 per cent. Iron ore is greater by $70,783, copper by $55,875, and zinc ore by $8,950. Gold is less by $27,892, and cobalt by $16,153. Of the non-metallic products, Portland cement shows an increase of $479,579, or 20 per cent., and natural gas $199,563, or 20 per cent. Bricks of all kinds are greater in value by $357,170, or 17 per cent., drain tile by $24,892, and lime by $22,262. On the other hand, petroleum shows a decrease of $144,295, or 26 per cent., salt of $98,757, stone of $70,311, and sewer pipe of $32,430. Further comment upon these and other fluctuations in production will be made when dealing with the several products in detail.

The nickel copper industry did not show the increase that the industrial development would apparently warrant. The output of nickel at the most is valued at 10.6 per pound. This valuation seems low when the minimum quotations for refined nickel at New York during the year was 40 cents per pound.

The outputs of pig iron and steel, however, show very gratifying increases, and indicate activity in construction work.

The seven blast furnaces in Ontario were all operated last year, most of them continuously. The Algoma Steel Company, Sault Ste. Marie, and the Hamilton Steel and Iron Company, Hamilton, have two furnaces each; the Canada Iron Corporation, Midland, the Standard Chemical Works, Deseronto (formerly Deseronto Iron Company), and the Atikokan Iron Company, Port Arthur, one each. The output of pig iron was 407,013 tons, valued at $6,301,528, as compared with 271,656 tons, valued at $4,390,839, in 1908. Of steel, which is made by the Sault Ste. Marie and Hamilton plants, the output was 296,031 tons, valued at $6,759,960. At Sault Ste. Marie the product was confined to standard T rails, the whole output of the blast furnaces and a large quantity of purchased pig being converted into this article. At Hamilton the product was basic open-hearth steel, 76,085 tons being in the shape of ingots and 700 tons steel castings. In the other departments of the Hamilton Company's extensive plant the products of the furnace were further developed into 3,359 tons billets, 289 tons miscellaneous forgings, 3,788 tons spikes, 626 tons axles, and 73,071 tons bar iron and steel.

The Ontario Iron and Steel Company, in its works at Welland, produced a quantity of open-hearth basic steel from scrap material, along with about 100 tons of imported iron ore. The Electro-Metals Company, of the same place, are carrying on a large business in the manufacture of ferro-silicon, the raw materials being iron ore imported from the United States, and silica in the form of rock or flint, brought from Frontenac county or Parry Sound district. The company makes use of about 7,000 electric horse-power in its furnaces and works.

As compared with 1908, the output of common brick rose from 222,361 thousand to 246,308 thousand last year, and the value from $1,575,875 to $1,916,147. There was a decided increase also in the value per thousand, the average being $7.78, as compared with $7.09 in 1908. The demand for brick was active during the year, especially in the larger cities, building operations in Toronto, for instance, which is essentially a city of brick, being decidedly brisk. A large quantity of brick is manufactured in and around Toronto, many of the brickyards being extensive and well equipped. Reference to the figures published by the Bureau as to the production of brick shows that the average value at the yard has risen from $5.73 per thousand in 1901 to $7.78 per thousand in 1909, an increase of over 35 per cent. The cost of brick constructions has been heavily affected during the same time, since the cost of labor has experienced an advance probably quite as great.

There has of late years been a marked improvement in the quality of brick made in first-class yards. Kilns of modern construction burn harder and more evenly, and there is a smaller proportion of soft brick. The present taste in brick houses, too, does not demand the same uniformity of color that was formerly insisted upon; in fact, a variety of shade, instead of being objected to, is rather desired. There is also a much greater range of products than was made years ago. From white and buff to cherry red and up to a dark, even purplish, hue, bricks of all tints and shades are freely used, and pleasing effects are sometimes obtained by employing clinker or over-burned bricks, greenish or yellowish in color. The hard-burned bricks of the present day bid fair to give us durable towns and cities, not perhaps so handsome as those built of stone, but less subject to disastrous conflagrations than those made of wood, so much employed south of the line.

Of all varieties of brick there were made last year $2,480,418 worth, comprising common $1,916,147, pressed $490,571, and paving $73,700. In the brick and tile yards there were 3,166 men employed, earning $961,881 in wages. The brick-making season is for the

most part confined to the months of late spring, summer and early fall. This, and not a low rate of wages, accounts for the comparatively small earnings of brick-makers, which last year averaged only $303.

The activity in building operations last year is reflected in the increased output of lime, of which 2,633,500 bushels were made, as compared with 2,442,331 bushels in 1908. The value also went up to $470,858, as against $448,596.

The value of the building and crushed stone produced last year was $660,000, of which $228,000 worth was limestone used as flux in blast furnaces. The output of the stone quarries in Ontario varies from year to year, not only in accordance with the fluctuations in the building trade, but also in accordance with the demand for large public works. It is also adversely affected by the growing use of cement, which is being more and more applied to uses for which stone was formerly employed. The greater part of the product is limestone.

The only kind of cement now being made in the Province is Portland cement, the manufacture of the natural rock variety having come to an end in 1907. Of Portland cement, however, the output has been annually increasing since 1891, when the industry began. Last year there were made 2,303,263 barrels, valued at $2,897,348, as against 2,022,877 barrels, worth $2,417,769 in 1908, the average price for last year being $1.257 per barrel at the factory, as compared with $1.195 in 1908, an increase of $0.061 per barrel.

The number of drain tile made last year was 27,418,000, having a value of $363,550. Tile drainage is being more and more practised by the farmers of Ontario, who recognize the advantage of freeing their low-lying lands of surplus moisture, which retards the growth and maturing of their crops and invites early frosts. The production in 1908 was valued at $338,658.

The production of natural gas has much increased of late years. In value it amounted in 1909 to $1,188,179, an increase over the yield of 1908 of $199,563, and being the largest output yet recorded. For the last four years the quantity produced has been as follows: In 1906, 2,534,200 thousand cubic feet; in 1907, 4,155,900 thousand; in 1908, 4,483,000 thousand; and in 1909, say, 5,388,000 thousand cubic feet.

Calcium carbide is made by two companies, the Willson Carbide Company, Merritton, and the Ottawa Carbide Company, Ottawa. Together they produced 2,349 tons in 1909 as compared with 2,364 tons in 1908. The principal use of calcium carbide is, of course, the production of acetylene gas for illumination purposes, for which it finds considerable employment in small or isolated places where ordinary lighting gas is not available.

The production of corundum, which had been discontinued by the largest operating company in 1908, was resumed last year, and 1,508 tons of this mineral, crushed and graded to size, were turned out during the twelve months. The Manufacturers' Corundum Company, lessees of the works of the Canada Corundum Company, Craigmont, and the Ashland Emery and Corundum Company, Burgess Mines, were the producers.

The chief employment of corundum continues to be for abrasive purposes, for which it is eminently suitable, though in certain special uses it has to compete with such substances as carborundum, an artificial compound made by fusing silica and carbon in the electric furnace, also with garnets, etc. Notwithstanding its high contents of aluminium, no feasible method has yet been brought forward of reducing this metal from corundum.

Peat fuel was made to the extent of about 60 tons by J. McWilliam, M.D., at a plant in the township of North Dorchester, Middlesex county. Dr. McWilliam reports: "We spent the whole season putting in new machinery and collected 600 tons of dust, but only pressed about 60 tons, when the frost got too much for us."

High hopes have at various times been entertained of a successful solution of the problems presented by the manufacture of an acceptable fuel from peat, and many promising attempts have been made to realize these hopes. The crux of the question undoubtedly lies in the removal of the moisture, of the retention of which peat is extremely tenacious. If artificial heat must be resorted to for this purpose, the cost is usually raised to a point at which the resulting fuel is unable to compete with coal, regard being had to the calorific value of each. Probably the most hopeful method of utilizing the fuel value of peat is by the producer gas process, but this puts it out of the field of domestic fuels, and restricts its employment to manufacturing or industrial plants, which can be located near the bog from which the peat is taken. An immense quantity of carbon is lying dormant in the peat bogs of Ontario, and there is little doubt that some day an efficient fuel will be produced from them. It may not be, however, until coal and wood are higher in price than they now are.

We have only given in this article excerpts from Mr. Gibson's review. The purely mining features we have entirely neglected. The report clearly indicates Ontario's position as one of the first mining Provinces of the Dominion.

EDITORIAL NOTE.

In 1899 the Engineers' Club, of Toronto, was organized, and in 1902 incorporation papers were taken out enlarging the powers of the club. The object of this club, as given in their constitution, shall be the professional improvement of its members and the encouragement of social intercourse among them. Recently the Provincial Secretary has seen fit to again increase the power and privileges of this corporation, and shortly we hope to learn that the engineers of Toronto and Ontario will have at their disposal one of the most complete club quarters, a club that will not only include the social but the professional life of the engineer.

CRITICISM OF THE ENGINEERING SCHOOLS.

Science prints in a recent number the thoughtful and stimulating **Criticism of the Engineering Schools,** given before the Stevens Engineering Society by Professor Dugald C. Jackson, of the Massachusetts Institute of Technology,—a criticism which chiefly bears upon the fact that engineers display too little public spirit and are not so conspicuously associated as are other public men with political movements tending toward the general welfare. Have the engineering school curricula in this country been adequate in this particular? asks Professor Jackson, and have they brought to their students the breadth of human vision and the altruistic motives required to these activities. He hesitates to answer in the affirmative, and, the situation standing as it does, inquires what truly humanistic studies can be rightfully excluded from the list useful as preparation for engineering professional life. Our solicitude need only be exercised to see

that sufficient of the mathematical and physical sciences, the historic and economic studies, and the languages make constituent parts of the curriculum, and that the spirit and order in which these are studied are right. It is probably in the latter that we are erring. The sciences, historical and economic studies, and languages are well represented in the curricula of many of our engineering schools, but there is a failure to impress on the mind of the student that the economic subjects are intimately related with the work of the profession. Perhaps here lies the explanation of the apparent failure of engineers to play their reasonable share in civic affairs. If that is the explanation, our methods of teaching ought to be promptly reformed.

SOME COSTS OF OPERATION OF THE ALBANY, N.Y., FILTER PLANT.

The filter plant at Albany, N.Y., comprises eight slow sand filters, constituting the original plant, and a preliminary filtration plant of sixteen units, each of 810 square feet filtering area, which was put in operation October 29th, 1908. In the report of H. J. Deutschbein, superintendent, for the year ending September 30th, 1909, the cost of operating this plant from October 3rd, 1908, to October 2nd, 1909, during which period 5,059 million gallons were filtered, was as follows:—

Pumping Station:	Total.	Cost per million gals.
Engineers and firemen	$ 7,962 18	$1 57
Incidental labor	815 87	0 16
Coal	7,292 87	1 43
Oil	305 86	0 06
Repairs and supplies	1,694 73	0 33
Ice	12 95	0 02
Total	$18,084 46	$3 57
Preliminary Filters:		
Attendants	$ 2,337 81	$0 46
Removing, washing and replacing sand	644 29	0 13
Total	$ 2,982 10	$0 59
Slow Sand Filters:		
Scraping beds	$ 779 41	$0 16
Removing scraped sand from beds	2,329 03	0 46
Washing dirty sand (for labor only —water used not charged)	502 76	0 09
Restoring washed sand to filters	676 05	0 13
Forking beds to obviate compacted sand layer	274 29	0 05
Removing sand from court to storage pile	764 44	0 15
Removing ice from filters	211 28	0 04
Removing, washing and restoring 14,134 cubic yards of sand (entire sand layers in filters 1, 3, 6 and 7)	3,872 10	0 77
Incidental labor, repairs, etc	546 94	0 11
Supplies	1,328 64	0 26
Ice	12 95	0 01
Total	$11,297 89	$2 23
Laboratory:		
Chemist	$ 1,550 00	$0 31
Laboratory help	1,926 36	0 38

AN EXAMPLE OF VARIED POWER USES IN A SMALL PLANT.

An installation of considerable interest for the varied uses to which the power is put is the power plant of the railroad repair shops of the New York Central lines at West Albany, N.Y. Electrical current is used for lighting and power to a considerable extent, both alternating and direct. For transmission from the power-house to the various parts of the shops the current, which is generated at 480 volts, three-phase, 60-cycle, is stepped up to 2,300 volts, and at each shop stepped down through transformers for operating the induction motors. Arc lights in the yards are on the alternating current circuit, while to provide direct current for incandescent lighting and about 40 per cent. of the motor load there is a direct current service at 250 volts, generated by three motor generator sets. Compressed air to the extent of 95,000,000 cubic feet per month is furnished at an average pressure of 90 pounds per square inch by two Ingersoll-Rand 360 horse-power compressors. This service is used for operating pneumatic tools, boiler tube cleaners, and for testing air-brake equipments, and various other uses. Hydraulic power is also used to a large extent, principally for pipe-testing and similar uses, and to supply the necessary amount of water under pressure a three million gallon service pump is provided.

Uninterrupted operation and ability to meet sudden demands are the essentials necessary in a plant providing such service, and, therefore, the boiler equipment was most carefully considered in the design of this station. The original equipment consisted of four 500 horse-power Franklin water-tube boilers equipped with Taylor gravity underfeed stokers, manufactured by the American Ship Windless Company. Later, when the station was enlarged, to this boiler equipment was added a battery of three 600 horse-power Edgemoor water-tube boilers, and these were also equipped with Taylor stokers. The large overload capacity and steady operation possible with these stokers dictated their choice for this plant.

NEW INCORPORATIONS.

Montreal.—Grimm Manufacturing Co., $150,000; J. H. Grimm, C. E. Grimm, C. E. Moore.

Belleville, Ont.—Sidney Electric Power Co., $500,000; A. B. Colville, J. B. Ferris, R. I. A. Humphries.

Oakville, Ont.—Oakville Construction Co., $25,000. J. W. West, W. Scott, Oakville; A. E. Cook, Toronto.

Toronto, Ont.—Excelsior Lumber and Construction Co., $100,000; J. W. Heffernan, F. C. Carter, A. Fleishman. Engineers' Club, of Toronto; A. B. Barry, C. M. Canniff, W. Chipman. Battleford-Saskatchewan Land Syndicate, $100,000; W. R. P. Parker, J. A. McEvoy, M. Gordon. Canadian Public Health Association; D. M. Anderson, T. Aird Murray, C.E., A. J. Harrington. Booth-Coulter Copper and Brass Co., $250,000; G. Booth, W. Coulter, W. E. Booth. Dominion Roofing Co., of Canada, $40,000; E. R. Maltby, C. J. Oille, G. R. Sproat.

Windsor, Ont.—Canadian Commercial Motor Car Co., $40,000; C. Thibault, E. D. Craig, E. C. Kenning. Burlington Windsor Blanket Co., $50,000; G. C. Rasch, W. G. Rasch, Burlington, Wis.; J. J. Horan, St. Louis, Miss.

Winnipeg, Man.—Trail Magazine, $100,000. H. J. Moorhouse, W. G. Bale, Winnipeg; J. A. L. Robinson, Regina.

British Columbia.—A. E. Tregent & Co., $25,000; Columbia Bitulithic, $150,000; Malcolm International Blue Line System, $10,000; Pacific Marine Brokerage Company, $25,000; Vancouver Motor Trades Association, $10,000.

PURE WATER SUPPLY AND FEDERAL ACTION.

Only a few months have passed since Dr. Hodgetts, late chief medical health officer for Ontario, was appointed adviser to the Conservation Commission.

At the time of his appointment we emphatically stated our opinion that the Government had got the right man, and that the whole Dominion would benefit by his translation.

Dr. Hodgetts has not only the faculty of directing organization, but he is capable of obtaining results by the application of common sense and practical methods. The result of the conference now being held at Ottawa between the Federal and Provincial Health Departments is certain to be attended with some legislative measure protecting Canadian waters from pollution. Everything appears to point to the necessity of appointing a Federal Council of Health with powers to make interprovincial and international arrangements and regulations for water pollution prevention.

Dr. Hodgetts, in his address to the Conference, states: "Certain it is we are not doing it by our present methods and laws. It can, however, be done by efficient laws that we have not as yet seen fit to enact, the enforcement of which should, in the main, rest with some central, well-organized and wisely administered Federal department co-operating with each of the various Provincial Departments of Health."

The doctor also pointed out that the Province of Saskatchewan was the only one in Canada which possessed obligatory laws relative to the prevention of the pollution of streams by sewage. Throughout the rest of the Dominion the laws were of such a weak character that they were of little practical value. In the single Province referred to it is illegal to raise debentures until schemes for water supply and sewerage have been sanctioned by the Government; elsewhere even the submitting of plans to the Provincial Boards of Health amounts to merely a matter of courtesy.

The laws in one Province may be as strict as it is possible to make them in prevention of water pollution, while in the neighboring Province there may be either no regulations whatever, or regulations of such a character as to cause them to be ineffective.

The neighboring Provinces of Saskatchewan and Alberta present a good example. In Saskatchewan most strenuous efforts are being made by Dr. Seymour (the Commissioner of Health) to maintain the purity of water supply. Regina, Moose Jaw, Saskatoon, Prince Albert, and a number of the towns are at present heartily and most willingly engaged in supporting his efforts by installing up-to-date sewage purification works. In Alberta nothing is doing, apart from some proposal to put down an experimental plant in connection with the Government buildings at Edmonton, the product of a Government official.

The folly of this separate action, or action on the part of one Province and no action on the part of another, is at once apparent when we state that most of the sewage from the Province of Alberta is conveyed by the North and South Saskatchewan Rivers into and through the Province of Saskatchewan. No matter, then, how strict the laws of prevention may be in Saskatchewan, Dr. Seymour, in spite of his efforts, will continue to be up against a condition of things which he cannot control until such time as Alberta decides to prevent the pollution of the two great rivers, or until such time as Dr. Hodgetts can obtain Federal legislation, creating a Federal controlling centre.

The old, worn-out ideas and opinions of streams automatically eliminating disease infection by length of travel have reached a period undeserving of serious discussion.

While organic matter may become stable and oxidized by admixture with clear water, bacteria are not so readily affected. The Niagara River chemically purifies itself by the rush over the falls and rapids; pathogenically, or practically, no purification takes place. We know, also, that sewage can be conveyed any distance in cold storage, and that when the ice breaks, the raw, unchanged sewage of Edmonton is delivered by ice-carriers to Prince Albert, and the B. Coli content shows positive every time.

These questions are more than Provincial—they are interprovincial, and Dr. Hodgetts appears to have got the right grasp of the whole matter.

As a practical example of the necessity of immediate Federal legislation, and a central advising authority operating with Provincial Boards of Health, we may take the position of the city of Lethbridge, Alta. Lethbridge pours the whole of its sewage, untreated, into the Belly River. On this river, just below Lethbridge, several coal mining villages are located, dependent on the river for water supply. Typhoid fever is endemic in these villages, and cases are constantly being brought into the Lethbridge hospital. Lethbridge is willing and anxious to install some method of preventing the pollution of the river, and has been patiently awaiting some leading advice from the Provincial Board of Health. None, however, has been forthcoming, apart from a letter recently published from the Provincial Board of Health, advising that nothing be done at present, as sewage disposal methods are said to be in a state of transition, and the Government are about to experiment on some new idea invented by one of its officials. Lethbridge, losing all patience, has, however, done something itself. It has called in an expert sanitary engineer, not to make engineering plans, but to report as to the best method of dealing with the sewage problem.

Now, what Lethbridge really feels the want of is an independent authority on which it can rely for leading advice, and to which it can submit any proposed scheme for impartial judgment.

The establishment of an authority, either Provincial or Federal, must be based upon absolute independence as affecting advice. The engineering department of the authority **must have no interest whatever in private consulting work within the area of operation.** It must have no axe to grind or special method or scheme to push. Otherwise, municipalities can have no confidence in submitting any scheme for consideration or in asking advice. This is the view which Dr. Seymour has taken in administrating the Bureau of Public Health in Saskatchewan, which has met with entire success. He insists that all connected with his department shall not act in a private capacity within the Province.

Dr. Hodgetts' idea of a Federal Council appears to be based upon the English system of the central authority as constituted in the Local Government Board, the president of which is a Cabinet Minister. In England, a municipality desirous of installing sewerage or waterworks has, in the first instance, plans prepared by an engineer,

which are submitted to the Board, and which, in turn, holds an enquiry at the locality, presided over by one of its engineering inspectors. Lengthy evidence is taken, the public being freely heard, the site examined, and the plans carefully gone into. Not until the Government Board has given its sanction can the municipality proceed with the work. By this means municipalities feel that their interests are being guarded, and they are assisted in coming to conclusions on questions on which they feel incapable themselves of forming any determination.

