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The Canadian Engineer

WEEKLY

ESTABLISHED 1893

VOL. 17. TORONTO, CANADA, OCTOBER 22nd, 1909. 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.

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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.

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

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

TORONTO, CANADA, OCTOBER 22, 1909.

CONTENTS OF THIS ISSUE.

TREES ON THE HIGHWAY.

One cannot travel through the rural sections of Eastern Canada and not be impressed with the number of handsome trees along the highway. During the period between the cutting down of the forests and the growing of these roadside shade trees some sections of the East presented very bald and uninteresting landscapes, but that is changed now.

Canada is developing a characteristic landscape, scenery most beautiful in spring and autumn.

It is a pity though that some time and money was not spent on maintaining the shape of these avenues of trees and in removing the objectionable natural growths along the roadside. Many hillsides, ploughed by the heavy rains, might be protected and beautified by planting sumach and other wild growths.

The contrast of a well-kept lawn or farm with a neglected roadside does not leave a favorable impression; and surely the municipality should at least keep pace with the individual. Usually it should be the leader.

CONCRETE UNDER CONSTANT VIBRATORY MOVEMENT.

Much has been written of concrete, its fireproofing quality, its adaptability, and its cheapness, stress in concrete, the allowable loading, and such like, have furnished texts for many articles and books, but concrete under repeated loads, the action of concrete under constant vibratory movements is not so well known, has not been so thoroughly investigated, nor written about.

Stone buildings have stood for ages beside wagon roads, but will concrete stand the vibratory motion, the repeated shocks caused by motor cars, motor drays, traction engines and the street cars of modern traffic?

This is a matter for the architect and structural engineer, and we are pleased to know that in some measure the question is being investigated.

What is the increased depreciation in concrete structures due to, repeated loading or vibratory motion?

PROBLEMS IN STATICS.

Some of our readers say our articles are too technical, some say they are not technical enough. Some say there is not enough theory, and others that there is too much. This week we commence a series of articles that we hope will combine both theory and practice.

Mr. T. R. Loudon, B.A.Sc., has consented to solve twenty-six problems that admit of easy solution by the methods adopted in statics. Those anxious to go more fully into the theory of the problems will find Mr.

Loudon's recently published book, Applied Statics, admirably suited to their need.

We expect this series of articles will interest the younger reader in technical literature, will give the recent graduate, who wishes to study, an opportunity to brush up his mathematics, and will provide an interesting and practical series of articles for all who deal with design.

EDITORIAL NOTES.

A Business Science Convention will be held at the Convocation Hall, Toronto, Ont., October 25th and 26th. The questions to be discussed are of wide interest. Two addresses by Mr. A. F. Sheldon, president Sheldon School, Chicago, are the main feature.

* * * *

British Columbia is again the storm centre of an "Asiatic labor" discussion. The contractors on the G.T.P. Railway cannot see their way to pay a very high wage to their employees on the grade; therefore the supply of white labor is scarce and the work drags. When urged to hurry, the contractor asks to be permitted to employ Asiatic laborers. The British Columbia Government says No. And there the matter stands.

SEPTEMBER LAKE LEVELS.

The United States Lake Survey reports the stages of the great lakes for the month of September, 1909, as follows:

Lakes.	Ft. above tide-water, New York.
Superior	602.39
Michigan-Huron	580.82
Erie	572.38
Ontario	246.28

Since last month, Lake Superior has fallen ¼ in., Lakes Michigan-Huron 2¾ in., Lake Erie 5 in., and Lake Ontario 6½ in.

During October, Lake Superior is likely to fall ¼ in., Lakes Michigan-Huron 2¾ in., Lake Erie 3 in., and Lake Ontario 4¼ in.

SOCIETY NOTES.

CANADIAN SOCIETY OF CIVIL ENGINEERS.

The results of the ballot for election to the Canadian Society of Civil Engineers which closed October 9th, 1909, have been announced.

Honorary Member

Collingwood Schreiber, C.M.G.

Members

Anderson, F., Ottawa, Ont.; Caughey, C. M., St. Catharines, Ont.; Conway, G. R. G., Monterrey, Mexico; Fay, F. H., Boston; Fox, C. B., Toronto; Harvey, J. B., Ottawa, Ont.; Volckman, G. W., Ottawa, Ont.

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Associate

Casgrain, C. P., Quebec.

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Transferred from the Class of Student to that of Associate Member

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ENGINEER'S CLUB OF TORONTO.

At the meeting of the club on October 14th, M. Dillion Mills occupied the chair. Professor Robert Angus, of the Faculty of Applied Science, Toronto University, gave an adress in which he described some of the better European science laboratories and large factories. In an early issue we expect to be able to give Mr. Angus' lecture in full.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS —TORONTO BRANCH.

The annual meeting of the Toronto branch of the American Institute of Electrical Engineers was held in the rooms of the Engineers' Club of Toronto, on Friday evening, October 15th. An interesting paper on "Transmission Line Calculations" was read by Mr. A. J. Soper, of Messrs. Smith, Kerry & Chace, and a lengthy discussion in which Mr. E. M. Ashworth, Professor T. R. Rosebrough, Mr. H. W. Price, and others, took part, followed.

The election of officers for the current year resulted as follows: Chairman, Mr. H. W. Price, School of Practical Science; vice-chairman, Mr. E. Richards; executive committee, Messrs. A. L. Mudge, R. J. Clark, H. A. Moore, and F. A. Gaby. Mr. W. H. Eisenbeis, of the Canadian Westinghouse Company, is secretary.

The Toronto members of the society are looking forward to a number of good meetings during the coming winter, as several prominent engineers have signified their intention of presenting papers. The meeting was preceded by an informal luncheon, served at the St. Charles Cafe.

REPORT OF THE MEETINGS OF MUNICIPAL ENGINEERS, HELD ON TUESDAY AND WEDNESDAY, OCTOBER 12th and 13th, 1909.

In accordance with the resolution passed at the first meeting held on September 29th, the engineers of the municipalities met on October 12th in Committee Room No. 1 of the Toronto City Hall.

The meeting was called to order at 2 p.m. and the municipalities were represented as follows: London, E. I. Sifton, Ald. Stewart; Woodstock, C. Archibald; St. Mary's, L. H. Reesor, W. R. Reynolds; Stratford, R. H. Myers, Mr. Barnett; Guelph, J. J. Hoig, E. Richards; Berlin, E. J. Philip; Hespeler, L. E. Weaver; Toronto, E. Richards; Galt, E. B. Merrill.

The interests of Waterloo were looked after by Mr. Philip, while St. Thomas, Preston, Ingersoll, and New Hamburg were represented by the Engineers of the Commission.

Mr. Ross, the Consulting Engineer of the Commission, was asked to take the chair.

Secondary Voltages.

The first subject was that of secondary voltages for light and power. Final decision of this subject had been postponed from the former meeting to allow each engineer to study local conditions to determine whether he could comply with the proposed standard. A report on the subject by the Engineering Department of the Commission, may be summarized as follows: We would advocate the distribution of power at 13,200 volts (6,600 volts for Galt, Preston and Hespeler), the use of three-phase 13,200/575 volt transformers for power, and the use of 2,200/220-110 volt single phase transformers for lighting. Where a small power user wishes power from the lighting mains supply him with 220 volt single phase power using standard lighting transformers. Where a large power user wishes power and you cannot economically or advisedly reach him with your 13,200 volt circuits, sell 2,200 volt power and have him furnish not only motor but transformers, recommending the use of 2,200/575 volt transformers.

During the discussion it was found that London could use the 550 volt secondary, Woodstock could do so if the other municipalities took some of their present 25-cycle 2,200/220-110 volt transformers off their hands. It was also decided that 550 volt power could be made safe for all factory work.

The report was finally adopted with the following amendments:

It was considered inadvisable to run higher than a one horse-power single-phase motor on the lighting transformers.

It was considered inadvisable to run higher than a ten horse-power motor on the 2,200 volt lighting mains if the motor is to be on during lighting hours.

No limit in size is necessary if the motor is to operate only during restricted hours.

Frequency.

The decision of the last meeting on this subject was confirmed, and it was decided that practice should tend towards 25-cycle power for all purposes.

Single vs. Three-Phase Transformers.

This discussion, also postponed from last meeting for further data, was opened by reading the report of the Engineering Department. Their decision summarized was, all station transformers should be three-phase with two taps on the primary side, all power service transformers, three-phase 13,200 volts primary, 575 volts secondary, with two taps on the primary side, and all lighting service transformers to be single-phase 2,200/220-110 volts. (Percentage of taps under subsequent heading.)

During the discussion the questions of weights and sizes as well as prices were considered, and it being found necessary to secure further data the subject was postponed to the following day.

Taps on Transformers.

This discussion was opened by reading the opinion of the Engineering Department, which summarized was: We advise the use of two taps on the primary side only, arranged for normal voltage, 2½ per cent., 5 per cent. and 7½ per cent.

As these taps were for boosting only, the question of lowering taps was dismissed as unnecessary when Mr. Sothman advised that the normal voltage sent out from the Commission stations would always be as near 13,200 volts as the taps on their 110,000/13,200 volt transformers would allow It was then decided that on the understanding that the Commission will furnish 13,200 volt power at their stations, that their recommendations regarding transformer taps be accepted, to apply to both stations and 13,200 volt power service transformers.

It was also decided that all 13,200 volt transformers be specified to have two coils so that they may be standard with the transformers for the 6,600 volt circuits.

Feeder Regulators.

This subject was discussed for some time, advocates for and against the desirability of installing them from the start being strong in their opinions, and it was finally decided that the meeting should recommend that feeder regulators be installed on all lighting feeders but not for the power feeders, and if not installed at present that all arrangements be made for future use.

High vs. Low Voltage Synchronous Motors.

The Engineering Department reported that on the small sizes which would be used by most of the municipalities the cost of the high voltage motor would be more than the cost of a 2,200 volt motor with the cost of the increased size of transformers added. On the large sizes the high voltage motors would be cheaper. As Mr. Sothman had expressed a wish to discuss this question the subject was postponed.

The meeting then adjourned until 8 p.m. when the following was discussed:

Single vs. Three-Phase Transformers.

Mr. Reynolds and Mr. Philip during the intermission had secured some data from a publication on the comparative weights of these transformers, which showed that in small sizes the weight of a three-phase transformer (without oil) was greater than three single-phase transformers, while the reverse was true if the weights of the oil were added. This caused general discussion, as it was contrary to the general belief that it was finally postponed until the next day, when it was hoped to have greater data to work on.

Street Lighting.

This subject was opened by reading the report of the Engineering Department. Summarized this reports reads: The art of street lighting is in a transitory stage, due to the growing belief in small units closely spaced. The time since last meeting was too short to allow proper report being made up. Suggested that a committee be appointed to make up a

report and to invite experts from the manufacturing companies to offer recommendations at the next meeting.

A very interesting discussion resulted, which showed that the concensus of opinion favored incandescent lamps properly spaced, but the method of wiring and control was not determined. Finally the Engineering Department was asked to write the City Engineering Department of Boston for a copy of the report made by them covering the experiments and tests they conducted previous to accepting Tungsten and Magnetite lamps as their standard.

It was also decided to approve the report of the Engineering Department and appoint the committee suggested, leaving to the committee the arrangements for the trip, but requesting the report be made as soon as possible.

High vs. Low Voltage Synchronous Motors.

As Mr. Sothman was able to attend this session the subject was again brought up for final discussion, and it was finally decided that owing to the small sizes of motors needed, the fairly temporary use for these motors, the present state of the art of designing high voltage synchronous motors, and considering that for small sizes the low voltage sets are cheaper, be it resolved that the meeting recommend the use of the lower voltage units.

During this discussion the question of pump motors for London was taken up, and it was decided that synchronous motors should be used, and if separate power and light circuits are used from the Commission's station to the city station, the motors should be on the power circuit.

The meeting then adjourned.

Mr. Ross called the meeting to order at 9.10 a.m. on Wednesday, the same delegates being present with the exception of Alderman Stewart of London.

13,200 Volt Insulators.

The delegates gave their demands as follows: Berlin 1,000; Guelph 1,000; Woodstock 100; St. Mary's 350; and London 3,500. The number needed by Stratford, St. Thomas, and Preston would be secured. It was then resolved that the Commission secure quotations on 3,500, 7,500 and 13,000 f.o.b. some central point.

Under the same heading discussions were held on Cross Arms, Steel vs. Wood Pins, and Braces and Bolts.

Cross Arms.—Were considered to be too special to bulk orders, each municipality having special requirements as to length and spacing, but it was decided cross arms should be long leaf yellow pine and painted with two coats of good paint. Treated cross-arms not considered necessary.

Steel vs. Wood Pins.—This was settled in favor of a good wood pin. Mr. Sothman preferred an all steel pin, and asked to be placed on record; Mr. Ross voiced the sentiments of the other representatives, by deciding on wood pins for any voltage below 20,000 volts.

Braces and Bolts.—The Commission was asked to secure tenders on standard braces and through bolts.

Auditing.

Under this heading the Engineering Department presented copies of accounting systems and reports from the Public Service Commission of New York State, the Railroad Commission of Wisconsin, the Gas & Electric Light Commission of Massachusetts, and the Ontario Railway and Municipal Board.

These were considered, and then it was resolved that the towns authorize their auditors to meet and draw up a system of accounting to be submitted to a joint meeting as soon as possible.

Rates for Incandescent Lighting.

This discussion was opened by the discussion of lamp renewals. Berlin, Guelph and Woodstock furnish free renewals. It was considered advisable to furnish free renewals, but rates must be made to cover this. This began a discussion on rates. There were many variations of the Toronto plan considered, but they all amounted to some type of differential rate. The two plans considered best were to charge a monthly charge based on the number of rooms and a kw. hour rate, and, second, a fixed monthly charge based on the floor area of the house and a kw. hour rate. After a long discussion Messrs. Philip, Sifton and Archibald were appointed a committee to get an example of rates from all the municipalities and compare them, and compare estimated results of the various plans.

Grounding of Neutrals.

It was decided that all neutrals should be grounded.

Single vs. Three-Phase Transformers.

It was found that the manufacturing companies were not prepared to give full data on three-phase service and station transformers at the voltages required, so this question was postponed for discussion at the next meeting. Meanwhile any municipality desiring to expedite matters is to ask for tenders—and the Commission will secure general data on the subject.

Next Meeting.

It was decided that the next meeting was to be held at Preston, October 26th and 27th.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

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

8218—October 1—Granting leave to the Manitoba Government Telephone System to place its wires across the track of the C.P.R. at Neepawa, Man.