Is there anyone doubts but that some such system would be welcomed in Canada? We believe that much of the polluted water supply, with its consequent high typhoid death rate, is the result of the want of organized authority. There are municipalities by the hundred which hesitate because of the want of authoritative lead. They are anxious for some efficient water supply or method of sewerage, but they feel that they are in the hands of the Philistines. Can this be wondered at when we consider the history of the Lindsay ozone water purification plant. Here we have a community with every faith in a particular individual and his special goods, and in spite of guarantees, promises and converting enthusiasm, the municipality find they have paid for something which, in accordance with the Ontario Health authority, they find is useless. Experiences such as the latter make all municipalities hesitate, and they find it difficult to discriminate between the bona fide engineer and the commercial engineer.

Legislation such as outlined by Dr. Hodgetts in his address to the Conference should meet with the unanimous support of all sections of the people. There is no question of party politics in it. There is a question of health and the destiny of a people. No community can grow beyond the extent of its available pure water supply at the rate of thirty gallons per head per day. The transition of a family to a village, of a village to a town, of a town to a city, and the ultimate stability of the city, is dependent upon pure water. Transportation, cereal production, grain elevators, and all the patriotic enthusiasm for becoming a great nation are of no avail unless accompanied by drinking water. The whole future of the development of the prairie West is wrapped up in "the pure water question." The whole future of the maintenance and continued prosperity of older Canada is dependent upon immediate measures being taken to prevent what is now openly recognized, a gradual poisoning of originally pure and ample water sources.

FASHION IN WATER PURIFICATION.

By George C. Whipple.

(From a paper before the Central States Water Works Association, entitled "Clean Water as a Municipal Asset.")

Notwithstanding expert advice, the practice of following the leader is far too common. A method perfectly successful in one city is adopted by others only to find that it does not fit the conditions. The styles of water purification plants do not change as rapidly as those of ladies' bonnets, nevertheless waves of popularity occur even in matters scientific. This is well illustrated by the recent history of the septic tank. Taken up from a long career of obscure usefulness it became famous because of its usefulness in certain places, because of the wide-spread scientific interest in the theory of its action, and it must be admitted, partly because of the obscurity surrounding the work of the mysterious anærobic bacteria. Visitors from Europe now tell us that the popularity of the septic tank is on the wane—not that it is being abandoned altogether, but rather its proper sphere of usefulness is being found and its use limited to that. Meanwhile other phases of sewage disposal are looming large in the scientific press.

Or, to take an illustration from water purification, the preliminary filter of coarse material worked at a high rate is sometimes a useful and appropriate device, but its field of usefulness is extremely limited. The attempt to use it to assist in the removal of colloidal matter, while moderately successful, is usually more expensive and much less efficient than the use of a suitable coagulant. These waves of scientific interest in this or that process are indications of progress, but the crests of the waves do not measure the true sea level. And the writer believes that the disinfection of water will have a similar history, that when the initial enthusiasm has subsided it will take its place, an important place, no doubt, but one subsidiary to the long-established methods of obtaining clean water.

A TEMPORARY HYPOCHLORITE PLANT FOR TREATING THE WATER SUPPLY OF MILWAUKEE, WIS.

By Charles J. Poetsch,* M.Am.Soc.C.E.

On June 18th, 1910, the new Health Commissioner of Milwaukee reported that the number of typhoid cases in this city were on the increase and blamed the water-supply as the cause. In a conference with the mayor, the health commissioner and the city engineer, it was decided to sterilize the water immediately. On June 21st, a very temporary plant, consisting of a single tank in which a hypochlorite solution was mixed, was set up over the water-supply tunnel. The solution was fed to the supply before it reached the pumps by means of a 1-in. pipe, the flow being regulated by a valve. One week later the present plant was started in operation.

The plant now consists of a mixing tank 3 feet in diameter and 4 feet high, and of two solution tanks, each 8 feet in diameter and 7 feet high. The mixing tank has a stirring device operated by hand. The tanks are of cypress lumber, set up outside the pumping station over the supply tunnel and connected with galvanized-iron pipes with the supply. The flow is regulated by means of ordinary valves, according to the amount of pumpage in the station. Six pounds of hypochlorite of lime are used per million gallons—which seems to be ample according to a recent test made by the city chemist. Daily tests of the raw water and of the treated water are now being made by the health department. The results of these tests show about 200 bacteria per c.c. in the raw water, and from 2 to 6 in the treated water.

Temporary Hypochlorite Plant for Treating the Water-Supply of Milwaukee, Wis.

Should it be necessary to continue the treatment of the water, it is proposed to construct concrete tanks, close to the pumping station, with the mixing tank inside of the

*City Engineer, Milwaukee, Wis., in The Engineering News.

building, so as to be able to do the mixing by mechanical means; the solution could then be fed into the pump wells. Wooden tanks are liable to be digested by the hypochlorite in the course of time.

The pumpage is now 50,000,000 gallons per day. The cost of treating this quantity is $5.25 for labor and $4.95 for chemicals, making a total of $10.20 per day, or 20 cents per 1,000,000 gallons. The installation cost was about $225.

SEWAGE PURIFICATION INSTALLATION AT PRESCOT, ENGLAND.

The original sewage disposal works in Prescot were designed by Mr. Joseph Brierly, of Blackburn, and consisted of two sedimentation tanks and eight acres of land. At the time Mr. Brierly had advised the purchase of 48 acres, but only the smaller amount was actually obtained. It was soon found that the land was not only inadequate in amount, but was also unsuitable in character, being of a dense clayey nature. It gradually became sewage sick, and complaints in regard to the pollution of the brook, by the inhabitants of the district below the outfall, became more and more frequent. In 1906 the Prescot Urban District Council decided to advertise for competitive schemes, the result of which was that Mr. Harry W. Taylor, A.M.Inst.C.E., of the firm of Messrs. Taylor, Wallin and Taylor, was, on the adjudication of Mr. Priest, awarded the premium, and subsequently was appointed to carry out the scheme. A commencement was made in 1908, and the work was completed in the early part of this year. The installation has been in operation for the last five months, and from the outset has been working in a highly satisfactory and efficient manner. In the preparation of the scheme the engineers recognized the impossibility of converting and oxidizing the sewage within any practical area of tanks and filters. They were of the opinion that the essential operation was the withdrawal of the impurities from the sewage—the reduction of the foul sewage back to water by the de-solution of the sewage solids, rather than by liquefaction of such matters, and their chief object was to install as self-cleansing a mechanism as possible. The view they held was that which had been demonstrated by Dr. Travis, of Hampton, as the result of many years' arduous experimental work, and therefore they secured his co-operation. It is only by means such as these that engineers are able, with any degree of exactitude, to put into being, and to secure the full benefits accruing from continuous research work. The purification of sewage being essentially a de-solution operation, the great desiderata must necessarily be to expedite the de-solution changes, and to remove the separated matters as soon as practicable. Thus when the sewage first reaches the works it passes through a series of sand pits, screens, and detritus tanks, from which the deposited and arrested matters are removed daily. It then enters the hydrolitic tank, which the engineers believe to be the latest word in the scientific disposal of sewage. The advantages possessed by this form of tank being that (1) the coarser suspended solids are more rapidly and more perfectly removed from the sewage; (2) the finer suspended and colloid matters, which escape from ordinary tanks, are withdrawn, to some large extent, by the self-cleansing colloidors placed in the tank; (3) the arrested sludge is more easily and more completely removed from the tank; and (4) the effluent is freer from suspended solids, and less influenced by the products arising from the decomposing sludge. From the hydrolitic tank the liquid passes on to the filter, upon which it is distributed with great evenness by water-wheel distributors. The filters are 7 feet 6 inches deep, and are arranged in two series, two in each. They have a total area of 2,143 square yards, and are designed to take 28 gallons per square yard per foot in depth. The material in the filters is of clinker, coarse in the primary and fine in the secondary, but in each case sufficiently coarse as to be self-cleansing. Between the upper and lower filters and succeeding the latter are settling tanks to arrest the extruded suspended matters. The water then passes down the effluent ladder to the stream. The sludge removed from the several tanks is conveyed to trenches in the land, and covered over as soon as it will bear the weight of the earth. The ultimate results have been more than satisfactory, more even than was hoped for. The sludge is disposed of without nuisance, there are no offensive odours on the works, and the final effluent is a brilliantly transparent liquid, appreciably better than the brook it enters. The average analyses relating to the several stages of the treatment process are shown in the accompanying table.

Prescot: Average Results.

Sample.	Parts per 100,000. Solids. In suspension.	Separation effected by filter paper. In solution.	In colloid state. Separated from solids in solution by dialysis.	Nitrogen. Chlorine.	Ammoniacal.	Albuminoid.	Nitrous.	Nitric.	Oxygen absorption, 4 hours at laboratory temperature.	Dissolved oxygen.	Percentage purification referred to the crude sewage. Solids in suspension.	Albuminoid Nitrogen.	Oxygen absorption.
Crude sewage ..	38.6	83.6	10.9	11.5	8.62	1.14	nil	nil	10.6	—	—	—	—
Detritus tank ..	36.0	81.8	—	11.8	8.73	1.12	"	"	10.8	—	—	—	—
Hydrolitic tank ..	7.1	71.9	7.2	10.2	8.03	0.56	"	"	6.2	—	80.3	50.9	41.5
First filters	4.4	77.4	trace	9.2	1.50	0.068	.13	2.16	0.88	—	88.6	94.0	91.7
Second filters ..	trace	90.3	nil	9.5	0.07	0.022	trace	2.78	0.27	0.92	99.	98.1	97.5
The brook water into which the effluent passes	7.0	45.8	—	3.5	0.11	0.078	trace	trace	0.59	—	—	—	—

RAILWAY SIGNALING.*

C. L. Hacket.

Railway signaling naturally divides itself into three general heads. Namely, "Interlocking, Block Signals, and Miscellaneous Signals."

The primary reason for the use of signals on a railway is to convey information to the engine driver as to what action he is to take, and when to act. The difference between driving a locomotive and driving a horse and carriage is a question of momentum. In the case of the locomotive, a weight of several hundred, or thousand tons is moving at high velocity, in the case of the carriage, a weight of a few hundred pounds is moving at low velocity, the control of the one is only approximate except through the lapse of a considerable interval of time, while the other is practically under instant control. Signaling has developed two types of signals, which are known as, a Home Signal, and a Distant Signal. A home signal is a signal located along side of the track marking a definite point beyond which, the engine driver must not proceed, unless the signal indicates that he can do so. As noted above, it is physically impossible to stop a train moving at any considerable speed instantly, therefore if the train is to be stopped before it passes the home signal, some preliminary information must be conveyed to the driver, as to what indication will be presented to him by the home signal. The means employed is the distant signal, which is set in advance of the home, a distance depending on the brakeing distance of the highest speed trains, and is simply a repeater of the home. When the driver finds a distant signal indicating that the home signal is at the stop position, he can apply brakes and bring his train to a stop before he reaches the home signal. If the distant signal is indicating clear the home signal must also be indicating clear.

In modern signaling the semaphore has come into general favor, as giving the best results with unfavorable weather conditions, and changing back grounds.

The indications are given by the arm of the semaphore. The stop indication by the arm in the horizontal position, and the proceed indication by the arm inclined. Until recently the distant signal arm was distinguished from the home by having a V shaped notch cut out of the end. The indications of the distant signal were the same as the home, that is, the horizontal position of the distant arm indicated caution (that the home signal arm was at stop), the inclined position of the distant arm indicated that the home signal arm indicated clear. There is a confusion here quite apparent, as with the home arm horizontal, an indication is given that the engineer must not proceed beyond the signal whereas the horizontal position of the distant blade indicated caution, "proceed but be prepared to stop at the home signal," and the only distinguishing mark for the distant arm is the V shaped notch, which is not distinguishable at any distance nor in all weathers, consequently there is serious objections to this horizontal indication having two possible meanings. The latest practice is to have each arm capable of giving three unmistakable indications, i.e., horizontal meaning stop, inclined at an angle of 45° caution, and vertical, meaning proceed, this is more consistent, and it is impossible to mistake the indication.

The fundamental principle underlying the construction of signals, is that a failure in any part should cause the arm of the semaphore to assume the horizontal position, indicating stop. The common practice in America has been to give the indication by moving the arm from the horizontal to an inclined position below the point of support, this necessitates the use of a heavy counterweight to bring the arm back to the horizontal should any part of the signal break, naturally the accumulation of ice and snow on the arm itself would tend to offset this counterweight, and there are cases on record where such accumulation has been sufficient to hold the signal clear, when it should have returned to the horizontal. The German practice has always been to move the arm above the point of support, thus doing away with the heavy counterweight, and with this still further advantage, that any accumulation of snow or ice on the blade tends to bring it back to the horizontal. This practice has found favor among the American Signal Engineers, and also is being used on the Western Lines of the C.P.R. and C.N.R. This is unquestionably a move in the right direction and has everything to commend it.

While the day indications of a signal are given by position, the night indications are given by colors. Red has always been used to indicate the stop position, but for the other indications practice has differed on different roads. The different colors are obtained by means of shutters of colored glass, which are moved in front of an oil lamp attached to the signal mast, these colored glasses are fastened into the same casting to which the arm giving the day indications is attached, each indication of the arm has then a corresponding color indication. It is essential if the principle of signal construction above referred to, is to be carried out, that the day indications and the night indications should be given by the same mechanism, that is, it should not be possible to give an indication for proceed with the arm, without at the same time and by the same means, giving this proceed indication with the proper color. There are a good many signals in use in Canada to-day which do not conform to this requirement. The night indication in these, is given by rotating the lamp on its vertical axis, while by means of a pinion gear the arm is made to move, it is under these circumstances easy to conceive of a condition where the night indication would be one thing and the day indication the opposite. This becomes particularly dangerous when we realize that at night, when the engineer gets close up to the signal, the head light of his engine would illuminate the arm, and there are very few engineers who finding the arm indicating clear, would not accept this as sufficient authority to proceed, even though the light on the signal as he approached showed red.

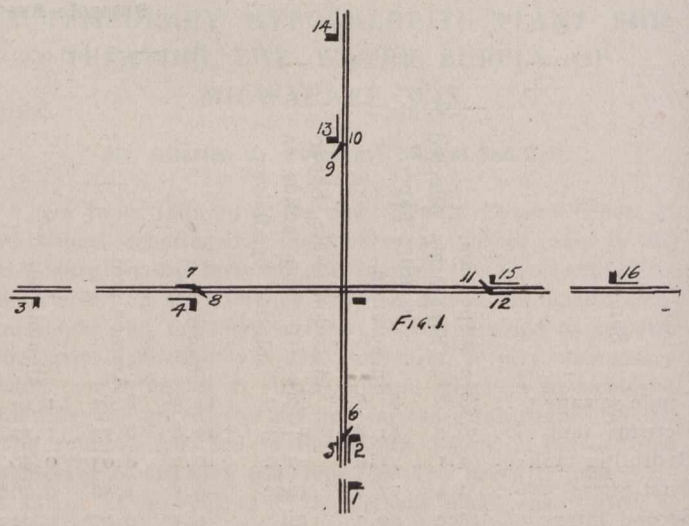


Fig. 1.

*Read before the Central Railway and Engineering Club of Canada, at Toronto, Ont.

With regard to the question of the proper colors to use for the night indications. As stated above practice has differed in this respect. Some roads use white for the clear indication (white in this case meaning that the lamp flame is not covered by any colored glass), and green for the caution indication of the distant signal. On the other hand, some roads use green for the clear or proceed indication, and orange for the caution. If we bear in mind again the principle of construction, it is not difficult to arrive at the conclusion that all night indications should be given by some distinctive color, and in no case should the flame itself be used, except as a stop indication. For if the white indication is used, a broken colored glass would give this indication. Up to the present the only colors with sufficient range to be used as night indications are the red, green and orange.

Another essential point to be remembered in connection with signaling is that it must be made impossible for any of the indications except the stop indication, to be displayed except by an authorized means. That is if the signal is operated by means of levers, then by means of the lever only, can any indication be made. This necessitates the use of a rigid connection between lever and signal, or if wire is used there must be a back and front wire, if only a single wire is used to pull the signal clear, any unauthorized person could clear the signal which is manifestly an unsafe condition.

The Standard Code definition of Interlocking is as follows: "An arrangement of switch, lock and signal appli-

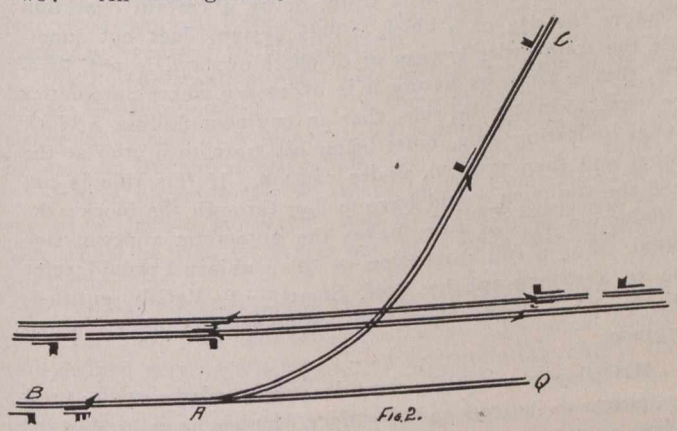


Fig. 2.

ances so interconnected that their movements must succeed each other in a predetermined order." Interlocking in Canada up to the present has been confined, to a great extent, to the protection of the crossings of two railways at grade. This is by no means its only possible application, and indeed is probably the least important of its uses. It finds its greatest economy in terminals, junctions, and at points where a great many switches are grouped together, at such points all the switches can be handled from a central point by one or two towermen, with absolute safety to the trains, and with the greatest amount of expedition.

Under the law in Canada, all trains approaching a grade crossing with another railway, are required to come to a stop before proceeding over the crossing, unless the crossing is protected by interlocking. Aside from the safety afforded by interlocking the crossing, it can be shown that there is an actual saving in operating expense when the trains reach a certain number. Henderson in his "Cost of Locomotive Operation" estimates that it cost in the neighborhood of 65 cents to stop a train and again accelerate it to its original speed. Mr. Peabody, signal engineer of the Chicago & Northwestern R.R., after having experimented with different trains, concluded that it averaged 45 cents per train. For the sake of illustration, if we take 45 cents as the cost, it is an easy matter to determine how many trains per day will justify the expenditure necessary to install interlocking at a crossing. Fig. 1 shows in diagram the signaling necessary to protect a single track crossing a single track. There would be 16 levers, this sized plant installed would cost $4,800.00 and would require a day and night towerman to operate it. The yearly cost for the plant would stand about as follows:

Cost of interlocking, complete	$4,800
Interest on cost, 4%	192
Depreciation, 7%	336
Cost of maintenance per year	240
Cost of operation per year	1,200
Total cost per year	$1,968

Saving to be effected:

Trains per day.	Cost per year acct. stopping.	Total yearly cost of interlocking.	Net saving per year.	Cost of interlocking.	Time required to pay for installation from saving.
14	1,971	1,968	3	4,800	
20	2,817	1,968	849	4,800	5½ years.
25	3,521	1,968	1,553	4,800	3 "

It is apparent then that 14 trains a day over this plant would justify its installation, aside altogether from the saving due to increased safety.

Interlocking is based on the following principles: First. That a failure in any part of the apparatus will prevent a clear signal being displayed. Second. That the normal position of all signals is "stop." Third. That a signal cannot be cleared for a train to move across the interlocking until all the switches in the route are properly set and locked. Fourth. That a signal cleared locks all the switches, and that no switch or lock can be moved while the signal is clear. Fifth. That the signal cleared guarantees to the engineman the route, with no possibility of a move being made by any other train that could in any way foul the route given. In Canada the first four of these have been always conformed to, but the fifth (fully as essential as the other four) has not, Fig. 2 is a sketch of a plant in operation which does not. A train moving from B to C having received a clear signal, No. 1 is not protected from a possible movement by a train from Q which could cause a serious side swipe at the frog A. I have seen several other plants, which also have this serious loophole, and it has been my experience that if a loophole is left in any signaling installation it is only a question of time when some train will run into it.

In order to prevent a train running by a signal at a crossing, the law requires the use of a derailing switch operating in connection with the signals, the signal can only be cleared after the derailing switch has been closed and locked. The closing of the derailing switch on one line locks the derails on the crossing line open, the idea being that if signals alone were used, it would be possible to have a train on the crossing run into by a train on the other line should the engineer disobey the signal. Each individual interlocking plant is a problem in itself, different conditions either in track lay-out or operation, require different treatment in the location of the signals, and this is the province of the signal engineer. The signal engineer of a large road is one of the most important officials, his knowledge and experience must be large and varied, he should be a civil engineer, and also thoroughly understand how the trains are operated, his duties once the plant is installed, is closer allied to the operating end of the railway than to the engineering. In order for him to be able to advise what arrange-

ment of signals will give the greatest results, he must be in close touch with the officers who are responsible for the movement of the trains, otherwise his usefulness to the railway is not fully utilized.

In Fig. 1 we have the layout of a simple crossing of one single track line with another. Each derail is handled by a lever situated in a convenient building. The locks for the derails are handled by levers, and the signals by levers. All of these levers are grouped together in a frame, the interlocking between the levers being obtained by the use of cross locking operated by the levers, and held in the lever frame itself. The levers are numbered consecutively from left to right, the derail switch, lock or signal which they operate being numbered to correspond to the lever. The connection between the levers and the functions being made by means of pipe carried on rollers, the turns in the pipe lines being made with bell cranks. The lock lever also operates what is known as a detector bar, whose function is to prevent the switch or derail being unlocked if there is a train on the track. This detector bar consists of a long bar of steel supported on a number of links pivoted to a casting attached to the base of the rail, free to move in a plane parallel to the track and inclined slightly toward the centre. When the bar is moved, the links raise it above the tread of the rail, if however, a wheel is on the rail the bar cannot be moved, as it will be held down by the wheel tread which projects beyond the rail head, this prevents the lock plunger from being withdrawn while there is a car on the track. In the Figure the interlocking between the levers would be:

Reverse	lever	No.	1,	lock	lever	No.	2	reversed,		
"	"	"	2,	"	"	"	5	"	10	reversed,
									13	normal.
"	"	"	3,	"	"	"	4	"		
"	"	"	4,	"	"	"	7	"	12	reversed,
									15	normal.
"	"	"	5	"	"	"	6	"		
"	"	"	6,	"	"	"	8	normal,	11	normal.
"	"	"	7,	"	"	"	8	reversed,		
"	"	"	8,	"	"	"	6	normal,	9	normal.
"	"	"	9,	"	"	"	8	"	11	"
"	"	"	10,	"	"	"	9	reversed,		
"	"	"	11,	"	"	"	9	normal,	6	normal.
"	"	"	12,	"	"	"	11	reversed,		
"	"	"	13,	"	"	"	10	"	5	reversed,
									7	normal.
"	"	"	14,	"	"	"	13	"		
"	"	"	15,	"	"	"	12	"	7	reversed,
									4	normal.
"	"	"	16,	"	"	"	15	"		

Thus the first lever to be moved would be the derails, then their locks, then the home signal and last the distant signal; in returning the track to its former position, the order of moving the levers is just the opposite.

Block signals differ from interlocking signals only in this respect: Interlocking signals indicate a condition of the track and switches; block signals, on the other hand, indicate the presence or absence of a train in or from a specific length of track—they may indicate the condition of the switches also, but their function is to show whether a train can be admitted to a block section, or whether it is already occupied.

The Block System is a means of moving trains by means of signals, as opposed to moving trains by time table and train orders. The principle on which it is based is that two trains must not occupy the same piece of track at the same time. The line is divided into sections, the limits of which are marked by a signal, and trains are only admitted to one of these sections by means of the signal governing that block. The length of these sections will depend on the number of trains run, their speed, and maximum length.

There are several different methods of block signaling in use. The Telegraph Block System, a block system in which the signals are operated manually, upon information by telegraph. This is simply a make shift and is a combination of the block system and the Standard Code dispatching system, a combination that cannot be made if the basic principle of block signal operation is maintained. The Controlled Manual Block System, a block system in which the signals are operated manually, and so constructed as to require the co-operation of the signalmen at both ends of the block to display a clear signal. That is, in this system the signal at the entrance end of the block is so interlocked with the signal levers at the out-going end, that it requires the men at each end to co-operate in order to admit a train. There are several types of this system, "The Lock and Block," ordinarily used on double track, where head-on movements are not ordinarily made, and the Staff System used on a single track, where head-on movements must be protected. The Automatic Block System, a block system in which the signals are operated by electric, pneumatic or other agency actuated by a train, or by a certain condition affecting the use of a block. This system does not supersede the train order system of dispatching, and is not absolute, that is from its nature it is necessary where automatics are used, to insert the rule, that an engineer finding a block signal indicating stop, must bring his train to a stop at the signal and then proceed, under caution. If this rule is not used the trainmen would have to flag through the block; the introduction of this rule makes the automatic a permissive signal. For a full discussion of this subject I would refer you to a monograph by Prof. Smart, of McGill, entitled, The Basis of Train Operation, published by the Canadian Engineer.

Miscellaneous signals comprise train order signals, used at stations to indicate to the runner whether he is to stop for orders or not; station signals, used to protect trains standing at stations where no block system is in use; outlying switch signals used to indicate to a runner, whether or not the main line switch is properly set for him to proceed; highway crossing signals, used to warn the public at a highway of the approach of a train.

In the case of station signals, it is futile to simply put up a home signal 1,500 ft. or 2,000 ft. from a station, and expect that this will protect the station. It will not. If a train is running at forty-five or fifty miles an hour, as pointed out above, it would be impossible for him to stop at the signal, and if the signal does not mark the point beyond which he must not go, what does mark this? In order for a station signal to be effective it must have a distant signal working in conjunction with it. I have in mind a condition which I saw some time ago at a station, where a freight train had stopped. The caboose was perhaps some fifty feet inside of the station signal, which was indicating stop. Approaching the signal at this point there is a sharp curve. A following freight came round the curve and did not have time to stop before it reached the signal, with the consequence that it ran into the caboose of the standing train. A distant signal would have given him the proper preliminary information. The fundamental principle that must be kept over in mind in signaling is that a failure in any of the

parts must produce the stop indication. Thus when we put up a signal at a highway crossing to protect the public using that crossing, it is here just as necessary to keep this principle in view as it is at an interlocking plant. The crossing signal should be so constructed that if anything fails, the signal should give a positive stop indication to the highway. Most of the highway crossing signals simply consist of a bell; when the bell rings the public understand that a train is approaching the crossing, when the bell is silent it is perfectly safe for them to cross the tracks. This is evidently wrong. A broken wire, a discharged battery or one of several things may happen to prevent the bell from ringing, yet the non-ringing of the bell is an indication in the proceed position. Nor does the addition of a light in connection with the bell improve matters. The light is run usually by the same source of power as the bell, and anything that will cause the bell to fail will also cause the light to do likewise. A crossing signal to be dependable must be built on the same principle as a signal. It should have a visible stop indication that will show stop, should any break occur; the bell is a good adjunct to such a signal, but the visible indication which will take up the stop position by gravity is essential.

TECHNICAL EDUCATION.

Dr. J. Galbraith made the following remarks on the subject of Technical Education, at the Engineers' Club on Thursday evening, October 13th:—

As I understand it, the object of this meeting is an endeavor to formulate our views in some presentable manner, either in writing or expression, for placing before the Commission on Technical Education, upon October 25th, 1910.

I have obtained the sentiment of the Commission with regard to such a movement, and have their assurance that they would be glad to receive our views upon this important question.

I intend merely, at this meeting, to open the question, as it were, for your individual discussion. Technical education defined may have a very broad interpretation, and in the sense we are about to discuss it, it has a very broad interpretation. The name as used is a misnomer. It contains the art rather than the science; the doing of a thing rather than the knowledge of the scientific principles underlying, or the science is emphasized in the common use of the word. Thus, it would seem to indicate that it meant non-scientific education, whereas this is not the true import of the word.

These two departments are better separate, and designated as the theoretical and as the practical education.

In the educational process in which I am engaged, i.e., the training of young engineers, the work is well defined and laid out; being one of the oldest types of technical education, the forms are well fixed. First, we have the theoretical, there we have the practical to consider.

You may easily see that in the different branches of engineering there are various opportunities for teaching the practical. One thing is certain, however, that without the theory there is nothing. In our universities, therefore, we teach the theory largely and let the practical go. If the average man in our School of Science at the University of Toronto should look over our curriculum he would see the same subjects prescribed largely for the different branches and to some extent, even a similarity to those in a classical course, but he would not understand this seeming similarity. It means that a fairly broad basis is set, and later in good time, you can see that the man's training would be limited by the nature of the particular branch or profession itself. I was on the Board of the Municipal Technical School of Toronto, and one great difficulty there was that the men we had as pupils were from all the trades, hence, the Board had nothing to go by, it being very hard to say what was safe to teach with their varying advancements in the different branches.

Men would study arithmetic and get disgusted because the course was too elementary. What was elementary for one would be beyond another's grasp. Thus, the problem was that we had to consider the teaching of individuals rather than classes. The candidates frequently did not know what they wanted themselves.

In the University, however, this was different; there, we have to deal with classified students, whereas almost nothing can be done to satisfactorily classify the students of the public technical school. Our own Municipal Technical School, in an elementary way, is arranged along the lines of the School of Practical Science, for the reason that nothing more than a general rudimentary training underlying many branches could be given. At least, that was the feeling of the Board at that time.

In a city of the nature of Toronto, and in fact most of our Canadian cities, it is well nigh impossible to teach various trades in a school supported by the public money, or the money of all trades. Dissension would immediately arise if one trade were taught and another not.

This explains the past of the public technical school. Furthermore, industrial education is complicated by the attitude of the labor unions. We had labor unionists on the Board of the Municipal Technical School, and their idea was that the trades should not be taught. We agreed mutually, however, upon the necessity of teaching science. Should schools teach special trades it would necessitate endowments from those trades. A partial solution of this question of industrial education is seen in the schools of some large corporations, or the teaching of trades by people most interested in them.

The C.P.R. and the G.T.R. each give instruction to their mechanics, and many concerns in the United States have adopted this method. There are two classes in these schools, i.e., men having a university training, and men who have not a university training. Each is trained in the most practical way, but they differ in many respects as they are for different purposes. This method of training is indeed the most hopeful kind of industrial training.

Another barrier in the way of establishing industrial schools is the obtaining of expert teachers. A teacher should understand both the theory and the practice, and it would be hard to find such university graduates who would teach, as most do not intend to, and the salary would hardly merit their continuance. A teacher must love the work and be willing to make these sacrifices for the work's sake. In certain cities in the older countries where special industries are localized, industrial training is an easier proposition. In Germany, for their local trades, as pottery, etc., they have their schools of applied chemistry, and in England scientific schools exist for the principal industry of a certain city, but we have no such cities, or few such. In Canada, the time is coming, I believe, when there will be plenty of teachers who are experienced in both the theoretical and the practical side of industrial training, but it is hard to find them now.

Mr. R. W. King expressed his opinion that localization of industry was what was needed in Canada. Before trades schools would or could be realized, there must be centres of industry.

Prof. C. H. C. Wright thought the problem of the meeting was that the Club should place its needs before the Com-

mission. "As engineers, where does the trouble lie in handling your men?" Can they understand language, read drawings, etc. Then should we improve the Public school, or should we make new schools.

Mr. R. W. Gregg, architect, expressed his opinion that trade unions look too much after their immediate interests, and do not look ahead, the chief problem being to teach men to think. Mr. Gregg stated that there was a necessity of making unions realize the importance of training apprentices.

Mr. Redmond, of the University of Kansas, favored fellowships being installed in universities for men by companies who will afterwards get the benefit of their training.

Mr. C. R. Young said that the question resolved itself into two parts; first, education of professional men; second, education of men in a manual capacity, since the professional man needs the broad training to deal with men, and the assistant it is who needs the specialized training. The correspondence school accomplishes these results in some measure, if we could teach men of manual type to read plans and figure roughly.

Prof. T. R. Rosebrugh favored a co-ordination in education, not a separation of professional and manual labor men. The problem, he said, might be solved by having some of the Publis schools manual training schools.

A committee was formed to present or draw up views of the meeting, the result of which was as follows:—

The president, C. M. Canniff; secretary, R. B. Wolsey. Dr. J. Galbraith, Mr. R. W. King, Mr. T. Aird Murray, Mr. R. W. Gregg, Prof. C. H. C. Wright, Mr. J. G. Sing.

DESIGN OF TALL CHIMNEY.

A new brick chimney of about 7,000 h.p. capacity has recently been completed by the Dwight Manufacturing Company, of Chicopee, Mass. This chimney was designed by Chas. T. Main, Engineer, of Boston, and the features particularly distinguishing it are the great height as compared with the diameter of the base, and the method of lighning protection. It will take the place of the present induced draft apparatus, and will furnish draft for all the present equipment, and for future boilers to be installed. It is 250 feet high above the top of the foundation, has a twelve-foot diameter flue, and consists of an outer shell and a core built of common red brick. The foundation is of concrete, and rests upon a ledge of rock at a depth of about 30 feet below the boiler room floor level. It is 40 feet square at the bottom and sides being battered so that the top is 28 feet square. The total weight of the chimney and foundation is about 4,500 tons, so that the weight per square foot on the supporting rock is slightly less than 3 tons, a most conservative figure.

The shell for a height of 50 feet 6 inches is plumb and of octagonal section, being 26 feet across from face to face. At this point there is a stone water table, and above this point the external shell has a circular cross section. The bottom diameter of this section is 24 feet 9 inches, while it tapers with a batter of 5/6 of an inch per foot to a diameter of 15 feet 8 inches at a point 33 feet from the top. It then remains plumb for a distance of 10 feet, while in the last 21 feet it flares to a diameter of 18 feet, there being a vertical section 2½ feet high before reaching the cast-iron cap.

The thickness of the shell walls beginning at the foundation is as follows:—

1st—40′—6″	32″.
next—50′ additional	24″.
" —50′ "	20″.
" —50′ "	16″.
" —57′—6″ "	12″.

The thickness of the core walls is as follows:—

1st—66′—6″	20″.
next—60′ additional	16″.
" —60′ "	12″.
" —63′—6″ "	8″.

The breeching to the power-house is 17 feet x 7 feet, entering one face of the octagonal section 15½ feet above the foundation. Over the flue opening the chimney is supported on a cast-iron lintle, and reinforced with eight 8-inch 18-lb. I-beams set in the brick-work. In the first circular section the external shell is reinforced by four bands of 3½-inch x 2½-inch x ⅜-inch angles, set in the brick-work, and spaced 10 feet apart.

A clean-out door is provided 3½ feet above the foundation and directly under the breeching, there being a roadway passing under same, between the chimney and the power-house. The bottom of the chimney up to the clean-out door is filled with gravel topped with four inches of concrete.

The problem of lighting protection presented some very interesting features to Mr. Main, the designing engineer. Ten ¾-inch copper rods are screwed firmly into holes tapped in the cast-iron cap at equal distances around the top. This cap is made in two parts, one set on the external shell and the other on the internal shell, which extends 12 inches higher than the outer one.

The ground conductors are four in number, and consist of ⅛-in. x 1-in. copper ribbons, spaced equidistant around the chimney. Each one of these is attached to the cast-iron cap by four ½-inch composition tap bolts, the cap being filled smooth under each band and a 2-inch expansion loop being provided between the inner and outer caps.

The conductors are attached to the brick-work by ⅛-in. x 1-in. copper clamps every 4 feet, which are nailed with two 3-inch copper nails to composition plugs set in the bricks. The conductors are free to slip behind the clamps and a two-inch expansion loop is provided every 100 feet. Every 36 feet a 1/16-in. x 2-in. copper band extends entirely around the chimney and is connected to the vertical ribbons by two ¼-in. copper rivets, the joining edges being champfered and tightly soldered. The joints in the bands and in the ribbons are made with four ¼-inch copper rivets, the edges being champfered and soldered as above.

At the base three of the copper ribbons are buried about 20 feet in the ground, the end of each being securely riveted and soldered to a No. 16 gauge copper plate 2½ feet x 5 feet, which is buried in two-foot layer of charcoal or crushed coke about pea size. This will prevent any oxidation of the plate or ribbon and its consequent disintegration. The fourth conductor is lead to a water main and soldered in two places to brass plugs screwed into separate lengths of pipe. For a distance of 10 feet above the ground the brass ribbons are protected by a grooved plank securely spiked to the brick-work.

All the brick-work was laid from the outside staging as it was considered that the masons could work with a greater degree of speed, safety and comfort, and produce a much better looking job than when laying overhand from the inside.

The chimney and the lightning protection system were designed, and the erection supervised by Charles T. Main, Engineer, of Boston, Mass.

ROADS AND PAVEMENTS

THE SECOND INTERNATIONAL ROAD CONGRESS.*

The second International Road Congress was divided into two sections and sub-sections, as follows:—

1.—Road Construction and Maintenance,
  (a) Town Work.
  (b) Rural Work.

2.—Road Traffic.

The questions submitted were as follows:—

1.—On metalled and paved roads:—The use of binding materials, the use of trackways on paved roads; progress made in the struggle against wear and tear and dust.

2.—The foundation and drainage of roads.

3.—Light railways and tramways on roads.

4.—Cleaning and watering in large towns.

5.—The choice of surfacing materials in large towns.

6.—Road work in relation to lighting and water supply.

7.—The influence of weight and speed of vehicles on special structures (bridges, etc.).

8.—The design of road vehicles which will wear best and cause least damage to the roads.

9.—Public road conveyances other than tramways.

109 papers were submitted and all with reports, etc., appeared in French, German, and English. Twelve of these papers were from the United Kingdom, and ten from the United States.

Under question 1 the following resolutions were adopted by the Congress:—

1.—It is desirable to study and develop the use of binding materials in metalled roadways, special attention being given (a) to determine in each case the character of the binder best suited to local conditions, (b) to determine as exactly as possible the physical and chemical characteristics which it is desirable to specify for tar, bituminous, asphaltic or other binders.

2.—To compare the results obtained by various methods of construction, and to investigate the effect of preliminary storage of tarred materials.

3.—To study wear and deterioration, and to ascertain the best construction for adoption where ordinary macadam is unsuitable and stone paving is not practicable.

4.—Apart from exceptional cases, depending on local conditions, the construction of trackways in paved roadways can be considered as only a makeshift.

5.—That superficial tarring may be considered as definitely accepted in practice, but the advantage of spreading sand or chippings after tarring is not yet proved, and should form the subject of comparative tests.

6.—That careful comparison should be made with regard to efficiency of the use of hot and cold tar applied by hand and by machines. In comparing results, the quality of the metal, the intensity of the traffic, and the climatic conditions should be regarded.

7.—That with regard to the available economical supply in each district, it is important to specify carefully the conditions to be fulfilled, especially as regards the maintenance of the "life," or lasting qualities, of the binding material.

8.—That it is desirable to ascertain the relative merits of heavy coatings with tar and more frequent light coatings, and of tar macadam.

9.—To re-affirm the resolution of the Paris Congress of 1908, viz., emulsions of tar or of oil, hygroscopic salts, etc., have a real but not lasting efficiency. Their use should, therefore, be limited to special occasions, such as race meetings, processions and festivals.

The following are references to several of the seventeen papers discussed under this question:—

Professor Blanchard, of Brown University, Providence, Rhodé Island, pointed out that in the present state of knowledge it was not possible to draw up a specification for a bituminous binding material which would secure a material possessing all the qualities desirable.

A special committee of the American Society of Civil Engineers, was now, he said, charged with the duty of collecting information regarding bituminous binders.

Mr. Harold Parker, chairman of the Massachusetts Highway Commission Boston, furnished particulars regarding the disintegrating effect on ordinary macadamized roads of intense traffic with motor-cars, and stated that greater success had been attained in checking this action by the use of tar in England than on the Continent. He claimed to have succeeded in making road surface with asphaltic oil and varying proportion of asphalte, which could not be pulled apart by automobile wheels, or worn out by steel-tyred wagon wheels.

Mr. P. LeGavrian, Engineer des Ponts Chaussees, Versailles, secretary of a commission appointed to study the suppression of dust, contributed a very valuable report based not only on his experience of heavy traffic roads near Paris, but also on replies to queries addressed to chief engineers throughout France, Corsica, and Algiers. He said the use of calcarous sand, marl, chalk and dolomite, (carbonate of lime and magnesia) as binding material for hard stones which had no binding qualities in themselves, had been very extensive in France, and was good enough for moderate traffic, but quite insufficient on roads with much traffic, especially if that included many high-speed motor-cars. Hydraulic lime mortar in proportion varying from 75 to 400 kilograms to 1 cubic metre of sand had been used in several departments; but with such binding the road crust was inelastic, and soon cracked and disintegrated. Cement-mortar binding had the same defect, and as its use increased the cost of metalling by from 1 franc to 3½ francs per cubic metre, it was not possible to recommend it. Mr. LeGavrian stated, however, that a road crust of cement-concrete of considerable thickness "recovered some relative elasticity," and gave a good road surface suitable for use where traffic was moderate and cement was cheap.

Mr. LeGavrian further stated that "Tar-macadam has not yet been sufficiently studied in France; judging from English experience, it may be anticipated that, although it will not turn out to be a radical cure, still it will prove to be a remedy not to be despised. Tar-macadam, undoubtedly more costly than the simple tarred coating, will always have the advantages of homogeneity, that quality of paramount importance to all good roads.