8219—September 29—Authorizing the C.P.R. to construct industrial spur along the lane in block 10 and 16, and across 24th Street, City of Saskatoon, Sask.

8220—September 29—Authorizing the C.P.R. to construct bridge No. 6.7 on the Cascade Section of its line.

8221—September 30—Authorizing the C.P.R. to open for the carriage of traffic that portion of the double track of the Ontario and Quebec Railway, Smith Falls Section from St. Lazare to Dalhousie Mills.

8222—September 30—Authorizing the C.P.R. and G.T.R. to operate their trains across interlocker at Brampton, Ont.

8223—September 29—Authorizing the Corporation of the City of Toronto, Ont., to lay sewer on Howland Avenue under the tracks of the C.P.R. in said city.

8224—September 29—Granting leave to the Rural Municipality of Pipestone, Man., to place its wires across track of C.P.R. near Ewart, Man.

8225—September 30—Granting leave to the City of Winnipeg, Man., to construct for the purpose of a patrol road, suitable crossings where its right-of-way for its transmission power lines crosses the C.P.R.

8226—October 1—Authorizing the West Canadian Collieries, Ltd., to construct an overhead crossing across the C.P.R. at Bellevue, Alta.

8227—September 29—Authorizing the Arthabaska Water & Power Company of Victoriaville, P.Q., to lay water pipe under the tract of the G.T.R. Company about 1,000 feet west of Nicolet River Bridge, at Victoriaville, P.Q.

8228—October 5—Approving and sanctioning location of the Montreal & Southern Counties Railway Company from St. Denis Street, St. Lambert, to Chambly Road, Longueuil County, Chambly, P.Q.

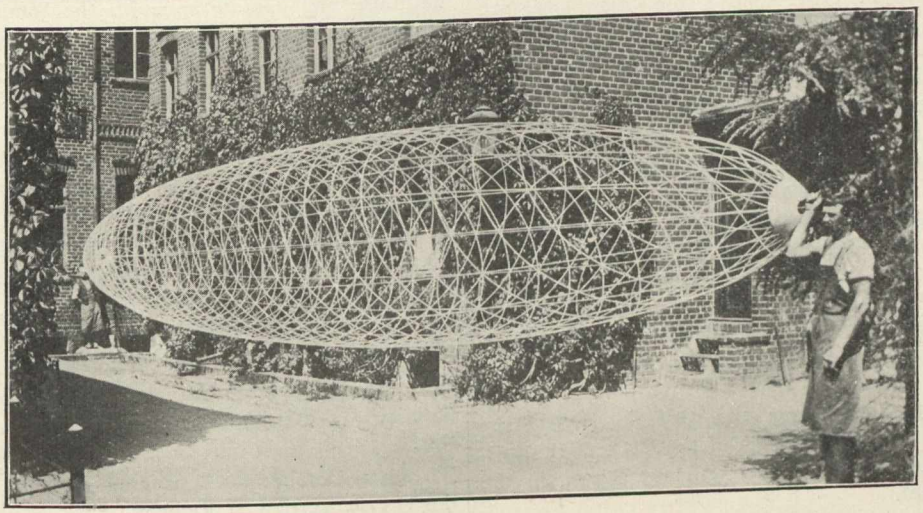
(Continued on Page 454.)

ALUMINIUM TO BE DISCARDED FOR AIRSHIPS IN GERMANY.

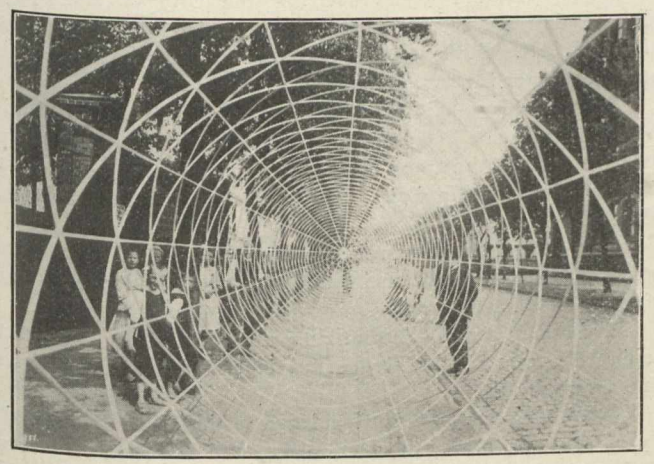
On account of many mishaps with aluminium airships, a new type of airship frame is making its appearance in the German empire, which in this branch of aeronautics is admittedly leading. There went stirring news through the German daily papers some days ago to the effect that Count Zeppelin the first man in aeronautics intends to use no longer aluminium for his airships but some lighter material, among others wood. The idea came to him at last year's accident, when his Z II. exploded. He, himself, and experts, meditated what in all the world could have been the cause of the above catastrophe, and it is now certain that the immense mass of metal contained in the rigid skeleton and cars attracted atmospheric electricity and conducted sparks from the metal to the gas.

Models were built of wood and the best type is illustrated herewith. As can be seen, the whole has the shape of a spindle and thus offers less air resistance than the cylinder of the Zeppelins. We know that the bending moment is greatest in the middle and therefor here the diameter is largest. Such a shape will therefor resist bending forces much better than the cylinder of the Zeppelin ships. Another important feature is that wood can be repaired with few and simple tools and anywhere in villages or open field while a complicated aluminium skeleton requires special apparatus, tools and skilled mechanics which are available only in larger towns and this may prove fatal in the enemy's land, in a future war. Still there are other advantages of which the lighter weight is the principal one. The specific weight of Canadian pine employed here is 0.36 to 0.4, while that of aluminium is eight times as much. On the other hand this metal is three times as strong, anyway a stick of the same strength if of wood, is nearly one-third the weight. Thus, these airships can be made much smaller and yet have the same lifting power. A Zeppelin has reached the smallest size, with 11,000 cubic meters, while the wooden balloons may be 6,500 cubic meters. The inventor, a Berlin architect, has calculated that the saving in weight on account of direct and indirect effect would be about 30 per cent. of the total weight of the Zeppelin balloon frame, which is 10,000 kilograms. In other words if wood was substituted he would obtain 3,300 kilograms more lifting power, and this could be utilized for more fuel or a larger motor or more passengers. The material if coated with weatherproof varnish is unsensitive against heat, cold and moistness, while aluminium and other metals oxidize. Owing to its own elasticity it also can withstand shocks much better. But the main feature is that it does not conduct electric currents and will be comparatively safe in a thunderstorm, while the aluminium balloon of Count Zeppelin was ignited by electric spa ks in the thunderstorm at Echterdingen above referred to, which gave the motive for this invention.

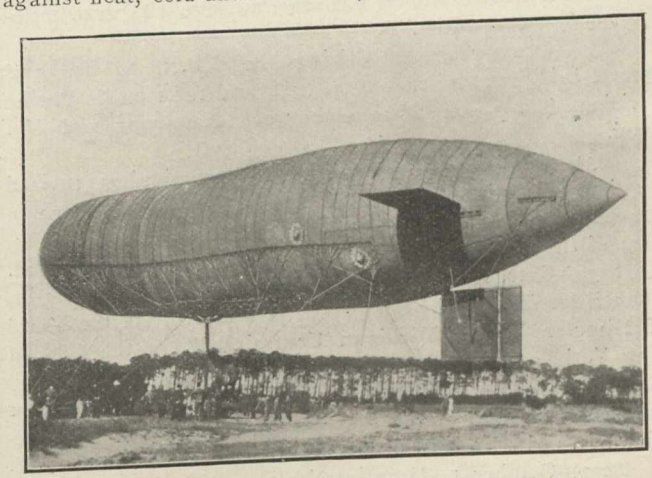
The designer is the Berlin architect, Mr. Rettig, who was the chief builder of the German parliament, and won the first price of national monument. As he has also designed many racing boats and thousands of school benches he has



Wooden Skeleton.



Wooden Skeleton—end view.



New Parseval over trial field of Aero-show.

become an authority in wood. His model illustrated herewith has a length of twenty meters and a height of 2½ meters. It was sent to the international aero exposition at Frankfort this summer, where it was quite an attraction. Now, as airships in full size will be built after his system, but as said before, they are not as big as the Zeppelin, although their lifting power and engine is about the same. The meshes of this type are only 3 to 4 square meters in size, and the envelope being thus supported by a smaller frame can withstand a greater pressure than in the Zeppelins, where the meshes are 8 meters long and 3 wide. Consequently, if through the sunshine or other causes the inner pressure rises, the gas will remain in the balloon and tighten the cover instead of escaping like in the Zeppelin, where the large suspended surface does not permit a great gas pressure. Thus, such a balloon is capable of staying in the air much longer for there is no danger that the envelope will be torn if the gas expands in the sunshine, etc.

RAILWAY ORDERS.

(Continued from Page 452.)

8229—October 5—Granting leave to the Montreal & Southern Counties Railway Company to place its wires for conveyance of electricity across the lands and track of the G.T.R at six different points in its yards at Point St. Charles, P.Q.

8230—October 5—Authorizing the Ontario Pipe Line Co. to lay gas pipes under the tracks of the T.H. & B. Railway, where the same crosses Victoria Avenue South, in the City of Hamilton, Ont.

8231—October 6—Approving of location of the G.T.P. through the City of Fort William, Ont., subject to the condition that the said railway shall do as little damage as possible, and shall make full compensation to all persons interested for all damage by them sustained by reason of the location of the said railway along any street in the said City of Fort William, Ont.

8232—October 6—Approving and sanctioning location of the G.T.P., Prince Rupert easterly, mileage 180.74 to mileage 235.675, coast Dist. B.C.

8233—October 4—Authorizing the C.P.R. to use and operate bridges at mileage 65.1, 84.4, and 106.1 on its Pacific Division, Thompson Section, between Kamloops and No. Bend.

8234—October 5—Approving and sanctioning revised location of station grounds of the G.T.P. on its Yorkton Branch from Sec. 4, Tp. 24, R. 5 to Sec. 6, Tp. 25, R. 4, west of the 2nd Mer. Dist. of Assiniboia, mileage 11 to 18.

8235—October 6—Recommending to the Governor-in-Council for sanction by-law passed at a meeting of the Board of Directors of the Michigan Central R.R. in the City of New York, on 22nd of September, 1909.

8236—October 5 — Authorizing the C.P.R. to open for traffic that portion of the Port Moody Diversion of the Cascade Sec. of its line of railway, from mileage 113.76 to 115.68.

8237—October 5—Granting leave to the C.P.R. to construct its railway across Main Street Village of Shoal Lake, Man.

8238—October 5—Temporarily approving tariff of tolls which the Bell Telephone Company shall be authorized to charge and agreement between the said company and eight other companies located in the Province of Ontario.

8239—September 25—Granting leave to the C.N.R. Co. to cross with its tracks the track of the G.T.P. at or near Riley, Alta.

8240 — October 4—Authorizing the C.P.R. to use and operate bridges on the Central Division, Broadview Section of its line of railway.

8241—October 4—Authorizing the C.P.R. to use and operate four bridges on the Shuswap Section, Pacific Division, of its line, between Revelstoke and Kamloops.

8242—October 7—Granting leave to the C.P.R. to construct its railway across thirteen highways, on its Sudbury-Kleinburg Branch.

8243—October 7—Approving and sanctioning location of the C.N.R. from mileage 72 to mileage 88, up the North Thompson River, from Kamloops, B.C.

8244—October 5—Authorizing the C.P.R. to construct, maintain, and operate spur for the Winnipeg Oil Company, Saskatoon, Sask.

8245—October 5—Authorizing the C.P.R. to construct, maintain, and operate industrial spur in Blocks 4 and 6 across 26th Street, Saskatoon, Sask.

8246—October 5—Authorizing the C.P.R. to construct, maintain, and operate spur to the property of the Kamloops Mines, Ltd., on Lot 43 Yale Dist., B.C.

8247—October 5—Authorizing the G.T.R. to construct proposed iron bridge to replace the present structure at farm crossing, at mile post 11.68 on the 17th Dist. of its line of railway west of St. Catharines, Ont.

8248—October 2—Authorizing the C.P.R. to construct, maintain and operate branch line, or siding, to and into the premises of Benjamin Moore & Company, Ltd., Toronto, Ont.

8249—October 7—Approving location and detail plans of the C.P.R. station at Redvers, Sask.

8250 to 8252—October 5—Authorizing the Corporation of the City of Peterborough, Ont., to lay and thereafter maintain water main under the track of the G.T.R. at Murray Street, McDonell Street, and Ware Street, in said city.

8253—October 5—Authorizing the Corporation of the City of Hamilton to lay and thereafter maintain water pipe under the track of the G.T.R. on Young Street, Hamilton, Ont.

8254 — October 5—Authorizing the City of Winnipeg, Man., to lay and thereafter maintain a sewer under the track of the C.P.R. where it intersects the crossing between Talbot and Carter Streets, Winnipeg, Man.

8255 and 8256—October 5—Granting leave to the Manitoba Government Telephones, to erect, place, and maintain its wires across the track of the C.P.R. 3½ miles south-west Hartney Station, Manitoba, and 2½ miles south of Selkirk, Man.

8257—October 12—Granting leave to the C.N.Q.R. to erect, place, and maintain its telgraph wires under the wires of the G.N.W. Telegraph Company near Cap Sante, P.Q.

8258—October 8—Authorizing the C.P.R. to construct bridge No. 75.1 on the Moose Jaw North-West Branch of its line of railway.

8259—October 5—Granting leave to the Rural Municipality of Miniota, Man., to erect, place, and maintain its wires across the track of the C.P.R. at P.C. one mile west of Arrow River Station, Man.

8260—October 5—Authorizing the Municipal Council of the Township of Harwich, County Kent, Ont., to construct a drain under the track of the Lk. E. & Detroit River Railway Company (P.M.R.R.) in the said township.

8261 to 8264—October 5—Granting leave to the Bell Telephone Company to erect, place, and maintain its wires across P.C. at the M.C.R.R. and P.M.R.R. Highgate, Ont., Montreal Terminal Railway at P.C. at Bout de l'Isle Park, P.Q., and the G.T.R. at Irondale, Hamilton, Ont., and at Notre Dame Street, St. Henry, Montreal, P.Q. (Westmount).

(Continued on Page 471.)

THE

Sanitary Review

SEWERAGE, SEWAGE DISPOSAL, WATER SUPPLY AND WATER PURIFICATION

THE SANITARY ENGINEER OR THE PATENT VENDOR.