Mr. Robert Drummond, County Road Surveyor, Renfrewshire, presented an interesting paper summing up experience in Scotland with the most modern methods of road repair. The use of mud for binding was, he said, being gradually abandoned in favor of basalt or whinstone chippings, and in populous places tarred chippings were used, or tar-spraying. Tar-macadam had been tried with very successful results.

*"Engineering," for 26th August, and 2nd September, contains a summary of the work of the Second International Road Congress which assembled in Brussels on 31st July, and broke up on 9th August.

According to Mr. Drummond, tar-macadam, taking everything into account, was as cheap as any of the other coatings, and gave much better results. It was only the question of initial expense which prevented the general adoption of tar-macadam. With the improved practice, in addition to the improved conditions, the life of the surface was prolonged in the proportion of 3, 4, and 5. The extra costs per square yard were, he said, as follows:—Binding with chippings or gravel instead of mud, 1d.; binding with tarred chippings, 2d.; tarred macadam bound with tarred chippings, 5d. He reported in favor of wheel track-ways made of granite blocks 12-in. wide and 6-in. deep, and stated they were occasionally used and found very advantageous on steep hills, with heavy traffic.

The resolutions of the Congress on Questions 2, 3, and 4, were according to "Engineering," more or less elementary or not of special interest to British engineers.

Question 5. Ten papers were contributed.

The discussion on this question was very keen. Continental engineers were inclined to recommend the abandonment of macadam for town streets of any importance, but the American and English engineers were very strongly of the opinion that macadam, especially when improved by tar or other bituminous binding material, must continue to be largely used, even in city streets of considerable importance. They, of course, recognized that, when traffic was very heavy, pavement must, for convenience and economy, supersede macadam, but were apprehensive lest a doubtfully worded resolution on the subject should check the very great improvement in macadamized roads which has been going on in the British Islands and elsewhere during the last ten years.

Resolutions were adopted recommending further study and experiment with tarred macadam, soft and hard wood pavements and asphalte.

Notes re German Practice.

The modern pavement in Germany is asphalte, which in the last thirty years has made its way into the majority of towns, and covers in greater Berlin 41.4 per cent. of the total street surface. In Charlottenburg as much as 63.8 per cent. of the street surface is asphalted. Two kinds of asphalte are used—rammed or compressed asphalte 2-in. thick on a bed of concrete 8-in. thick, and on minor streets cast or mastic asphalte, made with old compressed asphalte mixed with bitumen or Trinidad asphalte, and coarse sand. This is laid on in two layers, each 1-in. thick, and is said to be harder than the compressed asphalte, but to wear less evenly. The asphalte limestone used contains from 9 to 13 per cent. of bitumen.

Notes re French Practice.

The following referring to Paris is from the report of Mr. L. Mazerolle. Care is taken to renew asphalte before it has been reduced to less than 4/5-in. in thickness. The carriage ways have a total area of 9,300,590 sq. m. (say 11,123,500 sq. yards), with surfaces as undernoted:—

	Of total area, per cent.
Macadam	12.5
Stone-set pavement	60.3
Wood pavement	22.7
Asphalte	4.5
Total	100.0

No macadam is in use in streets where recoating more than once a year would be necessary. The prime cost of macadam per square yard, is about 5s., and the cost of maintenance averages 1s. 2d. per sq. yard. About one-third of the total macadam area was tarred in 1909, at a cost, including everything, of about 1 1-5d. per sq. yard. The prime cost of stone set pavement laid on 3-in. to 4-in. of sand averaged a little over 13s. per sq. yard, and the cost of maintenance was about 6.4d. per sq. yard per annum. The laying of stone sets on concrete had been given up in Paris "on account of the recognized lack of elasticity of such a pavement."

The chief fault of stone-set pavement was noise, and for this reason it was disappearing on the first-class roads with intense traffic. For footpaths mastic asphalte was now almost universally adopted in Paris.

Belfast.

Mr. Hector F. Gullan, Superintendent of Works, Belfast, in an interesting paper, arrived at the conclusion that very carefully laid stone pavements were the most suitable and economical for use on city streets, and supported his views by tabular statements. He gave the life of stone-set pavements as fifty years, of soft wood as nine years, and hard wood as twelve years, and asphalte as fourteen years.

Egypt.

Mr. D. E. Lloyd Davies, M.Inst.C.E., chief engineer for Alexandria, Egypt, described most promising results obtained by rolling natural asphalte rock, broken to a 4-in. gauge, to form a road surface, and described a natural mixture of sand, clay and lime called "Tina," which made excellent binding for ordinary macadam.

Colonel Crompton, in England, who is prominent in the crusade against the dust nuisance, is of the opinion, that improved waterproof macadam was a satisfactory solution of the problem of dealing with the majority of the streets in all our towns.

Questions, 6, 7, 8, and 9.—Papers on these questions were said not to be of sufficient general interest, being unimportant and inconclusive.

London is mentioned as the location for the Third Congress in 1913.

DUSTLESS ROADS OF CALIFORNIA.*

Austin B. Fletcher, M. Am. Soc. C.E.

The writer takes up this subject with some diffidence since he has had less than a year's acquaintance with California, and since he knows only by hearsay of the conditions which obtain outside of what is known as Southern California. As has been remarked before, California is a big State; it measures in area some 155,900 square miles and in extreme length more than 700 miles. It is thus possible for it to possess many varieties of climatic conditions. Southern California, however (and to that part of the State this discussion will be limited), may be called a dry country for perhaps eight months of each year, and during the summer months a very dusty one. Almost no rain falls except during the period between November 1st and March 1st; the mean temperature in January is said to be 54° F., and in August, 72° F.

As a result of these climatic conditions, for a large part of the year the roads are absolutely dry, and, except where they are oiled or watered, they are extremely dusty and disagreeable to travel over. Much of the soil, particularly along the coast, is an adobe. The soil when wet is extremely

*Paper presented at the third National Good Roads Convention, held at St. Louis, Mo., September 28th to 30th, 1910.

unstable, but when dry it packs very hard, and where the travel is light it makes a better road surface than those composed of sand or silt, but when a considerable volume of gravel used an adobe road, clouds of very fine dust are raised and the conditions become intolerable.

To lessen the dust nuisance many of the main travelled roads in times past have been surface oiled. It has been said that this oiling was done originally as much to protect fruit trees from dust as for any other purpose. In many instances the oiling was carelessly done, and no particular care was given to the selection of the oil, and doubtless in some cases better results would have been secured had a better grade of oil been chosen.

Asphaltic oil is very widely distributed throughout Southern California, and in the vicinity of Los Angeles there are a great many wells. Most of the oil is used in its crude form, or after a partial refining for fuel or illuminating purposes. The use of these oils for road purposes is, therefore, not more than secondary in importance, and until recently no proper study seems to have been made to ascertain the qualities necessary for the best results in road construction and maintenance. So far, it is the general opinion that the natural oils, that is, the crude oils, with almost no refining, have given the best results in California, supposedly because in the refining process to get off quickly the lighter oils for illuminating purposes, the process is hastened by the use of high temperatures, resulting in the burning of the residuum. Since the residuum of the oil is the portion which is useful for road purposes, it is easy to see the cause for some of the poor results obtained. The burning of the residuum may also explain some of the poor results which have occurred from the use of California asphalts. Until the asphaltic road oil or solid asphalt ceases to be a by-product, and until the refining is done carefully with intent to produce good asphaltic products, the natural oils will probably give the best results.

Crude oils cost usually at the wells 75 cents a barrel of 42 gallons, and for refined residuums $1.10 may be taken as the average price. These prices mean $.018 per gallon for crude and $.026 per gallon for the refined in tank car lots. Some of the oil is said to contain as much as 75 to 80 per cent. of asphalt.

One hears everywhere in Southern California the expression: "The oiled roads have received a black eye." The reason for this is apparent, since of the many miles seen by the writer nearly all were in an extremely bad condition. It was his good fortune to see these roads immediately after the first rain in many months. All of the inequalities of surface and ruts were marked clearly by standing water. Of all the roads so seen not one which was built according to the original California theory was in good condition. It was always said, however, that the conditions, as the writer saw them, were better than those which existed in the adobe soils previous to the oil treatment. It must be borne in mind that the oil was applied to these roads primarily to lessen the dust nuisance. In this respect alone the treatment was surely a success.

The old method of doing the work was to plow up the soil, harrow it, pulverize and apply the oil, at the rate of from 2½ to 3 gallons to the square yard, in one or more applications, as the road officer thought best, with the intent to get a sort of wearing coat, some inches in depth, thoroughly permeated with oil. Where the natural soil was sandy or gravelly the results were better than where there was only adobe, but no work of this kind was durable. Chuck holes and ruts soon developed.

It is fair to say here that the California road-builders are not unlike road officers elsewhere, at least in one particular. They seem to be of the opinion that, having once fixed up a road, no further attention need be given to it. If the ruts and chuck holes above mentioned had been properly filled when they were in an incipient condition the roads would no doubt be in better condition than they are now. The formation of ruts or chuck holes was attributed to the lack of solidarity or rigidity in the oil-impregnated coating, which was doubtless true in part, and so the petrolithic roller was introduced to remedy what was thought to be the sole difficulty.

In brief, the petrolithic roller consists of a drum, about 4 ft. in diameter, having distributed over its peripheral surface a number of studs or projections, about 9 in. in length, in rows, and staggered, the projections each having an area of cross-section of about 4 sq. in. The rollers weigh about three tons, and are usually drawn by four horses.

Perhaps the best work done at first by this process was in the vicinity of Pasadena. There the roadway, after it was brought to the established crown, was plowed to a depth of 6 in., graded and rolled with a petrolithic roller to within 4 in. of the finished surface so as to form a compact subgrade. The roadway was then sprinkled, loosened and oiled with from one-half to three-quarters of the total amount to be applied to the road. The road was then plowed to a depth of 5 in. below the finished surface and tamped with the roller to within 1½ in. of the finished surface. With a road grader the road was then shaped to a true and even grade, and a second coat and the remaining amount of oil used was applied and a layer of gravel or rock screening spread evenly upon the surface. The road was then plowed lightly and rolled with a tamping roller until it was thoroughly hard and unyielding and conforming to the desired cross-section. Any surplus oil remaining on the surface was absorbed by clean, sharp sand or stone screenings, and the road was rolled with a smooth roller. The specifications provided that the total amount of oil to be used should not be less than 2 gallons, nor more than 3 gallons, to the square yard of street surface, and the oil was required to contain not less than 65 per cent. of asphalt. It was applied at a temperature not less than 200° F.

When inspected by the writer the work above described was three years old. The soil was an adobe. No foreign materials, such as stones and gravel, was introduced, and the work cost about 27 cents per square yard. This price may be taken as a fair average cost of this kind of work under the conditions pertaining to Southern California. Much work of this kind has been done within the past two or three years, and when sand or gravel was used with the oil the results seem to have been fairly good.

The writer has in mind a considerable amount of work in one locality where there is much sandy gravel available, which of itself makes a fairly good road, except that it is dusty in dry weather. A number of much travelled streets there have been treated with asphaltic oil by the petrolithic process. No stones were added, as the gravel is very stony, containing fragments up to about 3 in. in diameter. A portion of the work, said to be two years old, was in fine condition. The surface is smooth and slightly elastic or "rubbery." This work, including a small amount of grading, was said to have cost about 30 cents a square yard.

The use of the petrolithic roller, except in gravelly soils or where stone or gravel are added to the soil, has been practically abandoned. By the addition of the stones greater stability is secured, and the road does not seem to rut so easily nor to shift "under the traffic."

The following specifications for "Petrolithic Macadam" is the most recent development in this kind of work:—

Specifications for Petrolithic Macadam. Oiling, Spreading, and Tamping.

The area to be oiled shall extend from curb to curb where there are no gutters, and where there are gutters, then from gutter to gutter, including all intersections of streets and alleys, and to the property lines on both sides of said intersections.

The street shall be plowed to a depth of not less than 6 in. It shall then be thoroughly pulverized and cultivated, and afterwards thoroughly sprinkled with water and dampened throughout.

Oil at a temperature of not less than 175° F., when it is spread, shall then be uniformly applied at the rate of ¾ gallon per square yard of surface covered. Immediately after the oil is spread, the street shall be thoroughly cultivated, adding water as needed.

A second coat of oil at a temperature of not less than 175° F., when it is spread, shall then be uniformly applied at the rate of ½ gallon per square yard of surface covered. Immediately after the oil is spread the street shall be thoroughly cultivated, adding water as needed. The cultivating shall be done longitudinally and diagonally until the oil is thoroughly mixed with the soil, and the whole mass is of uniform color and no streaks can be detected, the sprinkling to be carried on during the process of cultivating the oil into the soil as frequently as is necessary to keep the whole mass thoroughly dampened. The roadway shall then be plowed across its entire width 6 in. deep with a plow that completely turns over the furrow.

The street shall then be recrowned with a road-grader and tamping begun with a rolling tamper, which shall be immediately followed by a cultivator. This cultivator shall be re-set as the tamping progresses to cultivate to shallower and shallower depths, the purpose of cultivating being to keep the upper layer of the street loose to permit the shoes of the tamper to effectively consolidate the lower part of the oiled stratum.

As the tamping progresses, the surface shall be sprinkled with water as often as required to facilitate the tamping of the lower part of the stratum, and to effectively prevent the solidification of the upper part before the lower portion of the oiled stratum has been made absolutely solid. After the lower stratum has been tamped until the shoes of the tamper will not sink in more than 3 in., use of the cultivator may stop, but the tamping must be continued, using enough water to keep the upper part of the layer very soft until the shoes of the tamper will produce no further solidification of the bottom layer of the oiled stratum.

A layer of crushed rock or screened gravel, having a maximum size of 2½ in. and a minimum of ½ in. shall then be spread over the roadway to a depth of 4 in. in the centre, tapering to a depth of 3 in. at the curb or gutter, and upon this layer shall be uniformly applied a coat of oil at a temperature of not less than 175° F. at the rate of ½ gallon of oil to each square yard of surface covered.

The oil and rock shall then be thoroughly cultivated into the loose material overlying the tamped sub-stratum, after which the street shall be again re-crowned with a road-grader.

The mixture of rock and oiled material shall then be tamped with the rolling tamper until it is hard and unyielding. During this tamping process water must be added in sufficient amount to facilitate the tamping and insure a thorough solidification of the entire material from the bottom upwards.

When the tamping has proceeded until the shoes of the rolling tamper will no longer sink into the surface, and there is no tendency for the material to crawl under the tamper feet, the surface shall be smoothed and dampened, and a fourth coat of oil at the rate of ¼ gallon to the square yard of surface covered shall then be uniformly applied over the surface of the tamped street.

A layer ½-in. thick of rock screenings or pea gravel, free from dust (maximum size, ½ in.) shall then be applied, thoroughly sprinkled, and screenings rolled into the surface of the pavement with a smooth roller weighing not less than 250 pounds to the inch width of tire. Should an excess of oil remain on the surface after the rolling has been completed, a sufficient amount of screenings or gravel, above described, shall be spread over the surface to absorb such excess. The smooth roller above specified shall then be run over the street until the surface is smooth and firm. Any portion of the street that cannot be reached by the rolling tamper or smooth roller shall be solidly tamped by hand.

For spreading the several coats of oil herein provided for upon the roadway, the only style of apparatus that shall to be used shall consist of a cylindrical distributing drum attached to the rear of the supply, or tank wagon, in which the oil shall be brought upon the roadway, which cylindrical distributing drum shall be suspended near the surface of the street, and provided with openings regulated by valves, from which openings the oil shall be evenly spread upon the roadway in a number of small streams.

Oil.

The oil used shall be Adilane Sunset oil, which shall contain at least 75 per cent. of asphalt, and must not have been injured by overheating.

The newest development in the use of asphaltic oil for country road purposes consists in combining the upper course of the macadam road with oil. This method has been used to a considerable extent in Pasadena, and it has been generally adopted by the Los Angeles County Highway Commission in its work. In brief, the process is as follows: The lower course of macadam is constructed in the usual way, except that an attempt is made to fill thoroughly all the voids and to leave the upper surface of the lower course smooth, true and unyielding. The second course of stone is then applied to such a depth that it will be approximately 2 in. in thickness after rolling. The stones in this course vary in size from 1½ to ¾ in. in their longest dimensions. This course is rolled thoroughly with a steam roller, and the depressions are filled with stone as in the ordinary macadam work. Then ¾ gallons of oil is applied to each square yard, and a coat of sand or screenings is spread to a depth of ¾ in. The surface is then watered and rolled, and ¼ gallon of oil to the square yard in addition is applied. A light coating of screenings, ¼ in. and under in size, is then spread evenly to a depth sufficient to absorb all surplus oil and produce a uniform surface with no oil exposed and no patches of excess screenings. The road is then watered and rolled thoroughly until it becomes hard and smooth, true to grade and cross-section, free from all hollows and irregularities.

For such work, done under the supervision of the Los Angeles County Commission, where the macadam is 16 ft. in width, 8 in. in depth in the centre, and 6 in. at the sides, with 7 ft. of surface oiled, earth shoulders on each side, the cost runs from $8,000 to $11,000 per mile. The broken stone is now being furnished from quarries owned and operated by the county, delivered on the cars at the quarry to the contractors. The cost of the stone on the cars at one of the quarries is said to be 55 cents per ton. The high freight rates which prevail in California account in part for the large cost per mile. About forty miles of work of this character is already completed. The surface resembles very much sheet asphalt work, but such roads will undoubtedly have to

be repaired from time to time, probably by surface coatings. In the opinion of the writer, for country roads, such work will prove to be very satisfactory, particularly where there is much automobile traffic.

In Pasadena, very similar work has been under traffic for two or more years, and all of these roads seen by the writer were in excellent condition.

At Point Loma, in San Diego county, work of an entirely different character has been done. There exists on Point Loma a deposit of sand intimately mixed with clay, said to contain 15 to 30 per cent. of clay. The road there, several miles in length, was first properly graded, and its surface broken to a depth of 6 in. and pulverized with a harrow, all coarse material being removed. Water was then applied until the loosened material was thoroughly wet. A petrolithic roller, similar to that already described, was then employed until no impression was made by the tamper feet deeper than 2 in.

The surfacing material referred to above as "sand-clay" mixture was then applied in two courses, the first having uniform depth of 3 in. This course was thoroughly wet and rolled with the petrolithic roller in the same manner as was the subgrade. The second course in the amount needed to bring the roadway to the finished grade was then applied, attention being taken that the total depth of the sand-clay mixture should be 6 in. in centre and 4 in. at the sides in depth. The second course was then wet and rolled with the petrolithic roller as previously described. When thoroughly compacted, water was again applied and a split-log drag drawn over the surface until it was true to the desired cross-section, and then the surface was rolled with a smooth roller.

The resulting road is smooth and very hard. Traffic does not rut it, and when sprinkled once a week it is practically dustless, even under fast automobile traffic. This road receives careful attention, and during the wet months the split-log drag is frequently employed.

All of the different kinds of work before described result in roads which are practically dustless if they are given the proper amount of attention, but it is the opinion of the writer that combinations of asphaltic oil with sand, loam or clay, in thick layers and without the addition of gravel or broken stone to insure stability, are not a success. Such roads may be kept practically free from dust, but their surfaces are so uneven as to condemn the process.

The writer believes that the oil macadam adopted by the Los Angeles County Highway Commission is a step in the direction of smooth, dustless roads or country highways. He is in doubt, however, whether or not it would be as cheap in the long run to build these roads in the ordinary way, and after they have been under traffic for a short period to place a thin, protective coating of asphaltic oil on them on the theory that such coatings will have to be renewed every year or two, depending on the amount of traffic. It is his opinion that the roads as built will require surface application of oil from time to time, and he is somewhat in doubt under California conditions as to which method would be the cheaper in the long run.

The method employed at Point Loma, where no oil is used, seems to be ideal for the conditions which exist there, and there is no doubt that this process may be employed in other places, and that results approximating the Point Loma results may be secured by the artificial mixing of sand and clay in proper proportions.

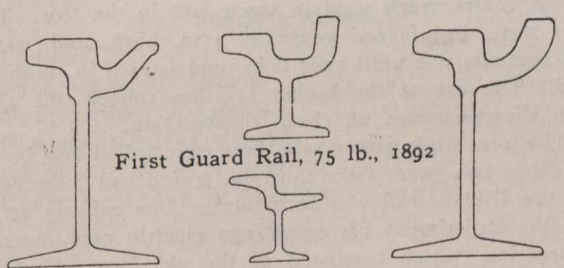
Much work is being done at the present time by several of the counties in Southern California on county highway systems. The methods employed by the different counties vary to a considerable extent, but all of the counties are seeking a type of construction which will result in dustless highways, and there seems to be no doubt that within a few years the intolerable dust conditions which now exist on the country highways will be done away with.