Wherein lies the wisdom of a municipality obtaining expert advice from the patent vendor?

Yet such is done every day. The business man comes along with a distribution of pamphlets and a vocabulary of ready-made science. His goods may or may not be the very best in the market. But, who shall judge. Shall the municipality judge? The people who are not in a position to compare the goods with any others in the market, just take for gospel all that the pamphlets have to say, pay the price and save the fees otherwise due, to the sanitary engineer for independent advice.

As soon as a consulting engineer has one dollar invested in a patent contrivance, he loses his birthright. He is no longer a consulting engineer, and has no right to ask to be consulted. He carries one thing in his waistcoat pocket only, the thing he has to sell. Who can blame him if he unduly praises it? This is his business. He is a salesman. If he sells a gilded bar of lead as solid gold, he is cute, this is business.

The consulting engineer should have the whole world market open to him. His choice should be unlimited and unbounded by proprietary interests. This is the advice he is paid for. His remuneration for advice is the only fee which can be due to him. Any other profit is the profit of the tradesman or salesman.

What can be said of the municipality, who, wishing to build a sewer, asks of the brick maker, his expert opinion, as to whether bricks or concrete will make the best sewer?

What can be said of the municipality who are content to elect the trading company for the installation of public works, as contractors and engineers combined?

Yet, these things are done. Lucky for the trading company that they are supreme to pass and certify as perfect their own work. Lucky for the municipality when they obtain the services of a trading company who condemn their own work when they know it to be imperfect, and thus play the rôle of perfect humanity.

There are no questions municipal which require greater variety of treatment, than the questions of sewerage, sewage disposal, water supply and water purification. There is no one defined system of sewage disposal or any one defined system of water purification which will fit all occasions and all local conditions. Every authority of standing in Europe and America has made this clear. Every consulting engineer recognizes this as the first outcome of his practical experience.

The main study of the consulting engineer is first to know his subject in all its aspects, and then, relative to local conditions, design and advise as to the best system to meet the particular conditions.

The prime study of the salesman and patent vendor, is only to know the details of his object of sale, and then force all local conditions to meet and fit into that object.

The consulting engineer is a man who should not only give the best of the maximum in engineering thought, but should also act as an auditor and check with reference to commercial fads, commercial exaggerations, commercial hustle and push which looks for the maximum efficiency in sales at the expense of the maximum efficiency in engineering results.

SEWAGE DISPOSAL.

Removal of Putrescibility.

Chapter VII.—Continued.

Distributing Appliances.

In our last issue dealing with the question of fixed sprays as adopted at Columbus, Ohio; Hamilton, Ont.; Birmingham, Eng., etc., we quoted authorities from the States, and the Royal Sewage Commission, Britain, acknowledging that even and equal distribution was practically unattainable, and further, that much attention was required in keeping the nozzles clear.

Scott-Moncrieff in the Chadwick Lectures last year raises the question of danger to health by spraying sewage from nozzles. He says:—"I think it is most unfortunate that any sort of support should have ever been given by persons responsible for the public health to any kind of sewage distribution that involves the spraying of pathogenic organisms, especially when no provision is made to provide against the action of high winds in throwing them broadcast into the atmosphere. I have no hesitation in saying that spraying septic sewage will one day be the cause of an alarming epidemic outbreak, and that after many lives have been lost this system of distribution will be absolutely prohibited." This statement has led the Birmingham authorities to make a series of observations as to the bacteriological character of the air at and near the sewage works. It can be said, however, that up to the present men working on spray sewage beds have not abnormally suffered from zymotic disease.

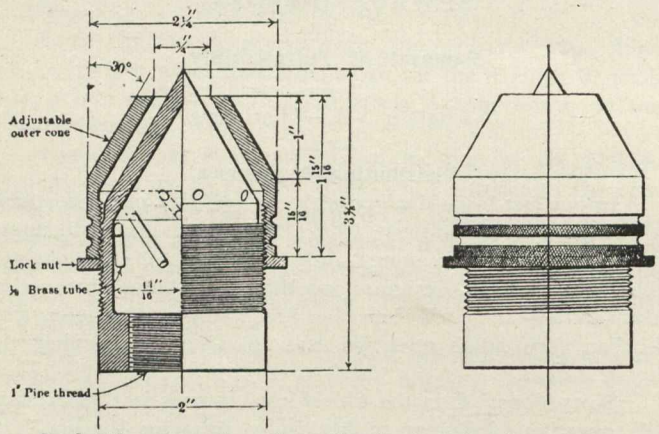
Prof. Winslow in his recently published experiments, "The Sanitary Significance of Bacteria in the Air of Drains and Sewers;" states, "My tests of drain air, like those of Carnelly and Haldane, and Laws and Andrews on sewer air, indicate that mechanical splashing may produce a local infection of the air in immediate contact with the spray. Such an infection does not, however, extend for any distance or persist for more than a minute or so."

It does not appear that there are good grounds for so

Prepared for this review by T. Aird Murray, Consulting Engineer, Toronto.

emphatic an opinion as Scott-Moncrieff has chosen to give. At the same time it would be most objectionable apart from chance of epidemic to locate sewage sprays in thickly populated districts, especially when the liquor sprayed is from septic tanks, the nuisance from smell is very bad indeed. The Royal Commission on Sewage Disposal, par. 158, state; "All forms of distribution in percolating filters are liable to give rise to nuisance from smell, if a strongly smelling liquor is to be dealt with. The nozzle form of distribution is naturally the most liable to give rise to smell."

In spacing out nozzles on a filter bed much depends upon the form of nozzle proposed to be used and the available head pressure. The head should never be less than 3 feet, and the most effective head is found between 6 and 7 feet. There is such a wide difference, however, in the various forms of nozzles now in use that in adopting any particular type, the correct spacing can only be determined by experiment with various heads. It has already been noted that owing to a spray forming a circle, there must be always four corners of the bed between each spray unwetted. As a circle is .7854 of the area of a square, about 78 per cent. of the total area of a filter only receives sewage. This area can, however, be increased to about 90 per cent. by allowing the circumference of each wetted area to overlap, this method is adopted in practice.



Sprinkling Nozzle, First Used at Columbus Ohio.

The difficulty of evenly wetting the whole area enclosed by the circumference of the spray, has been met to some extent by using a varying head. It is obvious that with a high head the portion of the filter bed immediately around the nozzle is overthrown. The action of a variable head, which means a gradual reduction of pressure draws in the circumference until the last of the dose simply wets the area around the nozzle. The objection, however, to a variable head is, the lack of uniformity in quantity distribution.

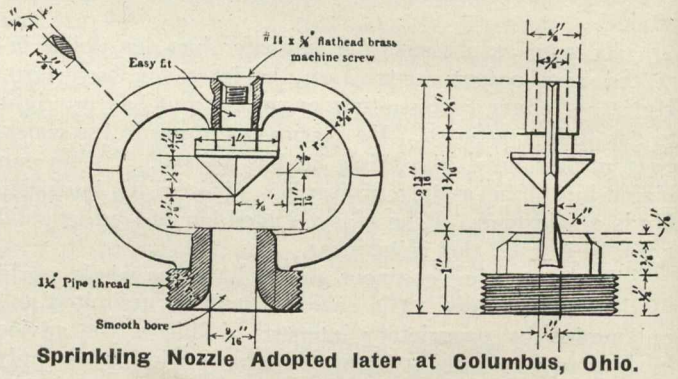
Uniform distribution by means of fixed sprays is greatly affected by winds. It is no uncommon occurrence to find the sprayed sewage at the edge of beds blown clear away from the filters in exposed positions.

Approximately the diameter of circle wetted by a nozzle may be taken at 2'-0" for every 1 foot head. With the Columbus sprinkler, 131 nozzles per acre of filter, at a 4.3 foot head, would provide a rate of filtration of 2,000,000 gallons per 24 hours; being equal to a rate of 10.9 gallons per minute, but only about one-third of the area would be dosed, which would really give a rate of 6,000,000 gallons per acre, the nozzles being spaced 19 feet apart. In order to increase the wetted area and obtain more uniform distribution, the head is varied from 7½ feet to 4.3 feet, providing respectively 13.5 gallons and 10.9 gallons per minute discharges.

At 13.5 gallons per minute discharge the nozzles are spaced about 16 feet apart; requiring 180 nozzles per acre, equal to a filtration capacity of 3,500,000 gallons per acre per day. As the quantity, however, wets about 92 per cent. of the total filter area, the rate is really 4,000,000 gallons per acre per day. Such a filter is only operated half the time so as to reduce the rate to 2,000,000 gallons per acre per day.

The above rate of 2,000,000 gallons per acre per day works out at about 225 gallons per cubic yard of filtering material, allowing a filter bed 6 feet deep. This may appear a high rate as compared with the rates of filtration as recommended in the British Royal Commission report for percolating filters, but it must be understood that the figures apply to American practice which deals with a much weaker form of sewage. Indeed, generally speaking, the rates as given by the Royal Commission can be doubled for treating American sewage. Rates of sewage treatment in proportion to filter area depend principally upon the organic strength of the sewage, and this again depends upon the amount of dilution figured upon the water supply per head per day. American rates of water supply are about double British rates.

In order to obtain an actual rate of continuous spray at 2,000,000 gallons per acre per day, providing about 225 gallons per cubic yard to a filter 6 ft. deep, the nozzles will



Sprinkling Nozzle Adopted later at Columbus, Ohio.

number about 390 per acre, spaced 11 feet apart. Each nozzle will wet a diameter of about 10½ feet at a variable head of from 4 feet to 2 feet, and provide a 4 gallons per minute discharge.

The pipes used for distributing the sewage to fixed sprays should be, generally speaking, of larger diameters than are necessary for the actual quantities of sewage. This must be obvious when the questions of friction and sedimentation are taken into consideration. The distributing pipes should be laid straight with screw cleansing caps at terminals so as to allow of cleaning. The upright branches to the nozzles are generally 3-inch diameter, providing for discharges of from 10 to 14 gallons per minute. In climates where frost is encountered it is necessary to lay the distributing mains on the base of the filter so as to maintain the temperature of the sewage. The method adopted at Birmingham of laying the mains on the surface of the filter would result in failure in North American climates.

The fixed spray has been received with greater favor in America than in Great Britain. In Great Britain travelling distributors and revolving sprinklers have come into general use. The advantages and disadvantages of the fixed spray may be summed up as follows:—

Advantages.

(a) No moving parts, therefore, not liable to freeze in cold climates.

(b) Comparatively a small first cost, the apparatus being simple and easily obtained.

(c) If properly installed easily kept open and clean.

(d) The main part of the distributing system protected from frost by the filtering material.

Disadvantages.

(a) Uniform distribution practically, up to the present, impossible.

(b) A maximum of 92 per cent. of the filter bed only in operation, usually 75 per cent. in operation.

(c) Constant attention required to keep nozzles clear.

(d) Possible nuisance from smell in the neighborhood, or possible distribution of pathogenic bacteria from the spraying operation.

Revolving sprinklers and travelling distributors will be dealt with in the following chapter.

(To be Continued.)

PROGRESS REPORTS ON ABERTHAW TESTS OF ACTION OF SEA WATER ON CONCRETE.

Late in 1908 it was generally reported that tests had been undertaken by the Aberthaw Construction Company, Boston, Mass., in co-operation with the Navy Department at the Navy Yard, Charlestown, Mass., to determine by exposure over a long period what effect sea water might have upon concrete. The specimens were made of various grades of cement in widely differing proportions, and were so placed that the lower portion of the surface of each would be continuously exposed to water, while the upper portion was always exposed to air, and the middle portion alternately exposed to each. At the end of six months of actual exposure, which was recently terminated, a very critical examination was made. Although the specimens had been exposed to freezing temperature during several months of the winter, and to the variable conditions of midsummer, this examination failed to disclose any visible change in the surface of any of the specimens. It is independently stated by the cement chemist, Mr. H. L. Sherman, of Boston, that all cements are behaving in a perfectly normal manner and the tests to date appear to be perfectly satisfactory. It is his opinion that a considerable time must elapse before any results will be obtained which will tend to throw any additional light on the effect of the water on concrete, or on the effect of various compositions of cement.

BOND OF CLAY AND CEMENT BRICK.

In connection with the use of cement for clay brick in the construction of their new mill, the Plymouth Cordage Company, of North Plymouth, Mass., made many interesting comparisons between brick made of the two materials. Bond was recognized as an essential feature in any method of construction, and in this respect cement bricks appear to great advantage. Clay bricks with one pallet side show a better bond than clay brick with both sides perfectly plain. It might be argued that cement brick with plain bed and build would furnish an inferior bond with the mortar. The fact is, however, that the cement brick is perfectly in bond with the mortar, to such a degree that the resulting wall is practically monolithic. Owing to the bond, attempts by the Plymouth Cordage Company to make cleanly cut openings in old work were a failure, unless great care was taken to first cut out the joints. If this was not done, the wall was defaced. Holes drilled through the wall would split out on the other side a space oftentimes over a foot square, especially when drilled from the inside. If mortar was left on the brick in laying, it was impossible to clean it off with any reasonable amount of water and acid and it could not be scraped off without defacing the wall.

The cutting of the cement bricks was found to be one of the most valuable features. It is possible to do almost anything with them. Cuts have been made half an inch thick, for the full length and width of the brick; ¼-inch cut from the full bed of a brick (except ½-inch from the face) to lay over and hide the edge of a casting. These are things which it is impossible to do with the ordinary clay brick.

NEW YORK NOVEMBER MEETING A. S. M. E.

At the New York November meeting of The American Society of Mechanical Engineers, to be held on the 9th, in the Engineering Societies Building, 29 West 39th St., at 8.15 o'clock, there will be two papers presented. One by Professor Gaetano Lanza and Lawrence S. Smith of The Massachusetts Institute of Technology, on "Reinforced Concrete Beams," and the other by Professor Walter Rautenstrauch of Columbia University, on "Stresses in Curved Machine Members."

The paper on "Reinforced Concrete Beams" is the same as that given at the Boston meeting of the Society on October 20th. It compares the results of tests upon full-sized beams made at the Massachusetts Institute of Technology, and the University of Illinois with three different theories of beams of this type.

The paper on "Stresses in Curved Machine Members," outlines the method of procedure for the design of principal sections of hooks, punch and shear frames and other curved machine parts. Experimental results are submitted in support of the theory presented.