HISTORY OF STREET RAILWAY RAILS.*

By E. B. Entwisle, Chief Engineer, Lorain Steel Company.

Before electric traction became general, and, indeed, for a limited period thereafter, the use of the stringer rail was almost universal. Two types are illustrated herewith, the centre and the side bearing, also the guard rail for curves. These were spiked to continuous wooden stringers, which rested upon cross-ties spaced 7 ft. to 10 ft. apart. This type of construction has been replaced by the girler rail, the development of which is shown by the absence of any lower flange in the first designs. The difficulties encountered in rolling girder rails with wide lower flange, especially of the grooved or guard type, were many, but were finally overcome by the Universal mill, which provides a separate roll with a vertical spindle for shaping the rail-head and guard in the final pass through the rolls.

The use of T-rails for industrial, steam and interurban railways is now general, and is shown in the varying weights of from 8 lbs. to 110 lbs. per yard. The sections of the



Chicago Straight Track, 129 lb.; 30-lb. Girder, 1885; Chicago Guard Rail, 145 lb.

American Society of Civil Engineers are in most general use; they originally numbered 13 sections from 40 lbs. to 100 lbs. per yard. Other sections have been added from time to time. They are commercially known as "A" sections down to 8 lbs. per yard and up to 10 lbs. The heaviest T-rail rolled weighs 175 lbs. per yard, and has been used for travelling-crane tracks where excessive loads are carried. In addition to the A. S. C. E. sections we have the American Railway Association sections, types "A" and "B," from 60 lbs. to 100 lbs., varying by 10-lb. increments; also four Dudley sections and six Pennsylvania Railroad sections, old and new. Before the adoption of the A. S. C. E. sections there were more than one hundred different shapes and weights of T-rails.

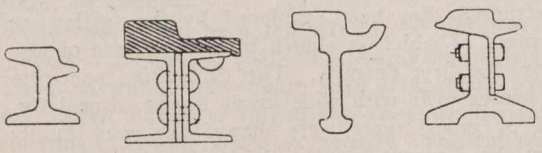
The manufacture of girder rails was begun when electric railways began to supplant the horse railroads and the old form of tram rail proved unequal to the demands of the heavier equipment. The Cambria Iron Company was the first to roll a girder rail. It was 3 in. high, and weighed about 35 lbs. per yard. This rail had a tram ¾ in. wide, and was used on one of the cable railways in San Francisco, where it rendered good service for over twenty years.

From 1885 to 1890 various forms of girder rail were proposed. The Richards rail of 1887 was one of the earlier types of grooved rail, of which large quantities were rolled

* Abstract of a paper read at the meeting of the Central Electric Railway Association, Indianapolis, Ind., September 22, 1910.

by the Johnson Company, this being one of the first to have any semblance of a lower flange. The present mode of rolling grooved and "Trilby" rails on a Universal mill had not yet been attempted.

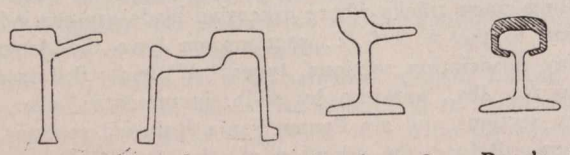
To obtain the advantage of a groove, or a guard, such as we now find necessary on short radius curves, the ordinary form of girder rail was used, and the guard was formed by riveting a bar of rectangular shape to the tram. As the demand for a more stable construction increased and the facilities for rolling advanced, there was produced the present guard-rail, in which the guard is united to the head in a solidly-rolled section with a full lower flange. This rail was not successfully produced until 1892, and then only in sections 4½ in. high.



San Francisco, 1877; Moxham Girder, 1885; Richards' 1887; Littell's, 1887

The need for rails of greater height than 4½ in., in order to take care of brick or stone block paving and yet keep the weight of rails under 60 lbs. per yard, led very early to the form of chairs much used in track laid in the '80s. These chairs were drop-forged generally 4 in. high, and were in quite common use until rails 6 in. and later 9 in. high were rolled. The use of the higher rail has caused the almost entire disappearance of chair construction.

The 9-in. high girder rails first were rolled late in 1892, and about two years later the 9-in. guard rail followed. In 1890 the Gibbon rail was introduced. One railway at least tried the experiment of operating electric cars over this construction, which consisted of the old form of stringer rail with a small depending flange through which the rail was secured to short cast-iron boxes placed at intervals of about 5 ft. No cross-ties were placed under the boxes, the rails being held to gauge simply by tie bars. This proved to be unsuccessful. The same inventor later produced the duplex rail, in which one-half represented the head and the other half the tram. These broke joints about midway in each length, and were secured through the vertical webs to



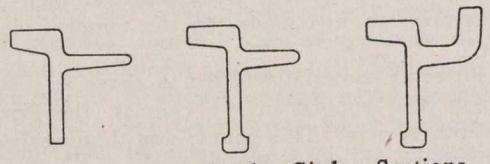
White's Rail, 1888; Lewis & Fowler, 1890; Beer's, May, 1859; Hunter's Renewable Head, 1869. Originally Proposed in 1820

cast-iron chairs, which in turn were spiked to cross-ties in the usual manner. So far as the writer knows, this was the only rail rolled in two distinct halves which ever secured an actual trial in track. Many other forms of duplex rail have been invented, but their alleged advantages do not appear to have induced many engineers actually to place them in use.

A box girder rail was patented by W. C. Wood in 1890, and was known as the Lewis & Fowler rail. This rail had many strong adherents, and was for a time commercially successful, but of late years it has given way to the present single-web girder rail, which is now considered standard. One firm alone has produced more than 870,000 tons of girder rail within the last ten years.

In the twenty-five years in which the Lorain Steel Company and its predecessor, the Johnson Company, have been rolling girder rails, two hundred different sections have been produced. These have varied from 3½ in. to 9 in. in height, and weigh from 30 lbs. to 164 lbs. per yard. About one-half of these sections are now available, the remainder having been declared obsolete. This census of the rail sections produced does not include T-rails, slot rails, nor the electrically welded sections which for a brief period occupied the attention of track inventors and designers.

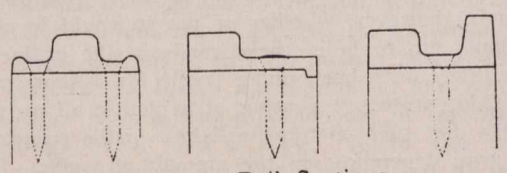
The limitations of this paper forbid a description of the various forms of current track construction. However, we may refer to one type of track construction recently adopted by the Board of Supervising Engineers of Chicago Traction, and of which track a large mileage has been laid and is in



Development of the Girder Sections

successful operation. No other city in the United States has laid an equal amount of track material during the same time. The Lorain Steel Company alone furnished more than 65,000 tons of Chicago section for straight track, the rail being of the Trilby pattern, 9 in. high and weighing 129 lbs. per yard. The first rail of the new construction was laid June 18, 1907.

One of the characteristics of the Chicago concrete track was the use of Carnegie steel ties weighing 14½ lbs. per foot. It was considered that the best construction would be obtained by inverting the tie, placing the base, which is broader than the head, on top so as to get a broader bearing for the rail on the metal surface. These ties were laid 5 ft. centres in connection with 2-in. x 5/16-in. tie rods, spaced 6 ft. centres. A similar construction was planned on the route of the old cable track, but with wooden ties spaced just the same as the old yokes of the cable track. This spacing was later reduced from 5 ft. to 3 ft. Where traffic prevented this construction, or because it was less costly to repair if disturbed by sewer or water-pipe construction, a trench about 2 ft. deep was dug and 8 in. of crushed stone used to fill in; wooden ties were laid on this and then concrete was applied to fill it up to within 6 in. of the top of



Stringer Rail Sections

the rail. The paving was separated from the concrete by a 1-in. sand cushion. The ties were placed 2 ft. centres and the tie rods 6 ft. centres.

It has been said that the necessity for a girder rail weighing 129 lbs. per yard is questionable. However this may be, manufacturers are willing to roll lighter or even heavier rails, provided railway engineers call for them. It is a long call from the first girder rail our company rolled in any great quantity, namely, section 38 lbs., No. 111, to the Chicago section 129 lbs., No. 403, but it must be remembered that cars and car equipments have been growing larger and larger. The weight relation between the bobtail car and the present pay-as-you-enter car (both having seen service in Chicago) is probably 1 to 25 or 30, whereas the increase

in the height of rail is about 1 to 2½, and the weight about 1 to 3½. The bobtail car is 12 ft. long and the pay-as-you-enter car 48 ft. long.

It may be that we shall have still larger cars and that larger and heavier rails will be required, but to the writer it appears that for the width of street set apart for street railways in most of our cities we have about reached the limit in car width, if not in length, and perhaps in the weight of rail which will carry them at the minimum maintenance cost. Our efforts now should be directed toward the standardization of rolling stock and track, that economy in first cost as well as in maintenance may be successfully practised. The work begun and now being prosecuted with zeal by the standardization committees of the American Street and Interurban Railway Association deserves our warmest commendation as being a step in the direction of reducing cost to the manufacturers as well as to the user of street railway materials.

FLOW OF GAS IN PIPES.*

The discussion of the flow of gas in the main transmission line is abstracted as applicable to any gas main. The results were obtained by the use of the most approved apparatus and the variations in rate of flow of gas in various parts of the cross section of pipes were determined by means of Pitot tubes. Following are the paragraphs regarding the determination of the flow of gas in the main transmission line:—

The main transmission line, which connects the pumping station with the city of Columbus, has a nominal diameter of 10 inches and a total length of 26.2 miles. It was the intention to investigate the flow through this line under different conditions of velocity while the pumping station was in operation. This we were unable to do until the station was closed down, when the flow was maintained by the pressure of the field.

A second Pitot instrument having the same form of tips as the one used on all work was connected to the transmission line .2 mile below the pumping station, while the traversing instrument was connected to the line just above the main gate valve at the Fifth Avenue measuring station at Columbus, making a distance between instruments of 26 miles. Thermometers were also inserted in the line at the two points. The pressure gauges used on the Pitot instruments were calibrated before and after the tests, and every precaution taken so that the results obtained for quantity of flow at the two points would be absolutely comparative, and therefore the difference shown would be the line loss due to leakage for the pressures prevailing at the time. A series of readings were taken the evening of July 6th, followed by another series beginning at 6 a.m. on the following day. The demands were such that constant conditions for the whole line were not maintained until 8.40 a.m., when the following readings were obtained:—

At the Pumping Station.

Time.	Pressure.	Pitot.
8:40	87 lbs.	.45 inches.
8:45	87 lbs.	.45 inches.
8:50	87 lbs.	.45 inches.
8:55	87 lbs.	.45 inches.
9:00	87 lbs.	.45 inches.
9:05	88 lbs.	.45 inches.
9:10	88 lbs.	.45 inches.
9:15	88 lbs.	.45 inches.
9:20	88 lbs.	.45 inches.
9:28	88 lbs.	.45 inches.
9:30	88 lbs.	.45 inches.

At Fifth Avenue, Columbus.

Time.	Pressure.	Pitot.
8:41.5	66.7 lbs.	.50 inches.
8:45.5	66.7 lbs.	.50 inches.
8:47.5	66.1 lbs.	.50 inches.
8:51.5	66.7 lbs.	.50 inches.
8:55.5	66.7 lbs.	.50 inches.
8:59.5	66.7 lbs.	.50 inches.
9:03.5	66.7 lbs.	.50 inches.
9:07.5	66.7 lbs.	.50 inches.
9:11.5	66.7 lbs.	.50 inches.
9:15.5	66.7 lbs.	.50 inches.
9:19.5	66.9 lbs.	.50 inches.
9:21.5	66.9 lbs.	.50 inches.
9:25.5	67.2 lbs.	.50 inches.

The temperature of the flowing gas during the above period was 71 degrees F. at first instrument, and 73 degrees F. at Fifth Avenue.

For computing the quantity of gas flowing at the two stations the average corrected readings are as follows:—

Pumping Station.

Pressure, 87.5 lbs.
Pitot, .45 inches alcohol.
Temperature, 71 degrees F.
Diameter pipe, 10.13 inches.
Cu. ft. per hr. at 60 degrees, 238,120.
Cu. ft. per 24 hrs. at 60 degrees, 5,714,880

Fifth Avenue.

Pressure, 66.77 lbs.
Pitot, .50 inches alcohol.
Temperature 73 degrees F.
Diameter pipe, 10.13 inches.
Density, .622.
Cu. ft. per hr. at 60 degrees, 223,730.
Cu. ft. per 24 hrs. at 60 degrees, 5,369,520.

The difference between the quantities as determined for the two points would be the leakage loss for the pressure condition prevailing or 345,360 cu. ft. per 24 hours.

At the Fifth Avenue measuring station the pressure is reduced to whatever pressure is being maintained in the high pressure lines of the city distribution system. At the times the above results were obtained this pressure was about 15 lbs. In the station is located a Pitot instrument, the tips being connected to the 10-inch line below the regulator. This instrument, therefore, should indicate the same quantity of gas as shown in the high pressure line. To verify this some readings were taken on the station instrument at the same time as those were being obtained on the line, and the quantity of gas computed from the tables as used by the company. The readings taken with the results obtained are as follows:—

—Time, 5:42 p.m.—

Line Instrument—Pressure, 57 lbs.; Pitot reading, 80 inches alcohol; gas per hour, cu. ft. 265,600.

Station Instrument—Pressure, 16 lbs.; Pitot reading, 1.7 inches water; gas per hour, cu. ft. 316,370.

—Time, 8:45 a.m.—

Line Instrument—Pressure, 66.7 lbs.; Pitot reading, .50 inches alcohol; gas per hour, cu. ft., 223,730.

*Abbreviated from a report by Professor E. A. Hitchcock, of Ohio State University, made to the city of Columbus, Ohio.

Station Instrument—Pressure, 14.5 lbs.; Pitot reading, 1.23 inches water; gas per hour, cu. ft., 263,400.

Comparing these results, that is taking their ratio, we find for the first case the quantity by the station instrument is .8424 of the main line, and for the second case .8328 of the main line, thus indicating that the station instrument gives results some 16.2 per cent. high.

In estimating the capacity of a transmission line having given the initial and terminal pressures, the following Oliphant formula is generally used:—

$$Q = C\ a \sqrt{\frac{P^2 - p^2}{l}}$$

Q equals cu. ft. gas discharged per hour.
c equals constant 42.
a equals factor depending upon diameter of pipe.
P equals initial pressure plus 14.4 lbs.
p equals terminal pressure plus 14.4 lbs.
l equals length of line in miles.

Applying this formula to the 10-inch line on which observations were made, and solving for the constant C, where
Q equals 227,800
a equals 368 for pipe 10.13 inches diameter
P equals 102
p equals 81.1
l equals 26 miles,
we find that C equals 50.8 instead of 42. In another case where the drop on the same line is extreme as shown for January 7th, 1910, at 6 p.m., where the quantity corrected for the station Pitot instrument is,
Q equals 490,200 cu. ft. per hr.
P equals 219.4
p equals 52.4
2 equals 368
l equals 26½ miles, ½ mile for cooler, valves and fittings, we find C equals 32.2.

In applying the same values as above to the Robinson formula:

$$Q = C \sqrt{\frac{a^5}{l} (P+p)\ (P-p)}$$

where the constant C is taken 48.4, we find for the first case the constant equal to 57.53 and for the second case of high velocity the constant equal to 37.45.

Our observations, therefore, indicate that the constants which are generally used with formulae for pipe line flow should change with the velocity or drop in pressure per mile.

THE MODULATION SYSTEM OF STEAM HEATING.

The objection most often voiced with regard to ordinary systems of direct steam heating is that they do not allow of close regulation of temperature. If the inlet valve at the radiator is opened on a mild day it is soon necessary to open a window because of the excessive heat. Complete shut-off results in rapid cooling while if it is attempted to partially open the valve, water hammer, poor circulation and kindred troubles ensue. In two-pipe systems, the type most usually met with, there are two valves to be adjusted which adds to the complexity and inefficiency. Aside from the discomfort involved in such experiences, there is always a waste in not being able to operate a heating system at its most economical point. The combination of a radiator with a full head of steam, and an open window certainly does not make towards efficiency. The coal pile is being turned into heat units which are making their direct escape through the window. There is no possibility of modulating the temperature to conform with the variations in the weather.

In hot water systems, on the other hand, temperature modulation is the main consideration. By varying the rate of combustion of coal in the heater the water may be given any degree of heat up to 212 degrees with open tank systems. In the case of closed hot water installations it is possible to raise the temperature to about 240 degrees. In very severe weather the radiators can be maintained at nearly the same temperature as with low-pressure steam systems, while in the spring and fall a banked fire will provide a mild degree of heat just sufficient to "take the chill off." But a water system is phlegmatic in action. In case of a sudden cold snap it is impossible to heat up the mass of water in a hot water system quickly enough to prevent the building from cooling off to an uncomfortable degree. For similar reasons unexpectedly mild weather is likely to catch a hot-water system napping, so that it is necessary to open doors and windows to dispose of the heat fast enough for comfort. Piping and radiators must be considerably larger than with steam for the same size building with greater first cost and inconvenient bulkiness.

A heating system to be satisfactory should embody the good points of steam and hot water heating, while avoiding the weaknesses of both. A system which combines the rapid and effective action of steam with the range of temperatures possible with hot water cannot fail of giving satisfaction. Such a heating outfit not only creates personal comfort for the occupants of buildings but also works a decided economy in coal consumption.

The modulation system of steam heating has now been in practical use for a period sufficiently long to show that it fills these exacting requirements most acceptably. As its name implies, it is a steam heating system with which it is possible to modulate the temperature at each radiator. This is accomplished by means of an adjustable modulation valve on the intake end of the radiator and an automaic air and water valve on the discharge end. The latter permits the discharge of water back to the boiler, but prevents steam from escaping, while the hand-operated modulation valve permits of the radiator being wholly or partially filled with steam, thus allowing the occupant to vary the temperature at will. A most attractive feature of this system is that the steam pressure carried need not be higher than about one and a half pounds and usually one-half to one pound is ample even in very cold weather. The needless intensity of high-pressure steam is thus avoided.

Another feature of excellence is the positive circulation obtained. The fact that the steam cannot escape to the return raisers until it has been condensed in the radiator insures a differential pressure between the supply and return sides of the system. The radiator condensation results in a reduction of pressure within the radiator that causes an inrush of steam whenever the modulation valve is opened.

With this system the general operation is under the immediate control of the janitor or engineer in charge, but the temperature of individual rooms may be varied at the pleasure of the occupant. The steam generated is thus enabled to do exactly the amount of heating desired, and no more coal need be burned than is absolutely required to insure comfort. The result is a satisfactory heating system operated at maximum economy.

Its superiority over the older methods for medium-size and small buildings appears to be conclusively demonstrated. It has a field of its own quite apart from that of the vacuum system, which finds its best application in larger installations and for central station heating or scattered buildings.

RAILWAY EARNINGS; STOCK QUOTATIONS.

The following table gives the latest traffic returns it is possible to obtain at the time of going to press:

Road	Wk ended	1910	Previous week	1909
C. P. R.	Oct. 14	$2,334,000	$2,243,000	$2,138,000
G. T. R.	Oct. 7	908,412	1,237,013	902,777
C. N. R.	Oct. 14	341,800	325,900	300,600
T. & N. O.	Oct. 14	21,972	24,658	37,858
Hal. Elec.	Oct. 14	3,848	6,559	4,001

Figures showing the earnings of Canadian roads since July 1st, this year and last, are appended:

Road.	Mileage.	July 1st to	1910.	1909.
C. P. R.	10,326	Oct. 14	$31,278,000	$19,613,000
G. T. R.	3,536	Oct. 7	12,024,522	12,204,759
C. N. R.	3,180	Oct. 14	4,264,100	3,326,200
T. & N. O.	264	Oct. 14	356,561	455,385
Hal. Elec.	13.3	Oct. 14	69,941	66,501

Stock quctations on Toronto, Montreal and London exchanges, and other information relative to the companies listed in the above tables, are appended. The par value of all shares is $100.

Co.	Capital. 000's Omitted.	Price Oct. 14 1909.		Price Oct. 6 1910.		Price Oct. 13 1910.		Sales last week
C. P. R.	$150,000	186	185¾	196	195¾	195½	195	737
Mont. St.	18,000	212½	210½	238	236½	238	233½	138
Hal. Elec.	1,400	118	.....	130	127	.....	128⅜	36
Tor. St.	8,000	.....	124	124	123½	125	124½	575

G. T. R. 226,000 1st pfd., 111; 2nd pfd., 57½; com. 27½

CANADIAN NORTHERN GIVES EVIDENCE OF GROWTH AND EXPANSION.

The report of the Canadian Northern Railway for the month of August, issued recently, shows some very gratifying increases which is evidence of great growth and expansion. The gross earnings for the month were $1,093,000, as compared with $807,000 for the same period of 1909, an increase of $285,900, while the expenses have increased, owing to the extension and operating of the road for another 203 miles, from $602,700 in 1909, to $830,000 for last month. The net earnings show an increase of $58,600 from $204,400 in 1909, to $263,000 in the present year. From July 1st to August 31st the gross earnings were $2,318,100, an increase of $667,500 over the same period a year ago, for which the company's earnings amounted to $1,650,600. The expenses have increased from $1,216,600 in 1909, to $1,706,900, but the net earnings show a corresponding increase of $177,200 from $434,000 last year to $611,200 for the same two months of 1910.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

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

11852—October 1—Amending Order No. 11224, authorizing the C.P.R. to construct its railway across and to divert the highways on its MacLeod Division of its Crow's Nest Branch, from mileage 0 to mileage 30.7, being from the west boundary of Sec. 36, Tp. 8, Range 22, west 4th Meridian, to the east boundary of Sec. 12, Tp. 9, Range 26, west 4th Meridian, by inserting the words "closed and diverted," after the words "road allowance," at crossing No. 5, and substituting the figures "10" instead of "1" at crossing No. 21 in the said Order.

11853—October 3—Authorizing the Municipality of Ste. Cecile de Levrard to construct a suitable highway where the highway crosses the tracks of the Quebec, Montreal & Southern Railway Company in Lot 258, Cadastral No. 450 of the said Parish, Concession 4, County Nicolet, Quebec.

11854—October 3—Approving of the revised location of the Esquimalt & Nanaimo Railway Company's location of that portion of its line between Duncans and Cowichan Lake, from Station 893-31 to Station 967.

11855—September 27—Amending Order No. 9652, authorizing the C.N.O.R. to construct its lines and tracks across the public road between Lots 2 and 3, Concession 4, Township of Clarke, County Durham, at Station 875-40 by adding the following clause:—"That the approaches to the said crossing be graded twenty feet wide, and a foot of gravel be placed over the entire distance of the approaches where the ground has been disturbed."

11856—October 3—Authorizing the corporation of the town of Orillia to lay and thereafter maintain a water pipe under the track of the G.T. (Old Northern) Railway Company at a point about 1,300 feet west of the road allowance between Concessions 5 and 6, in the Township South Orillia, County Simcoe, Ontario.

11857—October 3—Authorizing the Water Works Department of the city of Guelph to lay and thereafter maintain a water main under the tracks of the spur of the G.T.R. on Dufferin Street, Guelph.

11858—October 4—Authorizing the G.T.P. to divert the highway between Sections 28 and 33, Township 23, Range 8, west 2nd Meridian, District of Yorkton, Sask.

11859—October 4—Approving and sanctioning the revised location of the C.N.O. Railway Company's line of railway between Stations 617-65 and 696-15, village of St. Andrews, County Argenteuil.

11860—September 27—Authorizing the C.N.O.R. to construct a subway carrying Choate Road under the railway from Station 356-66, Lot 5, Concession 2, to an under crossing at Cavan Street, Station 336-87, Lot 5, Concession 1, Township Hope, County Durham, Ontario.

11861—October 3—Authorizing the G.T.R. to provide and construct a steel bridge to cross the highway over its tracks where the company's railway crosses south of the said town of Chesley, Township Elderslie, County Bruce, Ontario.

11862—October 4—Authorizing the C.P.R. to use and operate bridges Nos. 8.05, 14.2, and 15.6, on the Tobique Section of its line of railway.

11863—October 4—Rescinding Order No. 11463, dated the 3rd August, 1910, made upon the application of the Kingston, Portsmouth & Cataraqui Electric Railway Company; and rescinding Order No. 11631, dated September 12th, 1910, amending said Order No. 11463, upon the application of the Canadian Freight Association, re loading of bulky or long articles through side doors of box cars.

11864—October 4—Authorizing the C.P.R. to use and operate bridge No. 10.6 on the Fredericton Section of its line of railway.

11865—October 4—Approving of the plan of the G.T.R. showing proposed remodelling of passenger station at Windsor, Ontario.

11866—October 4—Approving revised Rule No. 6, in the Canadian Classification No. 15, respecting articles too long and too bulky to be loaded in a box car through the side door; also providing additional ratings for asphaltum and paints and varnish.

11867—October 4—Authorizing the C.P.R. to construct, maintain, and operate a "Y" and to make the connections with the British Columbia Electric Railway Company, to construct the tracks pertaining thereto, all being in the N.W. ¼ Sec. 2, Tp. 16, Range 3, west 7th Meridian.

11868—October 4—Approving and sanctioning the location of the C.P.R. line of railway from a point in Section 12, Tp. 33, Range 22, west 3rd Meridian, to a point in Section 3, Tp. 39, Range 28, west of 3rd Meridian, Saskatchewan.

11869—October 5—Authorizing the Minister of Public Works of Ontario, to construct a highway crossing over the C.P.R. on Lot 5, Concession 3, Township Dowling, District of Sudbury, Ontario.

11870—October 5—Directing the C.P.R. Company to install and maintain gates, with a day and night watchman, at the intersection of its railway with Westminster Avenue, in Montreal West.

11871—September 26—Directing the G.T.R. Company to provide and construct a subway at the level crossing of the G.T.R. and C.P.R. at Brock Avenue, Toronto.

11872—October 4—Approving proposed diversion in the location of the G.T.R. Company's railway as constructed between a point on Lot 25, 1st Concession, of the Township of Brighton, about 300 feet east of the dividing line between Lots 25 and 26, Concession 1, and a point in Lot 29, Concession "B," said township.

11873—October 4—Authorizing the G.T.R. Company to carry proposed deviation of its railway, as already constructed, between a point on Lot 25, Concession 1, and a point on Lot 29, Concession "B," in Township of Brighton, over the lines of the C.N.R. Company by means of an overhead bridge.

11874—October 5—Authorizing the C.P.R. Company to close two highway crossings between Churchville Station and Eldorado Park,, and to construct a roadway in lieu of the two highway crossings to be closed.

11875—October 5—Authorizing the C.P.R. Company to construct an industrial spur for the Standard Lumber Company, near Cranbrook, B.C.

11876—October 5—Approving location of the Kootenay Central Railway from mile 24.9 at Fort Steele, to mile 35.9, at Wasa, Kootenay District, B.C.

11877—September 27—Rescinding Order No. 11392, August 9th, 1910, which authorizes the C.N.R. Company to cross, at grade, the public road between Lots 10 and 11, Concession 4, Township Clarke; the Railway Company to submit, within thirty days from the date of this Order, a detail plan of the subway authorized to be constructed under Order No. 9562, February 15th, 1910, for the approval of Board's Engineer,—the work to be completed by May 1st, 1911.

11878—October 4—Rescinding Order No. 11736, dated September 20th, 1910, which authorizes the C.P.R. Company to operate a branch line of railway from a point on the London Section at mile 9.56, Lot 6, Concession 4, Township of Etobicoke, to a point of connection with the G.T.R. in Lot 7, Concession 1, Township Etobicoke, and permitting the C.P.R. Company temporarily to put in switches and semaphores to be operated by hand.

11879—October 5—Authorizing the Hydro-Electric Power Commission of Ontario to erect transmission wires across the wires of the C.P.R. Company's telegraph at Strange Street, Waterloo, Ont.

11880—October 5—Directing that in order to enable the G.T.R. Company to operate those parts of its railway between Prince Rupert, B.C., and Thornton, Alta., already completed, the G.T.R. Company's Standard Freight Mileage Tariff, C.R.C. No. 7, for mileages 1 to 200, inclusive, be approved.

11881—October 5—Granting leave to the C.P.R. Company to construct its railway under the wires of the Erindale Power Company, Limited, at the road allowance between Concessions 2 and 3, Township of Etobicoke, County York, Ontario.

ENGINEERING SOCIETIES.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—413 Dorchester Street West, Montreal. President, Col. H. N. Ruttan; Secretary, Professor C. H. McLeod.
Chairman, A. E. Doucet; Secretary, P. E. Parent. Meetings held twice a month at Room 40, City Hall.

TORONTO BRANCH—
96 King Street West, Toronto. Chairman, A. W. Campbell; Secretary, P. Gillespie, Engineering Building, Toronto University, Toronto. Meets last Thursday of the month.

MANITOBA BRANCH—
Chairman, J. E. Schwitzer; 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

OTTAWA BRANCH—
Chairman, A. A. Dion, Ottawa; Secretary, H. Victor Brayley.

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.

THE UNION OF CANADIAN MUNICIPALITIES.—President, W. Sanford Evans, Mayor of Winnipeg; Hon. Secretary-Treasurer, W. D. Lighthall, K.C., ex-Mayor of Westmount.

THE UNION OF NEW BRUNSWICK MUNICIPALITIES.—President, Mayor Reilly, Moncton; Hon. Secretary-Treasurer, J. W. McCready, City Clerk, Fredericton.

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, E. C. Hopkins, Edmonton; Secretary, H. M. Widdington, Strathcona, Alberta.

ASSOCIATION OF SASKATCHEWAN LAND SURVEYORS.—President, J. L. R. Parsons, Regina; Secretary-Treasurer, M. B. Weeks, Regina

ASTRONOMICAL SOCIETY OF SASKATCHEWAN.—President, N. McMurchy; Secretary, Mr. McClung, Regina.

BRITISH COLUMBIA LAND SURVEYORS' ASSOCIATION.—President, W. S. Drewry, Nelson, B.C.; Secretary-Treasurer, S. A. Roberts, Victoria, B.C.

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, R. E. W. Hagarty, 662 Euclid Ave., Toronto.

CANADIAN CLAY PRODUCTS' MANUFACTURERS' ASSOCIATION.—President, W. McCredie; Secretary-Treasurer, D. O. McKinnon, Toronto.

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

CANADIAN FORESTRY ASSOCIATION.—President, Thomas Southworth, Toronto; Secretary, James Lawler, 11 Queen's Park, Toronto.

CANADIAN GAS ASSOCIATION.—President, Arthur Hewitt, General Manager Consumers' Gas Company, Toronto; J. Keillor, Secretary-Treasurer, Hamilton, Ont.

CANADIAN GAS EXHIBITORS' ASSOCIATION.—Secretary-Treasurer, A. W. Smith, 52 Adelaide Street East, Toronto.

CANADIAN INDEPENDENT TELEPHONE ASSOCIATION.—President, W. Doan, M.D., Harrietsville, Ont.; Secretary-Treasurer, Francis Dagger, 21 Richmond Street West, Toronto.

CANADIAN MINING INSTITUTE.—Windsor Hotel, Montreal. President, Dr. Frank D. Adams, McGill University, Montreal; 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, J. W. H. Jacombe, Ottawa.

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

DOMINION LAND SURVEYORS.—President, Thos. Fawcett, Niagara Falls; Secretary-Treasurer, A. W. Ashton, Ottawa.

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

ENGINEERING SOCIETY, TORONTO UNIVERSITY.—President, A. D. Campbell; Corresponding Secretary, A. H. Munroe.

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

INSTITUTION OF ELECTRICAL ENGINEERS.—President, Dr. G. Kapp; Secretary, P. F. Rowell, Victoria Embankment, London, W.C.; Hon. Secretary-Treasurer for Canada, Lawford Grant, Power Building, Montreal, Que.

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

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

NOVA SCOTIA MINING SOCIETY.—President, T. J. Brown, Sydney Mines, C.B.; Secretary, A. A. Hayward.

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,

ONTARIO LAND SURVEYORS' ASSOCIATION.—President, H. W. Selby; Secretary, Killaly Gamble, 703 Temple Building, Toronto.

ROYAL ARCHITECTURAL INSTITUTE OF CANADA.—President, F. S. Baker, F.R.I.B.A., Toronto, Ont.; Hon. Secretary, Alcide Chausse, No. 5 Beaver Hall Square, Montreal, Que.

ROYAL ASTRONOMICAL SOCIETY.—President, Prof. Alfred T. de Lury, Toronto; Secretary, J. R. Collins, Toronto.

UNDERGRADUATE SOCIETY OF APPLIED SCIENCE, McGILL UNIVERSITY.—President, H. P. Ray; Secretary, J. P. McRae.

WESTERN CANADA IRRIGATION ASSOCIATION.—President, Wm. Pierce, Calgary; Secretary-Treasurer, John T. Hall, Brandon, Man.

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

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION.—President, L. C. Fritch, Chief Engineer, Chicago G. W. Railway; 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. Hauer, Park Row Building, New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—29 West 39th Street, New York. President, Jesse M. Smith; Secretary, Calvin W. Rice.

WESTERN SOCIETY OF ENGINEERS.—1735 Monadnock Block, Chicago, Ill. J. W. Alvord, President; J. H. Warder, Secretary.

COMING MEETINGS.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—Ottawa Branch, 177 Sparks Street, October 26, 1910, Programme, Mr. W. J. Graham, Subject: Construction of Mathematical Instruments. Secretary, H. Victor Brayley.

NEW YORK CEMENT SHOW.—December 14-20, 1910. First annual convention in Madison Square Garden, New York. Under the management of the Cement Products Exhibition Company, 115 Adams St., Chicago.

CHICAGO CEMENT SHOW.—February 15-23, 1911. Fourth annual exhibition, at the Coliseum, Chicago, Ill. Under the management of the Cement Products Exhibition Company, 115 Adams St., Chicago.

AMERICAN INSTITUTE OF MINING ENGINEERS.—October 21-November 15. Canal Zone meeting. Secretary, R. W. Raymond, 29 West 39th Street, New York City.

ILLUMINATING ENGINEERING SOCIETY.—October 24. Annual convention at Baltimore, Md. Secretary, P. S. Millar, 29 West 39th Street, New York City.

TORONTO, CANADA, OCT. 20, 1910.

CONTENTS OF THIS ISSUE.

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 PENDING.

In addition to those in this issue.

Further information may be had from the issues of The Canadian Engineer referred to.

Place of Work.	Tenders Close.	Issue of.	Page.
Calgary, Alta., steel bridges	Nov. 7.	Oct. 6.	54
Calgary, Alta., railway material	Nov. 7.	Oct. 6.	56
Duncan's Cove, N.S., breakwater	Nov. 7.	Oct. 13.	508
Grand Forks, B.C., courthouse	Oct. 25.	Oct. 13.	508
Hanover, Ont., town hall	Oct. 22.	Oct. 6.	476
Newmarket, Ont., factory building	Oct. 24.	Sept. 29.	444
Newmarket, Ont., factory	Oct. 20.	Oct. 6.	54
Ottawa, Ont., lighthouse	Oct. 31.	Sept. 1.	275
Ottawa, Ont., lighthouse and buoy steamer	Oct. 31.	Sept. 8.	308
Providence Bay, Ont., wharf	Nov. 7.	Oct. 13.	508
St. Andrews, Que., wharf	Oct. 24.	Sept. 29.	444
Strathcona, Alta., public buildings	Oct. 24.	Oct. 6.	476
St. Andre, Que., wharf extension	Oct. 26.	Oct. 6.	476
Ste. Croix, Que., pier	Nov. 2.	Oct. 13.	508
Three Fathom Harbor, N.S., beach protection	Nov. 7.	Oct. 13.	508
Vancouver, B.C., warehouse	Oct. 26.	Oct. 6.	476
Victoria, B.C., lighthouse and steamer	Oct. 31.	Oct. 6.	476
Victoria, B.C., brass fittings	Oct. 24.	Sept. 22.	412
Victoria, B.C., clearing right-of-way	Nov. 2	Sept. 29.	444
Winnipeg, Man., induction motor	Oct. 20.	Sept. 29.	54
Winnipeg, Man., roundhouse machinery	Oct. 20.	Sept. 29.	444
Winnipeg, Man., pier	Nov. 2.	Oct. 13.	508

TENDERS.

Annapolis Royal, N.S.—Tenders will be received until Nov. 8th, for the construction of two ice piers. R. C. Desrochers, secretary, Dept. of Public Works, Ottawa.

Black Point, N.S.—Tenders will be received until November 7th for the construction of a breakwater. R. C. Desrochers, Secretary, Department of Public Works, Ottawa.

Clace Bay, N.S.—The Dominion Coal Company are calling for tenders for the erection of a new wash plant, also for the erection of a 150-foot brick stack.

South Ingonish, N.S.—Tenders will be received until Nov. 8th, for the construction of an extension to wharf. R. C. Desrochers, secretary, Dept. of Public Works, Ottawa.

Fredericton, N.B.—City Engineer Feeney invites tenders for the supply of 3,000 tons of trap rock for the construction of tarvia pavement, to be supplied during the coming winter.

St. Louis Du Mile End, P.Q.—Tenders will be received until Nov. 24th, for an addition to the post office. R. C. Desrochers, secretary, Dept. of Public Works, Ottawa.

Cravenhurst, Ont.—Tenders will be received until Nov. 8th, for the construction of a wharf and stone approach. R. C. Desrochers, secretary, Dept. of Public Works, Ottawa.

St. Catharines, Ont.—Tenders will be received until Oct. 24th, for the construction of bitulithic pavements and other necessary works. J. A. Pay, city clerk.

Toronto, Ont.—Tenders will be received until October 25th for the ventilation of the Parliament buildings. J. P. McNaughten, Secretary, Department of Public Works.

Ottawa, Ont.—Tenders will be received until November 8th for the construction, etc., of freight sheds and storehouses at Lake Superior Junction, Ont.; Redditt, Man., and Springfield, Man. P. E. Ryan, Secretary, the Commissioners of the Transcontinental Railway.

Winnipeg, Man.—Tenders will be received until October 21st for the supply of 600 feet of 2½-inch double-jacketed, cotton, rubber-lined fire hose in 50-foot lengths. M. Peterson, Secretary, Board of Control.

CONTRACTS AWARDED.

Fredericton, N.B.—Tenders for the new school building on the Weldon lot were awarded as follows: P. Mooney & Sons, masonry, $22,195; R. J. Green, carpenter work, $13,500; J. E. Wilson & Co., steel and fire escapes, galvanized iron and steel ceilings, $5,115; J. H. Pullen, painting, $1,440; R. E. Fitzgerald, plumbing, $3,715; J. H. Doody, heating and electric wiring,

Maisonneuve, Que.—Contract for lighting the streets was awarded to the Dominion Light, Heat & Power Co., for ten years. The company is furnishing arc lamps of 2,000 candle power, at a rate of $80 each.

Ottawa, Ont.—The Department of Public Works recently awarded the following contracts:—

Point Rielle, Que., ice-pier.—Contractor, Joseph Renaud, of St. Paul de Joliette, Que., at $2,478.

Wiarton, Ont., breakwater extension in Colpoy's Bay.—Contractors, Kastner & Porter, of Wiarton, at $13,990.

Prince Edward Island, dipper dredge.—Contractors, John Burns and Wm. Walters, of Ottawa, at $21,350.

Waterloo, Ont., public building.—Contractor, L. B. Lachance, of Ottawa, Ont., at $36,975.

Battleford, Sask., post-office.—Contractors, M. A. Pigott & Son, of Hamilton, Ont., at $26,735.

Arthabaska, Que., public building.—Contractors, Paquet & Godbout, of St. Hyacinthe, Que., at $22,000.

Shelburne, N.S., wharf.—Contractors, F. A. Ronnan & Co. and D. Stewart, of Halifax, N.S., at $24,790.

Marieville, Que., public building.—Contractors, Lachance Bros., of Ottawa, at $16,300.

Niagara Falls, Ont., armory.—Contractor, A. B. Robertson, of Niagara Falls, Ont., at $44,000.

Victoria, B.C., steel tugboat.—Contractors, McDougall-Jenkins, Engineers, Limited, of North Vancouver, B.C., at $43,440.

Montmagny, Que., wharf extension.—Contractor, J. Elzear Boulanger, of Montmagny, Que., at $5,250.

Spanish Ship Bay, N.S., repairs to Hartling wharf.—Work to be done by day labor.

Port Arthur, Ont.—Messrs. Stewart and Hewitson, of this city have been awarded the contract for the construction of a steel and concrete bridge, over the Ottawa River at Mattawa. The bridge will be 2,700 feet long, and some piers will be 50 feet high. The total cost will most likely run over $300,000.