The papers of the evening are of a character to draw out discussion upon the stresses in the elements entering into structures and machines and should result in the presentation of data on the general subject of stresses which will be of great importance to the designing engineer.

UNION OF ALBERTA MUNICIPALITIES.

At the annual convention of the Union of Alberta Municipalities, held in Lethbridge, Alta, last week, a good deal of discussion was provoked by a paper on "Municipal Ownership of Public Utilities," by Mayor Jamieson, of Calgary, who advocated that the municipalities should own such utilties as waterworks, sewer and electric light systems, and street railways. The three former should be operated as absolute necessities and given to the people without regard to cost or profit. No municipality should give up the use of its streets. If a corporation can install and operate a street railway at a big profit, the municipalities, with good managership, could do the some thing, and, in addition, keep full control of their streets. He cited the experience of Calgary, which, in the few weeks since the system was put in, had made profits of over three thousand dollars above all possible charges.

The following new officers were elected: Hon president, W. O. Griesbach, Edmonton; president, H. H. Gaetz, Red Deer; first vice-president, R. R. Jamieson, Calgary; second vice-president, W. Gariepy, Edmonton; secretary-treasurer, John T. Hall, Medicine Hat; executive committee, T. Dickson, Macleod; H. L. Higgins, Wetaskiwin; W. Lawrie, Cardston; G. Hatch, Lethbridge; Mayor Lee, Edmonton; and Mayor Young, High River. The convention will be held next year in Calgary.

THE TRACTION OF FREIGHT TRAINS AT DIFFERENT SPEEDS.*

By Clinton S. Bissell, M. Am. Soc. C.E.

The problem of railroad traction is to determine what a given tractive power can accomplish in overcoming a number of resistances, the principal of which is grade. The "ruling grade" is usually the maximum grade on a tangent, and the increase in resistance which would be introduced by curves on the ruling grade is, in the present day, done away with by equating or "slackening grade" throughout the length of the curve, with the purpose of producing a perfectly uniform resistance over tangents and curves alike. In the case of curves not thus equated, the additional resistance due to the curves must be applied as an increase to the ruling gradient throughout the length of each curve, and, if the proportion of curved line be considerable, the judgment of the engineer must decide upon what the ultimate "resisting gradient" will be.

Curves are commonly equated at rates varying between 0.02 per cent. and 0.10 per cent. of gradient per degree of curve, and 0.05 per cent. is a rate largely used for freight tracks where the speed is slow. It is well-known, however, that curve resistance does not vary uniformly with the degree of curve. Among authorities on the subject, the writer finds a general consensus of opinion to the effect that 0.05 for light curves and 0.02 or 0.03 per cent. for very sharp curves is about right, with intermediate values, approximately proportional. Using this as a standard, it is apparent that the amount by which the rate of the ruling grade should be reduced on curves is given by the following equation, in which C is the percentage of reduction and D is the degree of curve:

$$C = \frac{D}{D + 18} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

This reduction is for curves on ruling grades where the train is not required to stop. Using Equation 1, a 1 per cent. grade becomes 0.9 per cent. when equated for a 2° curve, and 0.47 per cent. when equated for a 20° curve. In what follows, the term, g, means either the "resisting gradient" or the "ruling grade compensated for curvature," at about this rate.

In a paper† recently presented to the Society, the writer developed the following equation, expressing the form of variation in the case of the weights of heavy freight trains moving at the slow speed of from 10 to 7 miles per hour:

$$\text{Tons of train weight behind tender} = \frac{P - 20\,g\,m}{\frac{a}{b + W} + 20\,g} \quad \ldots\ldots (2)$$

in which P = the drawbar pull, in pounds, m = the weight of the locomotive and tender, in tons, a and b are constants, W is the average weight per car of the train, in tons, and g is the rate of the ruling grade, in percentage, the ton being of 2,000 lbs. For a locomotive, weighing, with its tender, 168 tons, exerting a drawbar pull of 32,100 lbs., and hauling a train of modern high-efficiency cars, which is representative of ordinary conditions, this equation becomes:—

$$\text{Tons of train weight behind tender} = \frac{32\,100 - 3\,360\,g}{\frac{249.6}{11.2 + W} + 20\,g}.$$

In order to adapt Equation 2 to speeds greater than 10 miles per hour, two changes must be made. As the speed increases, the drawbar pull, P, decreases; and, to a much less extent, the car resistance, $\frac{a}{b + W}$, increases. The variation in the drawbar pull is unquestionably in the form of a curve, and elaborate modern tests** have shown that the rate of change is comparatively low at high speeds, becoming more and more rapid as the speed decreases, until near the limiting maximum value of the tractive power. At this point the curve usually exhibits a quick decline, producing contrary flexure; and, for modern heavy locomotives, this takes place at a speed of between 10 and 6 miles per hour. Such a variation cannot be expressed algebraically without great complication, but fortunately the major part of the curve, above 10 miles per hour, may be expressed very simply as an algebraic equation. From the records of the Pennsylvania Railroad Company the writer obtained the following data pertaining to a heavy freight locomotive of the type used in this study:

Speed, S, in miles per hour.	Drawbar pull, P, in thousands of pounds.
10	32.10
16	22.37
30	10.35

Observing that a suitable form of equation for a curve through these points is:

$$P = \frac{h - k\,S}{n + S},$$

in which h, k, and n are constants, and S is the speed; and deducing the constants, the expression for the drawbar pull becomes:

$$P = \frac{863.5 - 14.1\,S}{12.5 + S},$$

in which P is in thousands of pounds, and decreases as the speed increases, in proper proportion, as shown on Fig. 1.

The second step is to find an expression for the increase of train resistance, in pounds per ton, in proportion to the increase of speed. For this purpose the writer refers to the paper§ "Virtual Grades for Freight Trains," by A. C. Dennis, M. Am. Soc. C.E. Fig. 1 of that paper exhibits several curves of train resistance, and, commenting upon them, Mr. Dennis says:

"The train resistance, in pounds per ton, compensated for change in velocity head, grade and curvature, was plotted for very many points and speeds for each train, and the mean of these points taken, as nearly as possible, for each train. Fig. 1 shows what is believed to be the correct resistance under the conditions given, and differs radically from the results obtained by Wellington and other authorities experimenting with light trains, cars and rails."

For this investigation the writer selected the curve marked "52 Loaded Box Cars. Tare 37 per cent. of Gross Weight.

*American Society of Civil Engineers, Vol XXXV., No. 7, page 847.

†"The Maximum Weights of Slow Freight Trains," by C. S. Bissell, Transactions, Am. Soc. C.E., Vol. LXIV, p. 303.

**For example, "Locomotive Tests and Exhibits, Pennsylvania Railroad System, Louisiana Purchase Exposition," 1904.

§Transactions, Am. Soc. C.E., Vol. L, p. 1.

Track Soft," and used only that portion which is for a speed greater than 10 miles per hour. Taking the ordinates by scale, the following was obtained:

Speed, S, in miles per hour.	Resistance, Y, in pounds per ton.
15	4.50
25	4.73
35	5.00

in which the resistance, 4.73, is about 0.1 greater than as shown by the curve. In the light of Mr. Dennis' comments, this slight modification will not vitiate the accuracy of the following expression for resistance, which was deduced in the same manner as that for drawbar pull. The curve,

$$Y = \frac{388}{150 - S} + 1.625,$$

passes through the three points tabulated above. Had the modification not been made, the numerator of the fraction would have been smaller and the denominator, 150 — S, would have become about 47 — S. For speeds near 47 the variation would then have become much too great, since the curve has a rapid flexure on approaching its asymptote, S = 47. Under the circumstances, this slight change seems preferable to the complication necessary for a more exact treatment of the case.

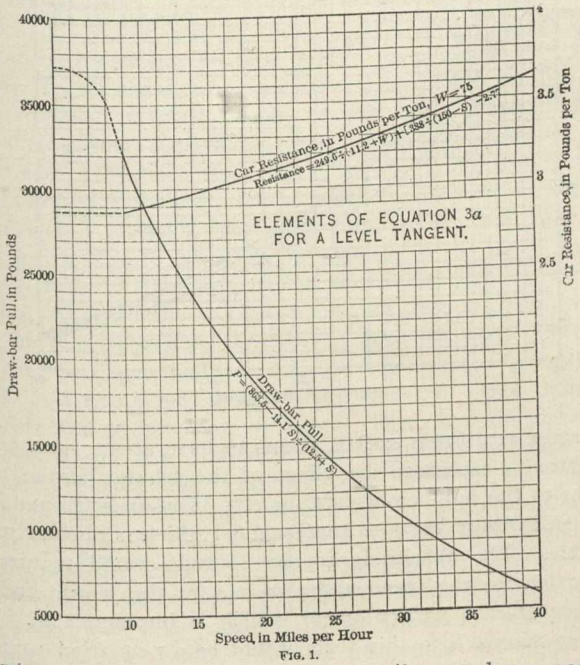


Fig. 1.

The value of Y for a speed of 10 miles per hour, according to this equation, is 4.396 lbs., and the increase in resistance at this speed must be zero, hence the constant, + 1.625, becomes — 2.77, and the expression for increase in resistance due to speeds exceeding 10 miles per hour is:

$$\text{Increase in car resistance} = \frac{388}{150 - S} - 2.77.$$

Denoting the constants by the letters, r, t, and c, and substituting the two expressions in Equation 2, the general equation is formed:

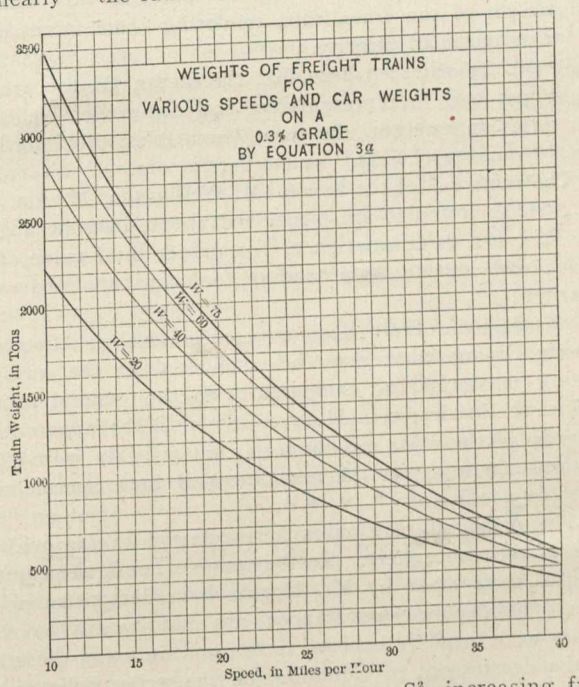
$$\text{Train weight, in tons, behind tender} = \frac{\dfrac{1\,000\,(h - k\,S)}{n + S} - 20\,g\,m}{\dfrac{a}{b + W} + \dfrac{r}{t - S} - c + 20\,g}. \quad (3)$$

in which S is the speed, in miles per hour, W is the unit of train weight behind the tender, expressed as the average weight per car, in tons, and the remaining letters are constants, as heretofore designated. Substituting in Equation 3 the constants for the locomotive and cars used in the given example, there results the equation:

$$\text{Train weight, in tons, behind tender} = \frac{\dfrac{1{,}000\,(863.5 - 14.1\,S)}{12.5 + S} - 3\,360\,g}{\dfrac{249.6}{11.2 + W} + \left(\dfrac{388}{150 - S} - 2.77\right) + 20\,g} \quad ..(3a)$$

It will be noted here that the train weight varies with a multiple of the square of the speed, which is in accordance with past experience.

As a matter of suggestion, the writer wishes to call attention again to the expression for increase in train resistance due to speed. Regarding the curve passing through the points, S = 15, Y = 4.5, and S = 35, Y = 5.0, as a circle tangent to the dircetion of abscissas at S = 0, and applying the principle that "the square of any distance divided by twice the radius will equal the distance from tangent to curve very nearly"* the radius is found to be 1,000. This gives the



rate of increase in resistance as 0.0005 S^2, increasing from S = 0. For S = 10 the value is 0.05, and therefore the increase in resistance above 10 miles per hour will be (0.0005 S^2 — 0.05), which may be substituted in Equation 3a for the expression $\frac{388}{150 - S} - 2.77$, if desired. The results are practically identical, the difference at 50 miles per hour being only 0.09 lb. per ton. The writer prefers the expression containing only the first power of S, because of its greater simplicity, and its flexibility in adaptation to data obtained by experimental tests. The curve on Fig. 1 marked "Car Resistance" shows the form of variation for an average car weight of 75 tons.

The results of Equation 3a for car weights of 20, 40, 60, and 75 tons, on a 0.3 per cent. grade, are exhibited in Fig. 2; and for similar car weights on a 1 per cent. grade in Fig. 3.

*This statement is to be found appended to tables designed by George T. Keith, M. Am. Soc. C.E.

The great effect which the car weight has is apparent from these curves.

The writer had completed the form of Equation 3a before he realized that the expression for car resistance was a form over which there has been much discussion and disagreement in years past. Those interested will find in "Economics of Railroad Construction," by Walter Loring Webb, M. Am. Soc. C.E., a carefully drawn comparison of formulae for "train resistance" identified with the names of Baldwin's Locomotive Works, Wellington, Barnes, Aspinwall, and Searles. All these formulae are of the form:—

Resistance, in pounds per ton = constant + multiple of velocity.

Professor Webb calls attention to the fact that only Searles' formula and Wellington's (which was based on Searles') contain a factor varying with the train weight, and he emphasizes the necessity of this element in any expression which aims to comprehend the entire range of variation. It is noticeable that the constant in the above form was evidently chosen to represent an average value for the expression, $\frac{a}{b + W}$, in Equation 3, and that, in the two formulae just mentioned, a part of the resistance is made to vary with the total weight of the train, thus rendering them more accurate for extremes of velocity.

It will be observed here that the factor, W, the average weight per car, is representative and comprehensive of all such terms as "weight the train," multiples of "length of train," "number of cars," or similar factors.

The remarks* of the late A. M. Wellington, M. Am. Soc. C.E., whose formulae are mentioned above, indicate a doubt as to his own determination of the proper total value of the various resistances. As a heading for some tabulated values he writes:

"Table 166. Train Resistance on a Level as Affected by Velocity Giving what may be considered as the ordinary working maximum, as computed from the general formula of Wm. H. Searles, coinciding closely with the apparent indications of the most recent† tests, but possibly as much as one-third too high for the resistances at high speeds under favorable conditions * * *."