Sault Ste. Marie, Ont.—MacArthur Brothers Company have been awarded a contract by the United States Government for making improvements in the St. Mary's River at the falls, Sault Ste. Marie, Mich. The work consists in the construction of a part of a new navigation channel, leading to the proposed new third and fourth locks on the American side, and construction of a new head-race, controlling works and ice passages for the Edison Sault Electric Company, the present head-race belonging to this company being in the way of the construction of the new canal. The items of work and the estimated quantities are as follows, the largest being Class B, dry work, navigation canal:

Class A, dredging navigation canal	47,700 cu. yds.
Class B, dry work, navigation canal	275,000 cu. yds.
Class C, dry work, head-race and forebay	15,000 cu. yds.
Class D, dredging, head-race and forebay	15,000 cu. yds.
Channeling	36,600 sq. ft.
Crib placing and framing, timber	154,000 cu. ft.
Crib filling	13,000 cu. ft.

Construction and removal of west cofferdam, head-race and forebay	Lump sum price.
Construction of new north dike	1,900 lin. ft.
Concrete (exclusive of cement)	22,000 cu. yds.
Furnishing and delivering cement	27,500 bbls.
Furnishing and delivering vitrified paving brick	15,000 brick.

At the present time this work is all under water, but it is proposed by the construction of cofferdams to unwater the same, and do this work in the dry. The total amount of the contract, based on the above quantities, is $675,288.00. Work is to be completed within eighteen months from date of starting.

Swift Current, Sask.—Contract for the power-house and settling basin was awarded to Laidlaw & McDonald, of Fort William, at $15,921 and $4,499, respectively. E. J. Brown & Co., of Swift Current, tendered at $17,500 and $6,037. Contract "E" for pumping machinery, "F" for electrical machinery, and "G" for producer gas plants were awarded to Chapman & Walker, of Toronto. The other tenders were as follows: The Canada Producer and Gas Co., Barrie, Ont.—"E," Pneumatic tanks, $4,950; "G," $21,500; extras, $3,265.92. Kilmer, Pullen & Burnham, Toronto, Ont.—"F," $2,800, no outside work. Smart-Turner Machine Co., Hamilton, Ont.—"E," $5,338, without tanks. Canadian Boving Co., Toronto, Ont.—"E," Complete, without outside work; "G," Oil engines $44,000, gas engines $41,000. Canadian Westinghouse Co., Hamilton, Ont.—"F," $3,335, no outside work; "G," $13,975. E. Leonard & Sons, London, Ont.—"F," $3,700, no outside work; "G," $19,075, extras $2,370. Canadian General Electric Co., Toronto, Ont.—"E," Complete, $6,045; "F," $38,868, $8,970; "G," $24,075. Drummond, McCall & Co., Montreal, Que.—"E," $6,100; "G," $21,600. Chapman & Walker, Toronto, Ont.—"E," $8,650; "F," $16,650; "G," $25,000. Allis-Chalmers-Bullock, Montreal, Que.—"E," Complete, $7,200; "F," $46,100, $10,550; "G," $28,470.

Yorkton, Sask.—Tenders for apparatus for an electric light plant were awarded as follows: The Canadian Westinghouse Co. Ltd., meters, at $1,122.95. The Packard Electric Co. Ltd., Winnipeg, transformers, at $814.05. Other apparatus called for not decided for two weeks.

Vancouver, B.C.—Contract for $200,000 addition to C.P.R. hotel was awarded to J. L. Skene, a local contractor.

Victoria, B.C.—The contract for the Dallas Road sea wall was awarded to the Pacific Coast Construction Co., Victoria, at $74,389.04. Other bidders were: W. E. Wilson, Portland, Ore., $78,777.66; Westholme Lumber Co., Victoria, $87,336.81; Engineer Smith, Victoria, $89,437; Moore & Petlich, $94,837.08; Parfitt Bros., Victoria, $110,084.30; Hugh Macdonald, Victoria, $112,588; Louis A. Borde, Seattle, Wash., $140,756.

Brunswick, Maine.—The Cabot Manufacturing Co. has placed a contract for the building of a reinforced concrete paper mill, with the Aberthaw Construction Co., of Boston. The new mill will be located on the bank of the Androscoggin River, opposite the Cabot Mfg. Co.'s mill, and will be leased to the Tejepscot Paper Co., Brunswick, Maine.

LIGHT, HEAT AND POWER.

Niagara Falls, Ont.—Mr. Roberts, superintendent of the Symmes Construction Company of this city, said that he has decided to erect a plant for the development of from 6,000 to 8,000 horsepower, for the operation of the hydraulic plants, crushers and other machinery in the Porcupine mining district. The plant will be located at Sandy Falls.

St. Thomas, Ont.—At the request of the M.C.R., a conference has been arranged between the company's electrical experts and City Engineer Bell and P. B. Yates, the city's consulting engineer, for next Tuesday night. At this conference the question of supplying Niagara power to the M.C.R. will be taken up. The company are not only talking of using the Niagara power for the machinery in its new roundhouse and the proposed shops, but will likely use it for its new electrically driven turntable.

Brandon, Man.—City Engineer Speakman left this morning to take levels and gather all other data possible to enable him to report to the city council on the proposed power-site at Curry's Landing, some seven or eight miles east of Brandon on the Assiniboine River. Mr. Speakman is satisfied that it will be possible to obtain a 20-foot head of water at the dam.

Saskatoon, Sask.—The installation of the new arc lights recently ordered by the city council are being installed as rapidly as possible. The northwestern portion of the city will get the benefit of considerably more illumination at night when the work is completed.

Edmonton, Alta.—It is understood that American capital has preceded the action of the city to secure the water rights on the Athabasca River at Grand Rapids. John S. Fielding who was sent by the city to investigate the power possibilities there found he had been forestalled. A survey had already been made by Americans securing the water rights.

Vancouver, B.C.—The Western Canada Power Company, formed about eighteen months ago to develop water power at Stave Lake for transmission to Vancouver, New Westminster and all outlying districts, expect, for the present, to develop twenty-six thousand horse power and deliver within six months at least twenty thousand horse power. The engineer estimates that from the sale of this power at an average price of twenty-five dollars per horse power, the net earnings will amount to $255,000, equivalent to nearly nine per cent. on the common stock.

Norway House, N.W.T.—The Hon. Wm. Ogilvie, ex-governor of the Yukon, when he returned after a month's trip, exploring the waterfalls and rapids on the Nelson River, for the department of the interior, said that there was enough power going to waste in the Saskatchewan and Nelson Rivers to successfully operate and equip a road twice the length of the Hudson Bay Railway. Furthermore, this power lies within a hundred mile radius of the line of the Hudson Bay Railway. He was greatly impressed with the possibilities of power development all through this region and it is evident that lack of power resources will not prevent the road from being electrified.

BY-LAWS AND FINANCE.

The following municipalities sold debentures last week:

Brockville, Ont.—$50,000, lighting.

Etobicoke, Ont.—$13,375.

Gilbert Plains, Man.—$10,000.

Revelstoke, B.C.—$50,000.

Hamilton, Ont.—The city council have announced that in January next, the ratepayers will be asked to vote on a by-law to raise $100,000 for good roads.

Shippawa, Ont.—On Tuesday, October 25th, the ratepayers will vote on a by-law to raise $30,000 to provide for the installation of a village waterworks system. It is planned to have a complete system having mains on every street in the village.

Harris, Sask.—Tenders are called for $1,500 permanent debentures.

Prince Albert, Sask.—A by-law was passed, providing for the construction of a main intercepting trunk sewer and system of sewage disposal and purification works.

Prince Albert, Sask.—The ratepayers were called upon to endorse the issuing of $12,000 waterworks debentures; $2,700 armory debentures, and $110,000 sewerage debentures. The following by-laws have also been carried: By-law to install filtration plant, cost $12,000; to construct trunk sewer at cost of $110,000; to build additional boilers for power house, cost $7,000; for extensions to sewer and waterworks at cost of $26,000; by-law to pay for improvements in city hall at a cost of $10,000.

Regina, Sask.—The by-laws for street railway $100,000, and agricultural association $100,000, carried by large margins.

Duncan, B.C.—The electric light by-law which was submitted to the property owners of the North Cowichan municipality on Saturday last passed by a majority of more than the required three-fifths.

SEWAGE AND WATER

Youville, Que.—Youville has been annexed to Montreal for over three years and the residents are dissatisfied because of the failure of the city of Montreal to provide a water system. A demand is to be made for a water supply at once, as thus far very little evidence has been shown of an intention on the part of the civic authorities to supply Youville's needs.

Pembroke, Ont.—Mr. T. Aird Murray of the Lumsden Building, Toronto, has been called in to report without delay upon an improved system of water supply for the town.

Ottawa, Ont.—The formation of a Canadian Public Health Association has been completed here. The main object of the association is to interest the public and spread information in regard to matters relating to public health. The following officers were elected: Honorary president, Sir James Grant, Ottawa; president, J. A. Starkey, M.D., McGill University; treasurer, Dr. G. D. Porter, Toronto; secretary, Major Lorne Dunn, Ottawa. It is said that membership will be open to all. A laboratory of federal health will be established at the Experimental farm to test various disinfectant agencies as to their efficiency and report on such, and also to produce sera, vaccines, antitoxins, etc., to aid in guarding against a general widespread of disease.

Ottawa, Ont.—In a paper before the opening session of the public health conference, Dr. Chas. A. Hodgetts, medical adviser of the public health committee of the conservation commission, gave some valuable advice for prevention of water pollution. The substance of the paper was a claim that federal legislation was necessary to prevent water pollution. Because of the wholesale pollution of the streams and lakes of the great tract north of the Great Lakes, it was impossible for local laws to prevent pollution. Dr. Hodgetts said it was clearly the duty of the government to make adequate laws in the matter or otherwise the public would be uselessly paying for plant intended to produce sewage free from disease-producing organisms.

Ottawa, Ont.—Allan Hazen, of New York, who has been making an examination of Ottawa's water supply, reports that notwithstanding the remarkable lack of pollution in the Ottawa River for the size of the river, yet there is sufficient pollution, so that the water cannot be used with assurance. He suggests that McGregor's Lake, fifteen miles north of the city, be used as a source for Ottawa's water supply. The cost of installing the system is estimated at $2,400,000. A filtration plant would cost $2,300,000. He reports that 80 per cent. of water now pumped was lost through leakage.

Peterborough, Ont.—The water commissioners have fitted up a laboratory in the city buildings for the testing of water under its different conditions. Henceforth, it will not be necessary to send the water to Toronto. The tests and bacteriological experiments will be conducted by Dr. McPherson, Medical Health Officer.

St. Catharines, Ont.—The Lincoln Paper Mills Company at their new "Lybster" mills, at Merritton, are laying 4,500 ft. of 12-inch main from Lock 21, Old Welland Canal, to furnish a supply of water for industrial uses and fire protection at the mills, 8-inch and 6-inch pipes being used in the yards for fire mains. A. S. Cook, C.E., is resident engineer for the company on the plant.

St. Catharines, Ont.—The ratepayers of St. Catharines will be asked to vote in January upon the question of providing a second water main from the city's reservoirs to the city, in order to increase the rapidly diminishing fire pressure and to meet the increasing demands for domestic purposes. The committee recommends the acceptance of the proposition of the commission. The estimated cost of the main, all 24-inch from the reservoir to the centre of the city, is $165,000. The cost of 30-inch from reservoir to encampment and the rest 24-inch would be $175,000. Engineer Alex. Milne recommends the latter for efficiency.

Winnipeg, Man.—It is very likely that a by-law for a visible source of water will be submitted to the people in December. The board talked over the situation and while Controller Cockburn took no stand, the other members spoke in favor of the submission of a by-law to determine public opinion in the matter of future water supply. The proposal to be offered is that of the Winnipeg River at Seven Portages, where a daily supply of 12,000,000 gals. can be obtained filtered and delivered, at an initial outlay of $3,862,000; or a 20,000,000 gallon daily supply for $6,538,000. The eventual capacity of this source is estimated at 48,000,000 gallons per day and the cost of the plant will be $10,519,000.

Victoria, B.C.—The city council are consulting with the Pacific Coast Construction Company with regard to waterproofing the Smith's Hill reservoir, from which at present there is a leakage of about 60,000 gallons daily. City En-

gineer Smith recommends that a waterproof cement be used and estimates the cost of repair at $7,000. It is stated that the Pacific Coast Construction Company has offered to make the reservoir watertight for $3,000 by asphalting the interior walls and ironing it with hot irons into the concrete walls.

RAILWAYS—STEAM AND ELECTRIC.

Halifax, N.S.—It has been arranged that the hearing of representations by the Halifax board of trade, favorable to the Canadian Pacific getting rates on the I.C.R. similar to the arrangement with the Grand Trunk, will take place before the railway commission at the November traffic sittings instead of this week.

Montreal, Que.—Much significance is attached to the application of the Grand Trunk Railway to the Dominion Parliament for power to acquire, hold, guarantee, pledge and sell or otherwise dispose of stocks, bonds or other securities of the Montreal Southern Counties Railway, which now operates between Montreal St. Lambert and Longueuil. The Grand Trunk now has an interest in this railway, but from the powers sought it would indicate an intention on the part of the Grand Trunk to control the line and possibly extend it to all of the suburban points of that railway along the south shore of the St. Lawrence now reached by steam. The Montreal and Southern Counties Railway has powers to extend their system up to Laprairie and other points beyond that place. Chateauguay and Beauharnois are some of the places which will probably be linked up with the system. The successful operation of this system probably means its extension to the Grand Trunk's suburban traffic west of the city, including Lachine, Pointe Claire, St. Ann's and Vaudreuil and intermediate points.

The company is also seeking power to hold one meeting annually instead of semi-annually, as at present, and the making up and balancing of accounts annually, instead of semi-annually. The granting of this legislation will bring the company in line with the Canadian Pacific Railway and the big American railways in respect to annual meetings and the making up of accounts.

A reserve fund for extensions, renewals, maintenance, repairs, etc., is also asked for.

Montreal, Que.—Hon. J. P. Casgrain states that the best stroke of policy the Quebec government could possibly pursue would be to build the Montreal Branch of the Grand Trunk Pacific, as such line connecting up the chief city and port of the Dominion with such an important transcontinental system as the Grand Trunk Pacific, would pay good interest from the very moment the last rail was laid. The province could either operate the railway in question or could lease it to the Grand Trunk Pacific at such a figure that would relieve the province of all future financial responsibility.

Montreal, Que.—Forty-three locomotives have been turned out at the Canadian Pacific Railway shops since August 1st, twenty-eight being built in August, and they weighed 200,000 pounds on the drivers, or a total weight of 220,000 pounds. During the last month seven have been produced at the Angus shops and eight at the locomotive works. These have been distributed all over the system and a number of them have been sent to foreign points.

Montreal, Que.—The Grand Trunk Railway System has recently placed in commission on their northern division, two telephone train despatching circuits. One circuit is between North Parkdale Junction and Burlington Junction, via Allandale, a distance of 145 miles, and the other between Allandale and Nipissing Junction, a distance of 165 miles. Train despatchers on each of these circuits are located at Allandale. The telephone is considered superior to the telegraph as a medium for despatching trains, as a factor of safety and also as a saving of time. It is understood that it is the intention of the Grand Trunk Railway to extend the use of the telephone over its more important lines.

Montreal, Que.—New equipment for G.T.R. has recently been shipped. Fifteen baggage cars and five combination express and horse cars, order for which was recently placed by the Grand Trunk Railway system with the Canadian Car and Foundry Company, have been completed and delivery made. The baggage cars are modern in all appointments, 63 feet 10¾ inches long, mounted on four wheel trucks and equipped with Westinghouse quick action and high speed brakes. They are lighted with Pintsch gas. The interiors of the combination cars are similarly equipped to the baggage cars, and have sliding stall partitions and the necessary appointments for the transportation of horses. Each car will carry sixteen horses.

Fort William, Ont.—The Canadian Pacific Railway has sent out a special chart for the use of the navigators who have cargoes from Fort William to the company's new elevator at Victoria Harbor. The course shown holds to that for the Midland harbor until a new line has been taken in a northeasterly direction, bringing Sturgeon Point in a line with the north end of Methodist Island. The course is maintained until the vessels can swing round and run southeasterly alongside of the company's new concrete wharves.

Fort William, Ont.—Mr. W. A. Dowler, solicitor for the Lac Seul, Rat Portage and Keewatin Railway Company, accompanied by Mr. Knowlton, the company's engineer, has arrived from Fort William for the purpose of making arrangements for the preliminary survey of the proposed line from here to a point on the Grand Trunk Pacific Railway. Mr. Knowlton and assistants will be engaged for some time running trial lines and generally making a preliminary survey of the route. The greatest difficulties which will present themselves to the engineer are expected to be in the immediate neighborhood of Kenora and in reaching Keewatin from this point.

That the company has decided to locate their proposed line will be gratifying to the people of Kenora and Keewatin, and it is to be hoped that the preliminary survey will be followed up closely by the permanent locating of the line, and that construction work will be commenced at an early date next year.

Guelph, Ont.—The South Ontario Pacific Railway Company will ask for authority to construct a line from Guelph Junction to Hamilton. This will give the long looked forward-to communication with Hamilton, and will mean increased profits for the Guelph Junction Railway.

Guelph, Ont.—The application of the Grand Trunk Railway Company for the privilege of making use of certain property of theirs on Cardigan Street for the erection of freight sheds, came up before the Dominion Railway Commission and was deferred until such time as the C.P.R. are prepared to present their case also.

Mount Forest, Ont.—It is reported that the radial railway line from Guelph will be the theme of the hour here before long. Guelph is said to be taking stock to the extent of $85,000. It is coming northward to Elora, Fergus and Arthur within a couple of years and aims going through Mount Forest to Owen Sound. It asks municipalities through which it passes to pass by-laws to take first preference stock.

Ottawa, Ont.—Mr. William Mackenzie stated that the C.N.R. hoped to run its trains into the Central depot before long. He believes the privilege of crossing the Hurdman road at rail level should be temporarily granted, pending the definite solution of the level crossing problem. There is little doubt that what the C.N.R. seeks would be granted as a temporary privilege.

Ottawa, Ont.—Increasing activity in railway development is evidenced by the large number of applications to Parliament for legislation. The C.P.R. wants authority to construct five branch lines in the northwest, from Conquest, Sask., to Asquith or Dunfermline, on the Pheasant Hills branch: from Wilkie, Sask., southerly to Moose Jaw branch; from Wilkie, southwesterly and southerly to the Moose Jaw branch; from Boissevain, Man., to Lauder, Man., from the Crow's Nest branch along the Old Man River, about 55 miles. Authority is also asked by the C.P.R. to make the terminus of its Lauder branch at Weyburn and to increase its bonding power in respect to its Toronto-Sudbury branch.

Stratford, Ont.—It is reported on good authority that the C.P.R. has taken over the charter of the St. Mary's and Western Ontario Railway Company thereby securing entrance into the city of Stratford and its vicinity. The charter provides for a line from Stratford to Grand Bend, a summer resort on Lake Huron. It originally specified a radial line, but it is understood a clause was inserted making possible a change to steam if so desired by the company. The town of Stratford has been expecting an electric line with cars run on the storage battery scheme supplied for the forty-mile run in Stratford. In all events Stratford will construct the storage plant as it intends to run storage-battery cars upon its own streets.

Toronto, Ont.—Two interesting announcements in relation to the development of the Canadian Pacific Railway in the Ontario division were made by James Oborne, general superintendent. They were the opening of a two million bushel elevator at Victoria Harbor and the building of a spur line from Code Junction to Ingersoll.

Toronto, Ont.—The grade separation which the G.T.R. is pushing with all possible speed between the C.P.R. diamond, west of Strachan Avenue to a point west of Church Street, Mimico, a distance of six miles, will, when completed, eliminate fourteen grade crossings. Eight of these are in the city, the remainder being in the townships of York and Etobicoke. As the work is one of gigantic proportions it is impossible to say with certainty, the date when the work will be completed. An idea of the change of grades may be obtained from the example at Dufferin Street, where the new rail level will be 24 feet lower than the present one, and at Dunn, Jamieson and Dowling Avenues this will be increased to 25 feet. The steam shovel having a capacity of excavating 1,700 tons daily is rushing excavation near Wilson Avenue and work will be continued until severe weather arrives and probably completed early in the spring.

Toronto, Ont.—A further improvement in the passenger business between Montreal and Toronto, as well as a considerable enlargement of the facilities for passenger traffic between the latter city and Winnipeg, is now being planned by the Canadian Pacific Railway. The new passenger traffic manager of the company, Mr. C. E. E. Ussher, has just returned from his first official trip to Toronto, and the above is the announcement which he makes.

Toronto, Ont.—The Canadian Northern will establish a repair plant and shops at Parry Sound. Next year it is understood an elevator with a capacity of at least 500,000 bushels will be erected. Should this materialize as expected an expenditure would probably go up to $200,000 for the improvement of docks and buildings at Parry Sound.

Toronto, Ont.—Brock Avenue is to have a subway under the G.T.R. tracks. The Dominion Railway Commisssion has made the order, and plans are to be submitted to the Board by October 26th.

The work must be finished, says the order, within six months of the approval of the plans. The apportionment of cost is to be arranged later on.

Windsor, Ont.—The large addition to the Grand Trunk roundhouse, Sandwich Street, which is about 189 x 25 feet, is progressing rapidly, and in about ten days the contractors, John Hayman & Sons, London, expect to be through with the work.

The new addition is being made to the old roundhouse, the back end of which has been torn down and the wall extended 25 feet further back. This new addition, which has been in course of construction for about six weeks, will cost the company about $10,000. The roundhouse, when completed, will be one of the latest standard with every modern convenience that would add to the general efficiency of the building.

Winnipeg, Man.—The roadbed and general conditions both in operating and service on the Grand Trunk Pacific Railway between Winnipeg and Edmonton, is coming in for great praise from patrons who have gone over the road.

Moose Jaw, Sask.—The Canadian Pacific Railway Company has laid a temporary spur from a point near the flour mills, and along the south side of Manitoba Street. The track is to be used for hauling in cement and gravel, to build a retaining wall on each side of the inclined roadway. One of the large trenches has been dug already, to a depth of

CORRECTIONS.

KILMER, PULLEN & BURNHAM

Advertisement on page 539, not on 541, as stated in Index to Advertisers.

five feet, and of about the same width. The length is about one hundred yards. The substantial character of this work is subject for congratulation.

Regina, Sask.—It is evident that the C.N.R. intend to rush the work in connection with the laying of their road between here and Moose Jaw. A gang of 75 men passed through the city on their way to start work on the grading. There were twenty teams and wagons and all necessary equipment for grading. They went out four miles across the prairie and preparations for a start were at once made. The line will run parallel with the C.P.R. line, but will be about half a mile north of it.

Edmonton, Alta.—Construction is to be commenced this week and will be carried on all winter from the Entwistle end of 70-mile contract on the main line of the Canadian Northern west of Edmonton, which McMillan Brothers of Winnipeg, have now in hand. Three hundred men are to be taken to Entwistle by sub-contractor Phillips and work will at once be commenced from points where the C.N.R. is to cross the Pembina River half a mile north of the Grand Trunk crossing.

Red Deer, Alta.—The C.N.R. have graded to a place two and one half miles southeast of Blackfalds. They are, however, making a detour 3 miles north to avoid the Blackfalds slough, touching four or five miles from Lacombe and swinging then due south back to Blindman. The reason of this detour, it is understood, is that the C.N.R. are not prepared as yet to bridge the one mile of ravine country in the direct line. The "S" line will join the Brazeau line about the northernmost part of this detour and both branches will use the same rails from within four or five miles south of Lacombe to within five or six miles north of Red Deer. This part of the line is designed to cross the Blindman by a bridge 100 feet high and a quarter of a mile long, just above the Blindman power plant dam.

New Westminster, B.C.—The sum of $100,000 will be spent by the British Columbia Electric Railway for yards, car barns and repair shops on the property recently bought by the company near the end of the New Westminster bridge on the Surrey side. The new buildings will be used exclusively for the cars and locomotives of the Fraser Valley branch. Necessary arrangements have been made by the railway company to use the dredge, King Edward, of the Dominion government for raising the level of the property about four feet.

Vancouver, B.C.—The city of Vancouver will receive from the British Columbia Electric Railway Company as its share on the percentage basis, the sum of $4,978.49 for the operation of the car service through the city streets during the month of September. This sum falls short of the August total, but the fact that there were no holidays excepting Labor Day and also that the exhibition at Hastings Park swelled the receipts in August, explains the decreased turnover.

Vancouver, B.C.—Application is to be made to the legislature next session for amendments to the charter of the Portland Canal Short Line Railway Company. It is understood that a Dominion charter will also be sought. The capitalization of the company will be increased and the name and title of the company will be amended in recognition of its transcontinental ambitions and importance. This legislation is to authorize the company to extend its line from the terminus at present provided for in a general easterly direction to the eastern boundary, from which under an Alberta charter it would connect with C.N.R. at Edmonton.

Victoria, B.C.—It is reported that the policy of the McBride government with regard to the Vancouver Island railway plans has collapsed. If this is the case the promises made to the people of Vancouver Island by the present government will not be carried out by it.

Victoria, B.C.—L. C. Gilman of St. Paul and A. H. MacNeill of Vancouver were here as representatives of the Great Northern Railway to discuss with the government the situation created by the recent executive decision that Vancouver has no power to alienate False Creek land to the railway. This decision is, of course, a serious handicap to the Great Northern and the company desires an assurance that such legislation as may be necessary will be passed next session in order that the railway may be able to secure this land and go ahead with its work of expansion in Vancouver.

The visitors saw the premier and Hon. W. J. Bowser this morning and were given a chance to state their case. They did not, however, obtain any promise as to what the Government would do. It is understood that the matter will be taken up by the executive as soon as a full meeting can be obtained, but this will probably not be for three or four weeks.

Norway House, N.W.T.—Party number one of the Hudson Bay Railway surveys has returned. The party was in charge of Engineer W. J. Clifford and had for its aim the determining of the final route of the much discussed Hudson Bay Railway from the Pas to Hudson Bay. This party had charge of the work on that section of the line known as the first section located between the Pas and Landing Lake, a distance of about 20 miles. It was believed that impassable muskegs would be encountered but Mr. Clifford reports that none such were found, in fact there are but few points on the whole section where it would be necessary to make unreasonable curves in the line in order to secure solid foundations. Invariably there are tangents on the line which are straight for as many as thirty or forty miles of a stretch. Before another year has passed the government hopes to be in possession of enough information to commence construction of the great railroad.

Minneapolis, Minn.—Latest reports indicate Canadian Northern will be a big loser by forest fires, but no other railways will have serious losses, as the country is unsettled.

PERSONAL.

Mr. H. J. D. Ross, A.M.Can.Soc.C.E., has returned to headquarters N.T. Ry., Ottawa, after three months' work on estimates on district "F." He returned with Mr. McTaggart's party.

Mr. Charles A. Baldwin, has been appointed manager of the New York office of the Massachusetts Chemical Company. Mr. Henry E. Cozzens resigned to enter other business.

Mr. N. B. McTaggart, M.Can.Soc.C.E., divisional engineer, district "F" N.T.Ry., with a staff of eleven assistants has moved to Ottawa from St Boniface, Man., for a couple of months to work with the assistance of the Headquarters Staff on district "F" N.T.Ry. estimates.

Mr. W. C. Ross, managing director of the Montreal Street Railway, has been elected vice-president of the American Electric Railway Association, the first time a Canadian has attained so high an office in the association.

Mr. R. J. Clark, for the past six years, assistant comptroller of the Toronto Railway and comptroller of the Toronto and York Radial Railway, has been appointed comptroller of the Kansas City Electric Street Railway, Power and Light Company. Mr. Clark has had a varied and extensive experience with the Toronto Railway, the National Trust Company and the Sao Paulo Company.

Mr. W. C. Ross, managing director of the Montreal Street Railway, has had conferred upon him a special honor. He has just been elected vice-president of the American Street Railway Association, which has been in session in Atlantic City this week. The fact that Montreal can claim one of the best street railway services on the continent is due largely to his ability. Mr. Ross is a director in other commercial and industrial concerns. It is the first time that the office has been held by a Canadian.

Dr. George C. Nasmith, M.A., Ph.D., who has been recommended as director of the City of Toronto Laboratory, was born in Toronto 32 years ago. He is the son of ex-Ald. Mungo Nasmith, who was for a time connected with the City Treasury Department. He was educated at the Jarvis Street Collegiate Institute and the University of Toronto, whence he was graduated in 1900 with the degree of Bachelor of Arts. He specialized in natural science, and in 1003 secured the degrees of Master of Arts and Doctor of Philosophy, after studying under Prof. A. B. Macallum, professor of physiological chemistry. Dr. Nasmith was appointed to his present position in the laboratory of the Provincial Board of Health in 1902. He read papers on coal gas poisoning and immunity from such poisoning, at the meetings of the

British Association at York, England, and Winnipeg, Manitoba. He has published a number of papers, and has conducted researches in regard to proprietary medicines, foods, malt extracts, the treatment of water by ozone, as at Lindsay, Ont., and the purification of water with chlorine. He has prepared a plan for the treatment of water with chlorine in the field and his prescription will be published by the Ontario Government.

MISCELLANEOUS.

Hamilton, Ont.—A dustless road from Niagara Falls to Windsor is the ambitious scheme County Road Superintendent Taylor will lay before the Good Roads Association at its next convention in Toronto. He hopes to line the municipalities along the line up solid behind the project, and looks for the support of every automobile owner in the province.

Lindsay, Ont.—It is understood that the Toronto Construction Company, which has the contract for the construction of the C.P.R. grain route, will sublet the Atherley-Lindsay section. Preliminary work will start this fall but the bulk of the work will be undertaken next spring.

Ottawa, Ont.—Joseph Cousineau, of Gatineau Point, who by an agreement with the Hull City Council, made three years ago, is responsible for the repairing of the Gatineau bridge, in return for the privilege of erecting a turnpike on the approaches to the bridge, will spend the sum of $5,000 on repairs to the structure, following a communication received by the city council from the public works department of Quebec, in which the inspector who examined the bridge, owing to many complaints being laid before the department stated that he considered the structure to be unsafe for traffic. He gave the council 30 days in which to commence the repair work, failing which he threatened to close the bridge for traffic.

Toronto, Ont.—The city engineer has decided that the span of the old bridge over the Don at Queen Street will not do to incorporate into the new high-level structure. A new span will cost $15,000, which the city will have to buy, because the Dominion Commission decided that the C.P.R. should not pay for that part of the bridge over the stream. The Board of Control recommended that the necessary amount should be provided.

Winnipeg, Man.—The Canada Metal Company which has for many years been engaged in the manufacture of special grades of metals will establish, as soon as the necessary arrangements can be completed, a plant in this city, and will, in future, do in Winnipeg a large amount of work formerly done in Toronto. As the West grows a demand for this work will increase and it is expected that in time the plant here will equal that in Toronto. For the beginning of the enterprise W. G. Harris, who is at present in the city, has purchased from the Ontario Wind Engine and Pump Company the plant of the latter organization at 301 Chambers Street. This structure is located on the west side of the city between Logan and Henry and the purchase price was $26,000.

Saskatoon, Sask.—Work on the overhead footbridge still proceeds, although the progress is to some extent kept back by the non-arrival of the last car of steel. The bridge itself is for three spans an accomplished fact on the west side, and if all goes well pedestrians should be making use of the finished bridge within a few weeks.

Vancouver, B.C.—British Columbia Telephone Company has sent a huge order for material to cost over $500,000 to the Wire and Cable Company of Montreal, and the Northern Electric Company of the same city. Over 250,000 feet of cable have been ordered from the Wire and Cable Company, the average size being 200 pair of wires per cable, but the capacity of some is as high as 600 pair of wires. The Montreal order also includes 25 tons of supporting wire, but owing to the large quantity required, orders had also to be sent to England, 60 tons having already been received from there, and a similar quantity is to follow. The order sent to the Northern Electric Company includes 52 switchboard sections and also 3,000 telephone instruments. A private railway yard has been established on Dunlevy Street so as to properly handle and store the material.

CURRENT NEWS.

St. John, N.B.—Captain Walsh, marine superintendent of the C.P.R. Atlantic lines, was in St. John, and said that the prospects were good for the coming season. The service to St. John will include this year a new line, that to Australia, sailing each month. It is expected that a line of steamers will be running between St. John and the Argentine Republic next year.

Montreal, Que.—As far as can be learned, the Canada Cement Company is absolutely secure, with very bright prospects before it. Mr. Frank P. Jones, the general manager, stated that he was not only well satisfied with the general orders coming in, and the company's ability to fill them, but that the outlook before the corporation was singularly bright.

Montreal, Que.—Mr. Wilfrid Stokes, managing director of the firm of Ransomes and Rapier, Limited, the well-known engineers of Ipswich, England, the firm which constructed the Assonan Dam in Egypt, has come to Canada to look over the field of opportunities for his company. He believes in the field of irrigation, and possibilities through consruction work of making many Canadian rivers navigable, that there is some scope for business for his firm.

Quebec.—It is announced that the caisson of the Quebec Bridge has been condemned.

Ottawa, Ont.—That an appropriation for the commencement of the construction work on a new Weland Canal will be made at the forthcoming session is the statement of W. M. German, M.P., who is here interviewing the Government about it. Mr. German says he has had assurances to that effect. The original idea was to enlarge the present canal from Port Colborne ten miles, and then construct a cut-off. Surveyors, however, have disclosed a dangerous bed of quicksand on the route of the cut-off, and an entirely new canal is now proposed. It would start about six miles west of Port Colborne, and have its outlet at the mouth of the Jordan river. The length would be 22 miles. This means that the Lake Erie entrance would be immediately east of "Morgan's Point," which affords a fine natural shelter. Also, it is said, by this route all rock cutting would be avoided.

Toronto, Ont.—Thomas W. Gibson, Deputy Minister of Mines, in his annual report of the Ontario Bureau of Mines, says that the output for Ontario for 1909 had a value of $32,981,375. This is an increase of twenty-eight per cent. over 1908.

Vancouver, B.C.—Considerable opposition has been raised by the Canadian Civil Engineers' local society here, against the acceptance of the proposition of Waddell and Harrington, American firm, to act as permanent consulting bridge engineers for the city. Mr. Webster, chairman of the local branch, was vigorous in his protest before the city board, saying he did not believe it was fair to Canadian engineers, and themselves residents of Vancouver. He hinted at the possible lack of reliability of some of the work of the American firm. The question was laid over by the Board.

Victoria, B.C.—The general policy of road building in the province, coupled with suggestions which may lead to definite results along certain lines which it is proposed to inaugurate, will be considered in detail at the quarterly meeting of the Board of Trade. In deference to the importance of the subject, and the widespread public interest taken in the question of good roads, it has been decided that not only will it have premier place on the agenda paper, but that it will probably be the only matter discussed.

Calgary, Alta.—It is said that samples of iron ore, taken a random from places in an area of 20,000 acres, when tests were made, averaged from 40 to 50 per cent. pure. Dr. Ings, at whose place tests were made, states that a company proposes to develop the steel and coal industries here, and that it has been assured of almost unlimited financial backing, and may spend upwards of $5,000,000 in establishing a plant.

SOCIETY NOTES.

The first regular meeting of the Toronto section of the American Institute of Electrical Engineers, will be held on Friday, October 21st, 1910, in the rooms of the Engineer's Club, 96 King St. West. The meeting will be called sharp at 8 p.m., for election of officers for the ensuing year. A paper on "The 110,000 volt Toronto Substation of the Hydro-Electric Power Commission of Ontario," will be presented by Mr. P. W. Sothman, chief engineer of the Commission. The paper will be illustrated with lantern slides, and following the reading of the paper, the members will visit the Substation on Strachan Avenue.

Central Railway Club of Canada.—After the reading of Mr. C. L. Hacket's paper, which is given on page 522 of the issue, the discussion took the form of questions on the various experimental types that certain signal inventors had tried. It was stated that so far as the interlocking system was concerned, the American railways were ahead in its use. The C.P.R. uses American standards of signaling straight through. A question was asked concerning certain forms of train signaling by electricity, or train stopping by electrical contact. Mr. Hacket, the speaker of the evening, said that although a great deal of time and money had been spent in trying to perfect an automatic system of train stopping, it had not, so far as he knew, yet been perfected. And with the exception, possibly, of the subways, elevated roads, and one or two electric lines, no such system had been successfully operated. He pointed out that this was only possible in an electrified subway, as there they did not have the outside storm and weather conditions to deal with. On a railway such a system would be subject, not only to weather conditions, but also to outside electrical conditions and transmission lines. The White Railway Signal was discussed, consisting of an electric bell at a highway crossing and a visual indication by a light. It was pointed out, however, that this was not perfect because the illumination for the light was gotten from the same source as the power for the bell, and if the bell failed, the light was gone also. The speaker believed that an oil lamp was more reliable. The general impression of the speaker and the various members was, that in spite of all the automatic appliances on the market, the human element could not be dispensed with successfully as yet.

MARKET CONDITIONS.

Montreal, October 18th, 1910.

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

Bar Iron and Steel.—The market holds dull and steady. Bar iron, $1.90 per 100 pounds; best refined horseshoe, $2.15; forged iron, $2.05; mild steel, $1.95; sleigh shoe steel, $1.90 for 1 x ¼ base; tire steel, $2.00 for 1 x ¼-base; toe calk steel, $2.40; machine steel, iron finish, $2.00; imported, $2.05.

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 year will be the largest in the history of the country. Prices on foreign fibre, 55c. per roll; dry fibre, 45c. (See Roofing; also Tar and Pitch). (164).

Cement.—Canadian cement is quotable, as follows, in car lots, f.o.b., Montreal:—$1.35 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.—The market is unchanged, being now per 100 lbs., as follows:—¼-in., $5.30; 5-16-in., $4.70; ⅜-in., $3.90; 7-16-in., $3.65; ½-in., $3.55; 9-16-in., $3.45; ⅝-in., $3.40; ¾-in., $3.35; ⅞-in., $3.35; 1-in., $3.35.

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 13¾ to 14c.

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 5,000, 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, 10c. 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.

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 market is steady and prices unchanged. Following are the prices, on cars, ex-wharf, Montreal:—No. 1 Summerlee, $20.50 to $20.75 per ton; selected Summerlee, $20 to $20.25; soft Summerlee, $19.50 to $19.75; Carron, special, $20 to $20.50; soft, $19.50 to $20; Clarence, $17.25 to $17.50; Cleveland, $17.25 to $17.50 per ton.

Laths.—See Lumber, etc.

Lead.—Prices are easier, at $3.35 to $3.45.

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 carrying $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 steady and prices are: $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 shows a steady tone although demand is on the dull side. Prices are firm, and approximately as follows:—$32 for 6 and 8-inch pipe and larger; $33 for 3-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 about the same, 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 71½ per cent. off for black, and 61½ 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, $1.08.

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; 14-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 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 steeel, 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 steady, 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 firm, at $34 to $34.50.

Zinc.—The tone is easy, at 5¾ to 6c.

CAMP SUPPLIES.

Beans.—Prime beans, $2.40 per bushel.

Butter.—Fresh made creamery, 24 to 26c.

Canned Goods.—Per Dozen.—Corn, 80 to 85; peas, $1.05 to $1.15; beans, 85c.; tomatoes, 85 to 90c.; peaches, 2s, $1.65, and 3s, $2.65; pears, 2s, $1.60, and 3s, $2.30; salmon, best brands, 1-lb. talls, $1.87½, and flats, $2.02½; cheaper grades, 95c. to $1.65.

Cheese.—The market ranges from 10¾ to 11½c., covering all Canadian makes.

Coffee.—Mocha, 20 to 25c.; Santos, 15 to 18c.; Rio, 10 to 12c.

Dried Fruits.—Currants, Filiatras, 6¼ to 7c.; choice, 8 to 10c.; dates, 4 to 5c.; raisins, Valentias, 5 to 6¼c.; California, seeded, 7½ to 9c.; Evaporated apples, prime, 8 to 8½c.

Eggs.—No. 1 eggs are 22c.; selects, 26c.; new laid, 31c.

Flour.—Manitoba, 1st patents, $5.80 per barrel; and patents, $5.30; strong bakers', $5.10.

Molasses and Syrup.—Molasses, New Orleans, 27 to 28c.; Barbadoes, 31 to 41c.; Porto Rico, 40 to 43c.; syrup, barrels, 3½c.; 2-lb. tins, 2 dozen to case, $2.50 per case.

Potatoes.—Per 90 lbs., good quality, 60 to 65c.

Rice and Tapioca.—Rice, grade B., in 100-lb., bags, $2.90; C.C., $2.80. Tapioca, medium pearl, 5½ to 6c.

Rolled Oats.—Oatmeal $2.45 per bag; rolled oats, $2.20, bags.

Sugar.—Granulated, bags, $5.05; yellow, $4.65 to $5. Barrels 5c. above bag prices.

Tea.—Japans, 20 to 38c.; Ceylons, 20 to 40c.; Ceylon, greens, 19 to 25c.; China, green, 20 to 50c.; low-grades, down to 15c.

Fish.—No. 1 green cod, $6 to $6.50 per bbl.; herring, $5.50 per bbl.; salmon, $8.50 per half barrel. Smoked fish.—Bloaters, $1.10 per large box; haddies, 8c. per lb.; kippered herring, per box, $1.20.

Provisions.—Salt Pork.—$24 to $31 per bbl.; beef, $18 per bbl.; smoked hams, 17 to 21c. per lb.; lard, 15½ to 17c. for pure, and 12½ to 15c. per lb. for compound; bacon, 15 to 21c.