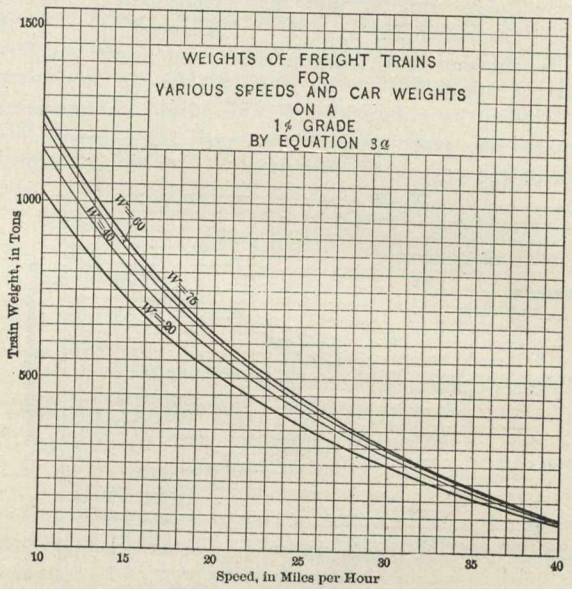
The principal resistances here referred to are evidently those of the atmosphere. To the writer's mind, the carefully executed tests made by Mr. Dennis have demonstrated that normal atmospheric resistances are not nearly as great as they were formerly believed to be; and, in using these tests for the developmnt of Equation 3a, the writer believes that the atmospheric resistances are represented by the slight upward trend of the curve used to show this variation.

Professor Searles says:** "A formula which shall express the resistance of a train to uniform motion must include at least the velocity and the weight of the train and engine."

In the development of Equation 3a, the writer has regarded the engine as merely the extraneous agent which supplies the drawbar pull. Since the drawbar pull contains no element of the internal or other resistances of the engine, the form of development has made it unnecessary that the engine weight should appear in the equation.

It has been difficult to obtain data with which to compare the results given by Equation 3a, but such comparisons as could be made have been satisfactory. In formulating the equation, the great object has been to deduce expressions which would represent the variation accurately to a point well beyond the extreme limit of speed. Recognizing that the problem is not one of absolute precision, the writer has in all cases used curves involving only the first power of the independent variable in preference to more complicated forms. The constants for each of the three curves, that is, the drawbar pull, the car resistance, and the increase in car resistance, must be determined by actual tests, and, therefore, upon the excellence of the tests depends the accuracy of the results. From good tests the constants can be easily deduced for each curve by a simple algebraic process. When this has been done, the car resistance constants may be retained, and only those in the expression for drawbar pull will need to be changed in order to suit the type of locomotive used.

The great disparity between the results of formulae which have heretofore been deduced to express the resistance



of a train at diffrent speeds seems to have arisen from either a failure to recognize the effect of the relation of the train weight to the number of cars, or else from an attempt to deduce an average value to represent it, which is obviously impossible. The absolutely correct formula would require an expression for the speed and also one for the weight and resistance of each particular car, which is impracticable. The nearest approach to this form would be an equation containing the speed factor, the number of cars, and the weight of the train, and this is the form of Equation 3, except that the two latter factors have been merged into one, "the average weight per car" of the train, which is a most convenient expression for the purpose to be served.

Equation 3 is adapted for use in all cases of hauls made by locomotives of either steam, electric, or other motive power; and also in cases of multiple-unit trains since each unit may be considered as a separate train. The general method of developing the three curves will be the same as exemplified above, except that the form of one or more of them might need to be changed to suit special forms of cars. It does not appear probable, however, that such a change will be necessary, for many years at least, except perhaps in the curve for the increase in car resistance due to increase in speed. It is with great interest that the writer presents this development, in the hope that the discussion may bring out whatever fallacies or errors exist, in order that they may be rectified, if possible.

*"The Economic Theory of Railway Location," by A. M. Wellington, M. Am. Soc. C.E.

†Not later than 1887. (The writer.)

**Field Engineering," by William H. Searles, M. Am. Soc. C.E.

DUST PREVENTION BY CALCIUM CHLORIDE.

From W. A. Mackinnon, Canadian Trade Commissioner at Birmingham, Eng., we have received the report of the official test made by the Roads Improvement Association of Great Britain. The judges were A. Dryland, A.M. Inst. C.E.; H. P. Maybury, county surveyor, Kent; Geo. W. Manning and W. J. Atkinson Butterfield, M.A. Assoc. Inst. C. E.

Introduction.—This official test of calcium chloride was carried out by the Roads Improvement Association (Incorporated) at the request of the manufacturers, Messrs. Brunner, Mond & Co., Limited, of Northwich, in pursuance of the association's policy of ascertaining and publishing trustworthy data as to the cost and effect of various materials for fixing the surface dust.

Nature and Properties of Calcium Chloride.—Calcium chloride is produced in large quantities as a bye-product in the ammonia-soda process of manufacturing common washing soda and in certain other chemical processes. It may be obtained in a number of forms, varying in composition only according to the amount of water contained therein. For instance, the common crystals of calcium chloride contain about 50 per cent. of water and 50 per cent. of true calcium chloride. Another fairly defined modification contains about 76 per cent. of calcium chloride and 24 per cent of water. By strong heating it may be obtained free from water. In all these, and in intermediate states, it has the property in a marked degree of absorbing moisture from the surrounding atmosphere, and if left exposed to damp air it eventually becomes a thick, syrupy liquid through the absorption of moisture. If it is then exposed to a dry atmosphere it will gradually part with some of this moisture and re-absorb moisture when again exposed to a moist atmosphere. It is on this property of absorbing large quantities of moisture that the utility of calcium chloride for laying dust on roads depends. The salt as supplied by the entrants for the "dry" method of treatment was in a granulated form, and contained about 70 per cent. of true calcium chloride and 30 per cent. of water. The effect of spreading this salt on the road is that it rapidly absorbs moisture from the atmosphere; the granules soon become soft, moist globules, which ultimately liquify by further absorption of moisture, and are then absorbed in the pores or interstices of the road-surfacing material. The syprupy nature of the liquid which results from calcium chloride by the absorption of water hinders its removal from the road material by washing due to rainfall, though ultimately prolonged wet weather must result in the extraction of nearly the whole of the salt from the material. The trials demonstrated, however, that even in very favorable conditions for the removal of the salt from the road material by rain an appreciable amount was retained for several weeks. When absorbed in the pores and interstices of the road the calcium chloride takes up or gives off moisture according to the degree of humidity of the atmosphere at the time. Thus, on a dry, hot day it will tend to become dryer, but will never in the conditions in this country pass beyond a certain stage, in which it is still a syrupy substance, having more or less binding action, due to its viscosity on the road material in which it has been absorbed. On the other hand, when the humidity of the atmosphere is increased, as is commonly the case at nightfall in this country even on dry days, the calcium chloride absorbed in the road will take up moistture from the atmosphere, and thereby render the road material moister than before. Thus in summer weather the effect of the treatment of a road surface with calcium chloride is to provide the material of the road with an ingredient which keeps it in a slightly damp condition by absorption of moisture from the atmosphere. Even in the dryest and hottest weather the road cannot become absolutely dry, and any dust or small particles which are picked up from it must, owing to the heavy, syrupy solution of calcium chloride incorporated with them, be disinclined to break up into small, fine particles, which would be carried or held in suspension for any appreciable time in the atmosphere. Consequently, any dust which may be raised from a road treated with calcium chloride is of a denser and less finely divided description, and so falls to the ground more rapidly. Calcium chloride is a body without any prounounced toxic or corrosive properties. By its solution in water the temperature of the water is considerably reduced for the time being, and a solution of calcium chloride in water freezes at a considerably lower temperature, depending on the amount of salt in the solution, than pure water.

Place of Test.—The test was conducted upon a stretch of road, constructed of granite macadam with water binding, one mile in length, from Ashford Station towards Stanwell village, in Middlesex, known as the Stanwell Road, Ashford.

Material Used.—The material used was calcium chloride in granular form. The entrants supply this material in barrels, holding approximately 9 cwts., at 50s. per ton, free on rails at their works, Northwich. They also quote the following prices:—

62s. 6d. net, per ton, delivered North London Station.
59s. 2d. net, per ton, delivered F.O.Q., Glasgow.
54s. 2d. net, per ton, delivered Manchester Station.

Methods of Treatment.—The entrants proposed that two methods of application of the material to the road should be tested:—

(1) By dissolving the granular calcium chloride in water and spraying it in solution upon the road from an ordinary watering cart (referred to in the report as the "wet" method; and

(2) By distributing the granular calcium chloride dry over the surface of the road (referred to in the report as the "dry" method).

The mile stretch of road allotted for the test is divided by the main London-Staines Road running across it. The section between Ashford Station and the crossing of the London-Staines Road, an area of 7,166 super yards, was treated by the "wet" method, and the other section, with an area of 4,400 super yards, from the juncture with the London and Staines Road towards Stanwell Village by the "dry" method.

Dates of Treatments.—The entrants' process is to give the road two initial treatments, twenty-four hours between each. Monday and Wednesday, May 24th and 26th, were originally arranged for the treatments to be applied. The treatments were duly applied on Monday, May 24th, in fine weather. Details of the material laid on, amount of labor employed, etc., will be found in Schedule No. 1 appended. On the night of Monday, May 24th, approximately an inch of rain fell, and, as rain continued on the Tuesday and Wednesday (the rainfall for the three days amounting to 1.36 inches), the judges acquiesced in the request of the entrants that the test should be postponed, owing to the inclement weather. June 12th and 14th were thereupon fixed for the treatments to be applied. As the section that had been treated by the "dry" method still showed some effect of the treatment on June 12th, the date fixed for the first of the re-treatments, it was decided not to treat further that section of the road, but to keep it under observation. The effect

of the "wet" treatment having disappeared, being practically washed out on May 25th, it was decided to re-treat that section (London Road to Ashford Station) by the "dry" method, and that no further trial should be made of the "wet" method. Schedule No. 2 appended gives particulars of the material laid down, labor, etc., in connection with the treatments on June 12th. This section was further treated on June 14th.

Analysis.—In order to obtain information as to the amount of calcium chloride retained by the road material after the lapse of a definite period, samples of the road material were taken from three different portions of each of the treated roads to a depth of 1½ to 2 inches from the surface, and the chlorine present therein was estimated. In order to exclude the small quantities of chlorine that might have been present in the road material before application of the calcium chloride, similar samples were taken from portions of untreated road of similar construction in the immediate neighborhood, and the chlorine present in this untreated road material was determined. The amount found in the untreated material was deducted from that found in the material from the treated portions of the road, and the difference consequently represented the amount of chlorine added to the road material through the application of calcium chloride. The amount of chlorine thus found in the material from the treated portions of the road in excess of that in the untreated portions is stated below in terms of the equivalent amount of 70 per cent. calcium chloride as used for the treatment of the road. The samples of road material were all taken on 13th July; i.e., approximately seven weeks and four weeks after the two portions of the road had been treated. It was thus found that the calcium chloride remaining in the road material at the end of seven weeks after the treatment on 24th May amounted to 0.21 pound per square yard of road surface, and that remaining in the road material one month after the treatments on 12th and 14th June amounted to 0.4 pound per square yard of road surface. A portion of the latter amount may be ascribed to the previous wet treatment. These figures must be taken as only approximately exact, owing to the difficulty of obtaining a small sample of the road material representing an accurately measured area of its surface, and to the fact that the calcium chloride probably penetrates to a greater depth than two inches below the surface. It may, however, be accepted that the amount of calcium chloride retained by the road material is not less than the amount stated, and is probably more. It is likely, however, that calcium chloride, which may have penetrated to a greater depth than two inches, would be practically useless so far as the suppression of dust is concerned. The amounts stated represent at the end of seven weeks about 40 per cent., and at the end of one month 57 per cent. of the amount of calcium chloride applied to the road, assuming the original dressing by the wet method had by that time become exhausted.

Judges' Comments.—We are of opinion that the results of the tests of calcium chloride applied in granular form by the "dry" method have shown that it is a very effective dust layer, and, provided no ill effects are experienced in winter as a consequence of the treatment, we are of opinion it is a cheaper and preferable process to that of street watering, which, as now carried out, is undoubtedly very injurious to macadamized roads.

SCHEDULE No. 1.

Official record of time occupied, material used, labor employed, etc., in connection with the treatment of granular calcium chloride applied to the road on May 24th by the "dry" method:—

Date of Treatment—Monday, May 24th, 1909.
State of Weather—Very hot, sunny and dry. Temp. about 110° Fahr. in sun.
Name, Length, and Area of Road—Town Lane, Stanwell—from London and Staines Road towards Stanwell.

Length of Road	880 yards
Average width of road	5 yards
Area treated	4,400 yards

Nature of Treatment—Material applied by "dry" method.
Preparation of Road and Labor—

	Rate.	Amount.
Only manure, paper, etc., removed, one man, ¾-day	¾-day	$0 60
Net amount of granulated calcium chloride used: 20 cwt., 0 qr., 16 lbs. = 2,256 lbs.	66/3 per ton (50/- material and 16/3 carriage)	16 20
Labor—Loading material into barrows and spreading: 5 men, 2 hours each	6d. per hour	1 22
Carting: 1 horse, 1 cart and 1 man, 3 hours each	1/- per hour	73
Entrant's foreman instructing and assisting in all above work: 3 hours	7½d. per hour.	45
Total cost = 42c. er sq. yard.		$19 20

General—The material was distributed on the surface of the road partly by shovels from a cart and partly by hand from pails.

2,256 pounds of material was spread over 4,400 square yards, or .51 of a pound of material to one square yard of road surface.

SCHEDULE No. 2.

Official record of time occupied, material used, labor employed, etc., in connection with the treatment of granular calcium chloride applied to the road on Saturday, June 12th, 1909, by the "dry" method:—

Date of Treatment—Saturday, June 12th, 1909.
State of Weather—Cold, showery. Temp. 58° fahr.
Name, Length, and Area of Road—Stanwell Road, Ashford—Ashford Station to London and Staines Road.

Length of Road	1,000 yards
Average width of road	7⅙ yards
Area of road	7,166 yards

Nature of Treatment—Material applied by "dry" method.

	Rate.	Amount.
Preparation of Road and Labor—Only manure, paper, etc., removed, 1 man, ¾-day	¾-day	$0 61
Amount of Material Used—Net amount of granulated calcium chloride used: 22 cwt., 1 qr., 9 lbs. = 2,501 lbs.	66/3 ton (50/- material and 16/3 carr.)	18 08
Labor—Loading material into barrows and spreading: 6 men, 2½ hours each	6d. per hour	1 83
Entrant's foreman instructing and assisting in all above work: 2½ hours	7½d. per hour	38
Total cost = 29c. per sq. yard.		$21 10

General.—The material was unloaded into hand barrows and spread by hand from pails.

2,501 pounds of material was spread over 7,166 super yards of road surface, or .35 of a pound of material per square yard of road surface.

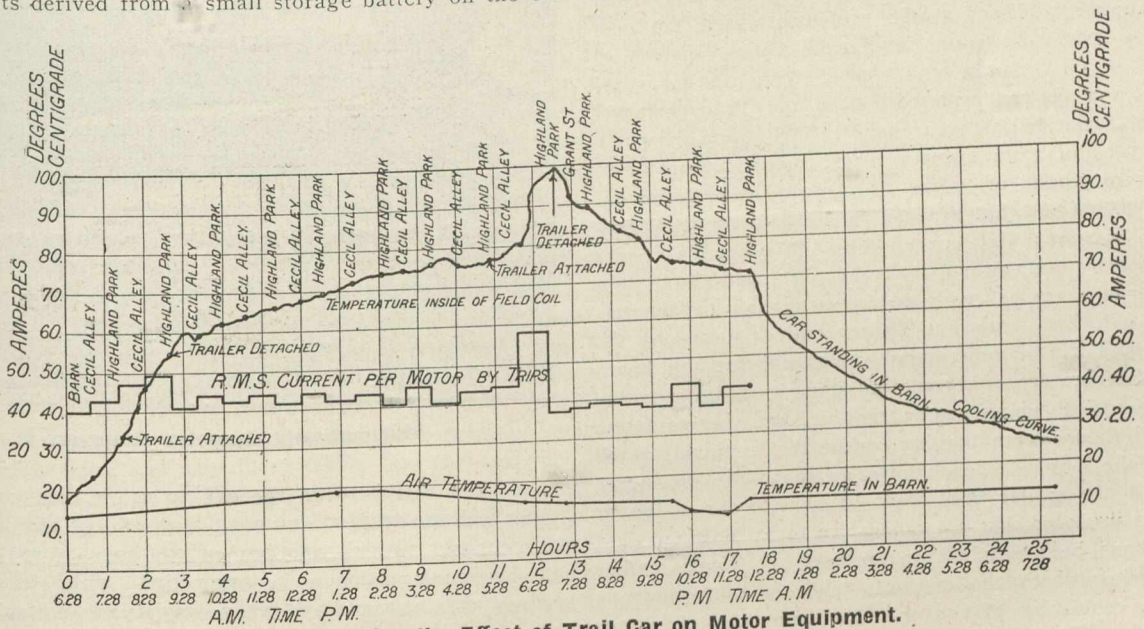
RECENT DEVELOPMENTS IN RAILWAY MOTOR CONTROL.*

By Clarence Renshaw, Westinghouse Electric & Manufacturing Company.

The control of railway motors, as practised to-day, depends upon some half a dozen or more fundamental principles, such as the magnetic blow-out, the series-parallel connection, the power-operated switch with indirect control, and so on, and during the period which may reasonably be included in the scope of this paper, there have been no new developments of this sort for me to chronicle. In the perfecting of details and the production of new forms, sizes and modifications of apparatus, however, many things of interest and importance have been done.

Unit Switch Control.

The most important developments of the latter sort have been in the unit switch system of train control. Designed originally for elevated and electrified steam railroad service, this control has heretofore been made for use with automatic acceleration only, and with the power for operating the control circuits derived from a small storage battery on the car.



Curves Showing the Effect of Trail Car on Motor Equipment.

In this system of control it is only necessary for the motorman to place the handle of the master controller in the series or the parallel position and the switches will then close automatically, under the direction of a current-limit switch in the motor circuit, and cut out the resistance until the full series or full parallel position is reached. This effect is accomplished by making the master controller merely close the magnet valve circuit of the switches required for the first step, and arranging other circuits so that the closing of these switches establishes new circuits to the magnet valves of the switches for the second step, and so on, by means of auxiliary contacts or interlocks mounted on switches.

This system of control is remarkably simple, considering the results that it accomplishes. About 1,000 or more of these equipments are in use on a number of large roads throughout the country, where they are giving excellent satisfaction. Many operators, however, have hesitated in adopting the system for use on single cars or two-car trains, with equipments of moderate size, because of the apparent complications due to the automatic features, and on this account a much simpler form of unit switch control has recently been developed for use in such cases.

In the simplified form of unit switch control, the various connections between the motors and the resistances are made by means of seven or more (according to the size and number of the motors) pneumatically operated switches assembled together in a "switch group," and one pneumatically operated "reverser." Each switch is connected to the piston of a pneumatic cylinder, and normally held open by means of a powerful spring. The opening or closing of the switch is regulated by means of a magnet valve, which admits compressed air when the circuit of the magnet is closed, and releases it when the circuit is broken. The reverser is moved to one or the other of its two positions by admitting air to one or the other of two cylinders similar to those on the switch group.

The supply of air for closing the switches is obtained from the main reservoir of the brake system, which is piped to an air chamber in the switch group, through suitable cocks and valves, together with an emergency storage tank for operating the car in case of failure of the compressor. The small amount of power which is required for operating the magnet valves is obtained from the trolley through a "control resistance," and its application is governed by a master controller at each end of the car. A direct wire from the magnet valve of each switch, or combination of switches, is carried to the master controllers, and these are so arranged that when the handle is moved to any notch, the circuit of the magnet valves of the several switches corresponding to that notch is closed and the switches are thus operated. By moving the master controller from notch to notch, therefore, the motorman starts and controls the motors in exactly the same way as with the ordinary hand-operated controller, except that instead of being mechanically connected to a re-

*Abstract of paper presented as Section (L) of the report of the Committee on Equipment of the American Street & Interurban Railway Engineering Association.

volving drum, located on the car platform and carrying the various contacts, the handle which he turns is connected by means of the magnet valves and pneumatic cylinders to much more powerful contacts close to the motors and underneath the car. It will be readily appreciated that such an arrangement is much simpler to understand than the automatic form, and as a matter of fact, the various circuits with this form of control can be as easily traced out as those of the ordinary drum-type controller.

The various circuits are carried to a multi-point train line receptacle at each end of the car, so that the circuits on two or more cars can be connected together by inserting a suitable jumper between adjacent receptacles, and the corresponding switches on each car can then be operated simultaneously by moving a single master controller.

Instead of the usual circuit breaker above the motorman's head, a small plunger is so arranged on the side of the switch group that when the current exceeds the desired amount the plunger is drawn in by the magnetic action of the blow-out coil at the end of the group, and by its movement opens the circuit to the magnet valves of the various switches, thus opening the switches. After having been opened in this way, the switches cannot be closed again until the master controller has first been returned to the "off" position. All of the main circuit contacts, therefore, corresponding to both controller and circuit breaker, are removed from the platform and located beneath the car.

The return of prosperity to the country after the recent period of depression is bringing to both city and interurban railway companies serious traffic problems which can best be solved by operating trains at certain times, instead of single cars. This matter was treated from an operating standpoint in a paper presented before the Transportation & Traffic Association last year by D. F. Carver, in which the advantages of train operation are clearly brought out.

Such trains could, of course, be made up of a motor car and a trailer, but at what expense to the equipment is indicated in the accompanying curve. This embodies the results of tests made by the writer a few years ago, and shows that the addition of a trailer (with the same seating capacity as the motor car, but somewhat lighter body and truck) for only one round trip of approximately one and one-half hours raised the temperature of the motors from its ordinary value of 75 degrees C. to about 100 degrees C., and that over two and one-half hours were required, after the removal of the trailer, for the motors to cool down again to the 75 degree point. Had the trailer been kept in service for a longer period, it is probable that a temperature of at least 110 deg. C. would have been reached, in spite of the Cool October weather during which the test was made. With multiple unit trains, consisting of two or more motor cars, however, the load on the equipment is even less when the cars are coupled in trains than it is when they are run singly, and it was with the idea of providing suitable apparatus, of the simplest and most reliable character possible, to enable such trains to be operated that the simplified form of unit switch control has been laid out.

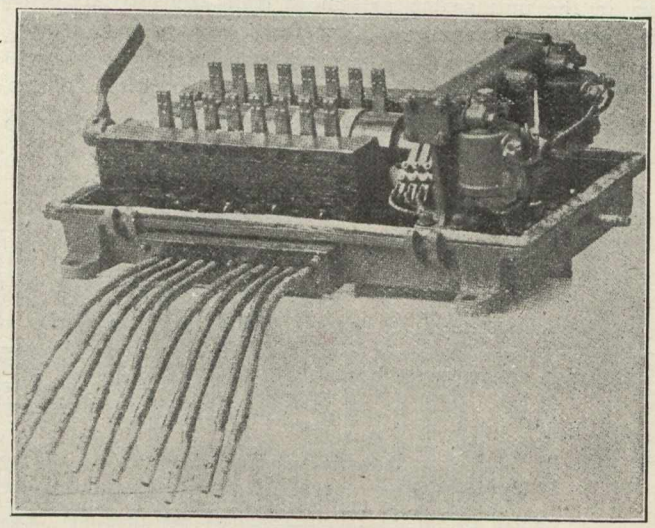
Nearly all of the essential features of the switches, magnet valves, etc., employed in this form of unit switch control, are not new, but have been in use for a number of years. We feel, however, that the simplification of the control circuits, and the general reduction in the number of parts required to make up a complete equipment, has now placed the apparatus on an entirely different basis, and opened up a new and wider field for its application than was ever before thought possible.

General experience shows that the introduction of a new method of accomplishing a given purpose always leads to improvements in the old method, rather than to its abandonment, as might be expected. As a result of this principle, the more common use of indirect control has led to various improvements and special features in the direct or hand-operated controllers.

One of these improvements is the use of an auxiliary unit switch contractor in connection with the controller, for reinforcing and protecting it. To accomplish this purpose a single pneumatically operated switch is mounted beneath the car, and the circuit to its magnet valve closed or opened by means of a pair of auxiliary contacts, operated by the main controller drum.

Multiple Unit Operation with Hand-Operated Controllers.

In cases where double motor equipments are used instead of quadruple, and especially with single-end cars, two-car multiple unit train operation may readily be arranged for with ordinary hand-operated controllers. To secure this, it is merely necessary to use a four-motor controller and resistance on the cars instead of a two-motor one, together with suitable receptacles and jumpers for connecting the two motors on the rear car to the controller on the forward



Pneumatically Operated Reverser.

one. When this is done the two-car train then consists of a standard quadruple equipment with two of the motors on one car, and two on another, or, to use a term which is now becoming common in connection with electric locomotives, the two-car train really consists of an "articulated" car.

With double-end cars no simple arrangement can be made so that the cars will be interchangeable, but similar operation can be secured by providing a certain number of head-end cars and a similar number of rear-end cars, in which case only the former need have four-motor controllers. This latter arrangement, or one very similar to it, has been used in several places.

The use of a transformer on each car, from which any desired voltage, or number of voltages, for application to the motors can be easily obtained, makes the single-phase system as ideal from the control standpoint as it is from that of power supply. Variable connections from series to parallel are entirely unnecessary in this system, and the motors may be permanently connected in parallel, in series, or in series parallel, as desired, and simple and economical control se-

cured by merely connecting them to different voltage taps on the transformer. Owing to the self-induction of such motors, also, which tends to minimize the current fluctuations, smooth acceleration can be secured with comparatively few notches, a total of five being usually sufficient even with equipments aggregating 400 horse-power or more.

All of these various control schemes as applied to different sizes of motors have been used in service on various roads, and all have been remarkably successful and satisfactory. As an instance of this, the master mechanic of one of the large single-phase roads stated not long ago that he believed he was having less than one-half of the trouble with his control apparatus than he would have had with hand-operated, direct-current controllers.

TAR AS APPLIED TO THE SURFACE TREATMENT OF ROADS.

By Hervey J. Skinner, Engineering Chemist.*

The problem of preserving the surface of roads and highways and the prevention of dust has been given attention by highway engineers for many years, but not until the year 1905 was the question seriously considered in the United States. The increasing use of automobiles and motor vehicles about this time introduced a new condition to be considered in the building and preservation of roads. Reports from various parts of the United States, England, France, and wherever the use of motor vehicles had become common showed that the automobile was exerting an extremely destructive effect upon road surfaces.

The macadam road has especially been subjected to this destructive action since it is the form of construction most commonly adopted for modern thoroughfares. The binder or fine material upon the surface of the road is removed by the constant passage of automobiles, thus exposing the larger stones, which become loose and which are either left on the surface or in windrows along the sides of the road. The roughened surface presents greater resistance to traction and allows water to percolate to the foundation of the road, thereby seriously injuring the whole structure.

Up to this time the macadam form of construction had been very satisfactory for the character of traffic for which it was designed, namely, that of iron-tired horse vehicles. In a perfectly constructed macadam road, the rock used is so adapted to the kind and amount of traffic that the fine material worn off from the rock replaces that which is removed by atmospheric agencies. Under ordinary conditions, it has been possible to maintain a hard and smooth surface at a moderate expense.

The advent of the automobile has changed very materially the character of the traffic. The action of the rubber tires is very different from that of iron tires and practically no dust is worn off to replace that removed by ordinary wear. The great tractive force or shear exerted by the driving wheels of motor vehicles is the main cause of this injurious effect. It has been demonstrated by a series of experiments in which separate speedometers were connected to the front and rear wheels of automobiles that there is a very appreciable amount of slipping of the driving wheels on the surface of the road. This slipping effect throws into the air large quantities of the fine surface material, which is caught by the air currents generated by the car body and subsequently removed from the road by the wind.

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Aside from the disintegrating action on the road, the dust raised by automobiles is a menace to health and a source of great discomfort to those living near much traveled highways, especially in residential sections. Another consideration of importance is the damage to property and instances are reco ded where country estates have been disposed of far below their value and farms and orchards abandoned owing to the dust nuisance.

The increasing number of automobiles each year emphasizes their importance as a factor to be taken into consideration, and consequently highway engineers have given careful study to the necessity of making a change in the present practice of road construction, as well as evolving some method of preserving the surface of the enormous mileage of roads already built.

The increased cost of maintenance resulting from these changed conditions has resulted in a search for some method of surfacing other than that commonly used on macadam roads. Various materials have been proposed and used, some of which are temporary in their nature and are simply intended as dust preventives. Others are more permanent in character and are advantageous in actually binding the surface of the road together, thus becoming an integral part of the structure. Of this latter class, crude oil and tar are the most important and numerous preparations of these materials have been used with varying degrees of success.

Coal tar has been employed in road building for many years. Tar macadam roadways were constructed in Nottingham, England, as early as the year 1840, although under rather crude conditions. Coal tar pavements have been tried in various parts of the United States, but as a rule the results have not been satisfactory, asphalt being found superior as a paving material. In more recent years, tar macadam roads have been quite successful and this form of construction is now used to a considerable extent.

The application of tar to the surface of a completed macadam road, while comparatively new in this country, was tried in France about forty years ago. The results were rather unsatisfactory, but the practice has been carried on to some extent at intervals since that time, especially in Italy and France.

In the United States, the first experiment which attracted the attention of road engineers was in the summer of 1905, when a series of careful experiments were made at Jackson, Tennessee, by the United States Office of Public Roads in co-operation with the city engineer of Jackson, to determine the value of coal tar in the treatment of broken stone roads. The widespread interest created by these experiments led to similar ones in various parts of the country, particularly in Massachusetts, Rhode Island, New York, New Jersey and Pennsylvania.

The variation in the methods of application and the lack of attention to the quality of the tar and the condition of the road have led to a difference of opinion as to the real value of coal tar in surface treatment.

The methods of applying the tar have varied considerably, but perhaps the one more generally used, especially in the earlier experiments, is to remove the dust and all loose particles by thoroughly sweeping the surface of the road and then applying the tar from an open kettle mounted on wheels and fitted with a portable fire box. The tar is brushed over and into the surface with stiff brooms such as are ordinarily used for street work. The kettle is kept in advance of the workmen and by using two kettles and heating one while the other is in use, the process is made continuous. After allowing the tar to soak into the surface for at least ten

hours, it is covered with a layer of sand or fine stone screenings. When several hours have elapsed, the road is completed by rolling with an ordinary steam road-roller.

In some places, and particularly in Europe, mechanical means have been employed for applying tar. Some years ago, the Road Improvement Association held in England a competitive trial in which many of the machines were fitted with ingenious devices. Nearly all of them provided for heating the tar and applying it under pressure by means of compressed air. Some of them were designed for carrying on the whole operation with one passage of the vehicle. The dust and loose particles were first removed by suction and drawn up into a receiver. The tar was then applied by compressed air and spread over the surface of the road by means of automatic brushes. The fine material previously removed was again distributed over the surface and rolled by the steam-heated wheels of the machine. Some of these machines were drawn by horses, and others, the larger ones especially, were self-propelled.

The method most commonly used at the present time is a compromise between strictly surface application and tar macadam construction, and is known as the penetration method. In this method the surface of the road is broken up by means of a scarifier, new material added to fill ruts or other depressions, and the road re-shaped. After a slight rolling without the addition of water, the tar is applied and allowed to stand as in the previous method. A dressing of fine material is then spread over the surface and the road well rolled, with the result that a surface is formed in which all of the spaces between the hard stone are filled with a minimum amount of tar. A road treated in this manner is similar to one built by the tar macadam process, in which the stone and tar are mixed before being laid.

Many of the trials which have been made with tar as a surfacing material have failed because of a lack of appreciation of a number of important details. The structure of the road, its condition at the time of treatment, the traffic to which it is subjected, the character and amount of tar used, are all important factors which are necessary for successful results.

The structure of macadam roads varies according as each engineer has deviated from the original method of macadam construction to meet his own ideas. As a rule, however, the formation of the road is much the same and is of minor importance in comparison with the actual condition of the surface at the time the tar is applied. The road should be dry and as free from moisture as possible, since water and tar are not miscible in any sense, and if the tar is applied to a wet road, the latter is, so to speak, tar proof and proper penetration is impossible. In such a case, peeling of the surface is very liable to result, owing to the tendency of the tar to remain on the surface as a crust. It is equally important that the road surface should contain as little dust or loose material as possible, as the latter will absorb the tar instead of allowing the tar to be absorbed by the road. This again results in the formation of a crust, which under certain conditions will peel off, leaving the exposed surface of the road comparatively free from tar.

The kind and amount of traffic to which different roads are subjected is very variable and in cases where the traffic is particularly heavy or excessive, ruts and hollows are sure to exist. These irregularities in the surface make even rolling impossible and unless repaired previous to tarring water will collect in them and soon exert a detrimental effect upon the tarred surface. In many instances, traffic has been allowed on the road too soon after treatment, and this alone has been the cause of a number of failures.

The character of the tar is of almost equal importance as the condition of the road. Tars vary widely in composition even when produced by the same process. The character of the coal used, the method of carbonization and the temperature of distillation all have a decided influence on the composition of the tar. The value of coal tar in the surface treatment of roads depends almost entirely upon the binding power of its heavy bitumens. Besides these bitumens, there are present other substances such as water, ammoniacal liquor, oily constituents including the light oils and the creosote or "dead" oil, napthalene, anthracene and similar compounds, and free carbon, the proportion of which varies according to the manner in which the distillation process has been carried out.

The presence of water in coal tar has a similar effect as moisture in the road. If a tar containing water is applied to a dry road, the latter absorbs the water more readily than the tar, producing the tar-proof effect to which reference has already been made. Difficulty is also experienced in handling tar containing an appreciable amount of water since the water causes foaming, and if the vessel is heated by direct fire the danger of the tar going over the side of the vessel and taking fire is great.

Ammonia is another undesirable constituent, it being alkaline in nature and having a tendency to form with the oil constituents soluble compounds which are easily washed out by the action of the rain.

Napthalene and anthracene, while they exert no particularly harmful effect as in the cases of water and ammonia, have no binding power and their presence simply reduces the amount of bitumens which may be present.

Free carbon, like napthalene, has no detrimental effect, but, on the other hand, it is a useless constituent so far as road treatment is concerned and its presence reduces the binding power and waterproofing effect since it possesses none of these qualities itself.

The oily constituents of the tar are valuable to some extent since they act as diluents. The light oils are more or less volatile, and are probably evaporated soon after the tar is applied to the road, but their presence makes the tar thinner and consequently renders their application easier. The creosote oils are also of some advantage as it is claimed they add life to the tar and prevent its becoming too brittle.

The amount of tar is another important detail and if more is applied than the road can properly absorb, it will remain on the surface and be taken up by the top dressing with the resulting formation of a crust. Another objection to an excessive amount of tar is that it has a tendency to become sticky in warm weather and slimy in wet weather.

Sand or fine stone screenings have been used as a top dressing in the majority of the trials with coal tar, although occasionally the fine material removed from the road previous to tarring has been used. Stone screenings are probably the best material to use on a macadam road since they furnish a dressing of the same material as the road itself.

A comparison of coal tar with other road binders and dust preventives is somewhat difficult in the absence of really comparative experiments. Some few trials have been made in which different materials were used on the same stretch of road, but in most cases those experiments using such materials have been on different sections of roadways and consequently the results are not truly comparable.

Another cause for lack of comparative data lies in the great diversity of materials which have been used. As we have seen, the efficiency of a dust preventive is in proportion to its binding power and, therefore, a comparison of only those materials of approximately the same binding

power is justifiable. The various dust preventives really form a series from water, which has no binding power, up to coal tar and the heavy asphaltic oils, which have the maximum binding power of any of the materials yet proposed.

Water, salt solutions and light oil emulsions are of the nature of temporary binders, and are not to be compared with the more permanent ones such as coal tar and oils having an asphalt base.

The use of oil has been confined largely to the United States and by far the greater portion of the work has been done in the West, owing to the proximity of the oil fields which supply oils with an asphalt base. In the eastern portion of the United States the cost of transportation has been so great that comparatively little experimenting has been done with oil. Tar has been used quite extensively abroad, especially in England and France. In the United States, its use has been confined very largely to the eastern and northern states, although the park authorities of the larger cities have used tar to quite an extent.

Experiments have pretty clearly demonstrated that tar is not adapted for the treatment of gravel or soft earth roads owing to the fact that it does not amalgamate sufficiently well with these materials to bind them together. For roads of this class, therefore, oil has been more successful than tar. The use of tar has been and must be confined almost entirely to macadam or broken stone roads, and for roads of this nature it is probably more suitable than oil.

Oil, as a rule, has greater power of penetration than tar, but its value it dependent in a large measure to its asphalt base and before its maximum binding power is reached the more volatile constituents of the oil must be allowed to evaporate. This evaporation is a slow process and until it is complete the disagreeable odor of the crude oil will be apparent and more or less objectionable. The use of oil has also received considerable criticism owing to the damaging effect which it has upon clothes and the paint and varnish of vehicles, especially in damp weather, when a greasy, disagreeable mud is formed.

Tar, on the other hand, solidifies quite completely as soon as it is cold and does not depend except to a small degree on the gradual evaporation of its volatile constituents for its hardening. It is comparatively free from the objection of being picked up and thrown by the wheels of vehicles, and although it has a decided odor which lasts for a short time after application, this is not particularly objectionable and to most people is much less offensive than that of crude oil. An objection is sometimes raised to the use of tar on account of a fine black dust which wears off the tarred surface. It is true that such a dust is formed, but the amount is insignificant in comparison with the dust which would have formed if the road had been untreated.

It is claimed that coal tar has a decided antiseptic value, but how much importance can be attached to this feature is questionable. It is reported that an investigation was carried on in France to determine the number of germs present in the atmosphere over a tarred and an untarred road in the same neighborhood and the number over the latter was found to be considerably in excess of those over the tar treated section. Crude oil also possesses a similar antiseptic property, but to a very much less degree.

A properly tarred road is similar to an asphalt pavement although of a more resilient character. The stone is all bonded together by the tar into a smooth, firm surface which can be swept and washed in much the same manner as an asphalt pavement.

The principal agencies which cause deterioration of tarred or oiled surfaces are heavy rain, frost and the decaying organic matter which accumulates on the surface of the road. So far as can be determined one kind of road withstands the action of these agencies as well as the other.

Water gas tar is used in connection with coal tar, but not to any great extent by itself. It has a greater power of penetration and less of it is required, but it is not so lasting in character. It is really in a class by itself and occupies an intermediate position between the temporary and the permanent binders. In some cases where a limited amount of money is available or where for climatic reasons it is advisable to treat the road with the idea of its lasting only through one season, water gas tar should prove a valuable dust layer and any extension of its use will undoubtedly be in this direction.

The value of coal tar in the preservation of macadam roads and as a dust preventive is still unsettled. It is certain, however, that in the majority of cases the life of a treated road has been materially lengthened, and by applying tar the complete rebuilding of many roads at an enormous expense has been avoided.

One great drawback in the standardization of tar treatment is the impossibility of securing a uniform supply of coal tar. Coal tar is purely a by-product and the processes by which it is derived are never run with reference to the quality of tar produced, but solely to obtain maximum yields of gas or coke, as the case may be.

The impossibility, therefore, of manufacturing tar to meet definite requirements makes it necessary to utilize the supply available, but in so doing a certain amount of selection can be exercised and changes made whereby some degree of uniformity is obtained. Some attempts have been made to control the quality of the tar, but with rather unsatisfactory results. The manufacture of special coal tar preparations was intended to provide a greater uniformity, but many of these are, in the opinion of those who have used them, very variable and the success attending their use is not in proportion to the extra price paid for them.

Strictly surface treatment of an already existing road, even under the best conditions, can only be regarded as a temporary expedient and its use will probably extend only in cases where for financial or other reasons the rebuilding of the road is not justified.

Partial reconstruction of the road whereby the surface is loosened, reshaped and the tar applied before the rolling is done is undoubtedly a method of considerable value and one which will find more general application in the future. Many highway engineers have predicted an entire change in the methods of road construction, but it is difficult to believe that the macadam method, which has been so universally and so successfully used for a long time, can be eliminated. It is more probable that some modification of the macadam form of construction will be adopted in which event the tar macadam method is sure to be one of the first to receive serious consideration.

COMING MEETINGS.

National Gas and Gasoline Engine Trades Association. Harry T. Wilson, treasurer, Middleton, Ohio; Albert Stritmatter, Cincinnati, Ohio. Next meeting November 30, December 1, 2, 1909, at Chicago, Ill.

National Association of Railway Commissioners.—Nov. 16. Annual meeting at Washington, D.C. Secretary, Martin S. Decker, Albany, N.Y.

America Railway Association.—Nov. 17. Annual meeting at Chicago, Ill. Secy., W. F.Allen, 24 Park Place, N.Y.

CORRESPONDENCE

[This department is a meeting-place for ideas. If you have any suggestions as to new methods or successful methods, let us hear from you. You may not be accustomed to write for publication, but do not hesitate. It is ideas we want. Your suggestion will help another. Ed.]

THE PRICE OF ENGINEERING.

Sir,—The editorial on " Must the Young Engineer Serve Under Articles? " which appeared in the October 15th issue of the Canadian Engineer, was written apparently expecting the answer " yes "; but the editor has left the matter open for consideration.

In view of this it might be well to notice that an affirmative answer to the question would mark a critical point in the development of engineering in Canada. Whether the result of the suggested change would be for better or for worse, at all events there are several large problems involved which, up to the present, have been allowed to remain as " sleeping dogs."

In the first place it would hardly seem right to apprentice young men to engineers who are themselves in no way legally licensed as yet.

Second, the unfortunate differences (often imaginary) which seem to exist between college and non-college engineers must still be completely cleared away before the question of " articles " would be of value.

Third, is it not yet unanimously decided whether engineering is to be regarded as a profession, as a fad or as a paying business? Some believe in the first named; and some, it would appear, in the second; while occasionally you find a man sufficiently practical to accept the third conception.

To say the least we are at sixes and sevens on these points which, together with some other problems must obviously be solved in conjunction with that of apprenticing.

If these combined results could be attained there would be little doubt as to the ultimate good effect upon the engineering of this country. However, it is doubtful what influence the suggested change might have upon the financial aspect of engineering which under existing conditions is not wholly satisfactory. It is with this state of affairs the present article is intended to deal.

We are told that in Canada there are ten or twelve colleges grinding out young engineers, presumably for employment in this country. In addition to this we have a number of young men entering the work without technical training; and also an influx of foreign engineers, draughtsmen, etc. Decidedly we are suffering from over-production.

Let us consider first the effect on the young engineers (say those with not more than ten years' experience). In them, according to the law of supply and demand it means lower salaries, the which has for some time been declining. As a consequence the more ambitious will naturally seek employment in the United States. Such men are usually well appreciated by the far-seeing American employer, and they are lost to their native land.

In spite of the low salaries we still find Canadian youth quite as anxious to take a chance on the " manly profession." But no wonder in view of the luring inducements of " working for experience " and " love of one's profession " handed out periodically by fatherly " disinterested parties."

At the present time consulting engineers, contractors and engineering manufacturers are reaping a harvest due to over-production of office and field assistants. Offices are flooded with applications from bright, intelligent young men whose experience is usually sufficient to handle a high percentage of the work.

So much is this the case that Canadian employers have naturally become independent as regards their engineering departments. They know that plenty of men are available; and with an eye for present dividends only, the one aim is to employ the office staff at the lowest possible price, regardless of the ultimate effect.

Canadian offices frequently have the reputation of not holding men very long. This is probably due to the above reason. Lack of interest, dissatisfaction and inferior work are the sure outcomes of underpaid labor.

Let us now consider the effect of the present conditions upon the consulting engineers, the contractors, etc., or in other words upon the actual cost price of engineering.

At first sight it would appear that the cost was lowered. However, upon examining other lines of business, departmental stores, for example, we find that those concerns with the best organization, and paying the highest prices for their skilled labor are producing the cheapest goods. Now how many engineering businesses in Canada can state that their organization is so perfect that, for instance, the average young men can enter their offices and remain absolutely free from the effects of petty favoritism or jealousy? And, also, that a young graduate with a few months experience can actually earn $100 or $125 per month?

Such conditions exist in the office of a well-known successful New York contractor.

At best engineering is a poorly paid occupation, and the present financial outlook is decidedly unfavorable for young and old from a monetary standpoint. It certainly devolves upon all members who take a practical businesslike view of their work to " boost " the price from top to bottom.

Experience in engineering is certainly necessary, but the deafening howl of the experience faddist throughout the country is not only lowering the price, but also in like proportion the confidence and respect of the general public in our national engineering.

If we felt certain that apprenticing engineers would raise the price, undoubtedly, if for no other reason, the change would be a God-send. But results in Europe have not worked thus. We might also glance at the conditions in electrical engineering where apprentice courses are of frequent occurrence. Starvation wages and general cut-rate prices have resulted.

Better organization and less internal friction will undoubtedly produce a better quality of work from juniors and increase their earning capacity. The ultimate benefit to all classes is evident. Good engineering is a valuable asset to the whole community and fully warrants the highest remuneration for all persons concerned. Yours truly,

R. E. W. Hagarty.

Toronto, October 1909.

PROBLEMS IN APPLIED STATICS.

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

It is the intention in the following series of problems to first take up examples of a most elementary nature and gradually work up to the more difficult problems of every-day practice. Of course, it is primarily assumed that the reader is either conversant with a few of the elements of statics, or is in a position to read some work on the subject. In order to assist the reader, the laws which are to be applied in each problem will be given in heavy type at the head of each question. It will also be the endeavor to set a problem each week that will in some manner bear on the example just solved, and in the following week the explanation will be given, thereby enabling the reader to exercise his ingenuity.

If the Vector Polygon be drawn for a set of forces which are in equilibrium, the polygon must close.

Let Fig. 58 represent a chain passed through a pulley to which is attached a hook, as shown. If the

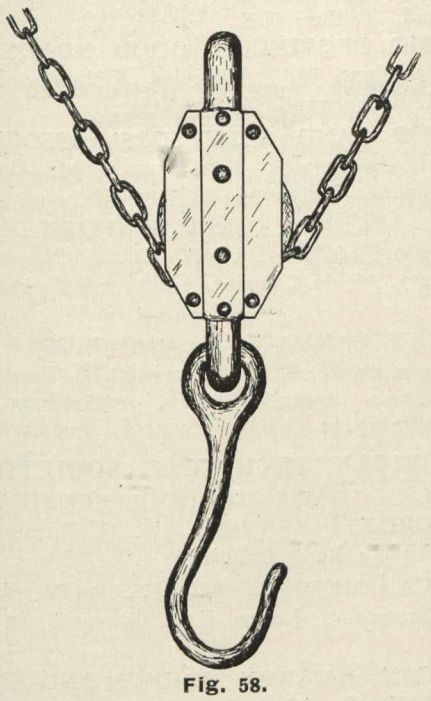

Fig. 58.

chain is inclined to the horizontal at 60° on each side of the block, what stress will be induced in the chain by hanging a weight of 3,464 pounds on the hook?

For all practical purposes the condition of affairs is such as indicated in the Statical Diagram (Fig. 59), a known force AB of 3,464 pounds acting vertically downward, and two unknown forces, BC and CA, acting in directions which are inclined at 60° to the horizontal.

It is required to find the magnitudes of the two forces, BC and CA.

The three forces AB, BC, and CA are in equilibrium; therefore, if their vector polygon be constructed, it must close.

To construct the Vector Polygon:—

From any initial point A (Fig. 60) draw a line AB to represent completely the vertical force of 3,464 pounds, which is known as the force AB, A and B being the letters on the areas to each side of the line representing the force in the Statical Diagram. (Such a system of lettering is known as Bow's Notation.) From B (Fig. 60) a line is drawn to represent the known direction of the so-called unknown force BC (Fig. 59).

Now, because the vector polygon must close, we know that the line representing the unknown force CA must pass through the initial point A (Fig. 60). Therefore, from A (Fig. 60) draw a line making 30° with AB; i.e., to represent the direction of the force CA. This line intersects the last line, drawn from B, at C.

BC and CA (Fig. 60) represent completely the hitherto unknown forces, and, since the sense marks in a vector polygon must point continuously from the initial to the final point (which in this case are coincident), the senses of BC and CA are as indicated by the arrowheads.

If now, the sense marks as found in Fig. 60 are placed on the representations of BC and CA in the Statical Diagram, it is seen that both BC and CA act away from the point; i.e., they are tensile forces. The chain is, therefore, in tension (tends to tear apart). This last fact might easily have been seen in the first place, for a chain could not transmit other than tensile forces; but it is dangerous practice to assume, without proof, conditions which seem to be self-evident.

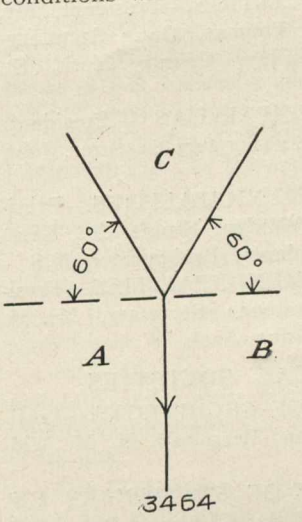

Fig. 59.

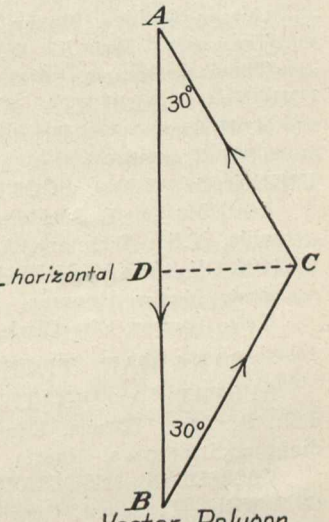

Fig. 60.

In order to find the magnitude of BC and CA, drop CD perpendicular on AB.

$$AD = DB.$$

Since AB represents 3,464 pounds,

$$AD = 1732 = DB.$$

$$BC = \frac{DB}{\cos 30^\circ} = \frac{1732}{1.732} \times 2 = 2000.$$

$$CA = \frac{AD}{\cos 30^\circ} = \frac{1732}{1.732} \times 2 = 2000.$$

If Fig. 60 has been constructed to scale, the lines BC and CA should each scale 2,000 pounds.

From the preceding it is seen, then, that the chain is **in tension** to the extent of 2,000 pounds.

The problem might have been stated in this manner: If the chain (Fig. 58) can safely stand tension to the extent of 1,500 pounds, what is the maximum weight that may be placed on the hook?

(This last problem will be solved next week.)

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(Continued on page 50.)

RAILWAY EARNINGS AND STOCK QUOTATIONS

NAME OF COMPANY	Mileage Operated	Capital in Thousands	Par Value	EARNINGS Week of Oct. 14 1909	EARNINGS Week of Oct. 14 1908	STOCK QUOTATIONS TORONTO Price Oct. 14 '08	Price Oct. 7 '09	Price Oct. 7 '09	Sales Week End'd Oct. 14	MONTREAL Price Oct. 15 08	Price Oct. 7 '09	Price Oct. 14 '09	Sales Week End'd Oct. 14
Canadian Pacific Railway	8,920.6	$150,000	$100	$2,138 000	1,611.000	175	187½	186¾ 185¾	427	176½	176	186 186¾	186 185¾	1549
Canadian Northern Railway	2,986.9	.....	.....	300.600	265,300	.....	.....	*1st. pref. 108½, 3rd pref. 57½, ordinary 23½	.....	.....	.....	.....	.....	.....
*Grand Trunk Railway	3,536	226,000	100	914,860	840,583	.....	.....	.....	.....	.....	.....	.....	.....	.....
T. & N. O.	334	(Gov. Road)	.....	37,858	20,838	.....	.....	.....	.....	188½	188	214⅞ 214½	212½ 210¼	687
Montreal Street Railway	138.3	18,000	100	77,673	70,483	.....	.....	124½ 124	122	104¼	103¼	124¼ 123¾	125½ 124¼	529
Toronto Street Railway	114	8,000	100	75,280	68,560	.....	.....	.....	.....	.....	.....	.....	.....	.....
Winnipeg Electric	70	6,000	100	.....	.....	161	187½	187¼	60	.....	162¾	187½ 187¼	.....	.....

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

ONTARIO ELECTRIC RAILWAYS.

From week to week we propose to give, on our page devoted to transportation interests, particulars of the equipment, mileage, and other information regarding the railways of Canada, together with a list of the officials. This series of articles commenced in our issue of October 1st.

Previously Given:—

Brantford and Hamilton Railway.
Chatham, Wallaceburg and Erie Railway.
Cornwall Street Railway.
Guelph Radial Railway.
Galt, Preston and Hespeler Railway.
London Street Railway.

THE INTERNATIONAL TRANSIT COMPANY, SAULT STE. MARIE, ONT.

President, Mr. C. D. Warren, Toronto.
General Manager, Mr W. C. Franz, Sault Ste. Marie, Ont.
Manager, Mr. T. J. Kennedy, Sault Ste. Marie, Ont.
Chief Engineer, H. Welburn.
Purchasing Agent, Mr. T. H. McGillivray, Sault Ste. Marie, Ont.

Kind of Road: Street Railway.

Length of Road, in miles:

Single track, 3.68.

Character of Service:

Car equipment, No., 8 motor cars; type, closed full vestibuled.
Number of motors, 6 cars, 4 motors each; 2 cars, 2 motors each; power of motors, 40 h.p.
Method of Controlling, unit control, G. E. Co.
Method of Braking, hand brakes, "Peacock."
Gauge of tracks, 4 ft. 8½ in.
Weight of rails, 80 lbs.

Power:

Direct current, D.C.
Voltage of transmission, 550 volts.
Trolley voltage, 500 volts.
Current collecting devices, overhead trolley, 6-in. wheel.

KINGSTON, PORTSMOUTH & CATARAQUI ELECTRIC RAILWAY COMPANY, KINGSTON.

President, Mr. H. W. Richardson.
Superintendent and Purchasing Agent, Mr. Hugh Nickle.
Chief Engineer, John Evans.

Kind of Road: Street Railway.

Length of Road, in miles:

Single track, 8.
Total in single miles, 8.

Character of Service:

Number of motors, 46.
Type, G. E. 800-1,000-67
Power of motors, 35 and 40 h.p.
Method of braking, hand.
Gauge of tracks, 4 ft. 8½ in.
Weight of rails, 60 lbs.

Power:

Direct current, D.C.
Voltage of transmission, 500 volts.
Trolley voltage, 500 volts.

RAILWAY ORDERS.

8265—October 5—Granting leave to the Norfolk Co. Tel. Co. to erect, place, and maintain its wires across the track of the G.T.R. at Lots 5 and 6, 14th Con., Tp of. Townsend, County Norfolk, Ont.

8266—October 5—Authorizing the Dominion Natural Gas Company, Ltd., to lay and thereafter maintain a gas main under the track of the G.T.R., where the same crosses Talbot Road, Tp. of Wyndham, County of Norfolk, Ont.

8267—October 4—Granting leave to the Kaministiquia Power Company to erect, place, and maintain its wires across the track of the C.N.R. at their intersection of Edward Street, West, Fort William, Ont.

8268—October 4—Authorizing the C.P.R. to construct, maintain, and operate branch line for the Kaufman Lumber Company at mileage 39.1, on the Sudbury-Kleinburgh Branch of its line.

8269—October 7 — Granting leave to the C.N.Q.R. to place, and maintain its tracks and telegraph wires under the telegraph wires of the G.N.W. Telegraph Company and the C.P.R. Company at the crossing of the C.P.R. at Lachevrotiers, Parish of Deschambault, County of Portneuf, P.Q.

8270—October 7—Granting leave to the Manitoba Government Telephone system to erect, place, and maintain its wires across the track of the C.P.R. on Nairn Avenue, and Eaton Street, Elmwood, Winnipeg, Man.

8271—October 6—Authorizing the Saskatchewan Government Telephone system, to erect, place, and maintain its wires across the track of the C.N.R. near Craik, Sask.

8272 — October 6 — Authorizing the United Gas Companies, Ltd., to lay and thereafter maintain gas pipe under the track of the G.T.R. where the same crosses Forks Road, 1st Range from the river, Tp. Moulton, County Haldimand, Ont.

8225 to 8279—October 7—Granting leave to the Bell Telephone Company to erect place, and maintain its wires across the track of the P.M.R.R., M.C.R.R., C.P.R., and G.T.R. at various points in the Province of Ontario.

8280 to 8285—October 6—Granting leave to the Hydro-Electric Power Commission of Ontario, to erect, place, and maintain its wires across the track of the G.T.R. at six points in the Province of Ontario.

(Continued on Page 47.)

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.

Quebec.

MONTREAL.—Tenders will be received up to Wednesday, 27th October, for timber, and Portland cement. Specifications may be obtained upon application to Mr. F. W. Cowie, Chief Engineer, at this office. David Seath, secretary-treasurer, harbour commissioners, 57 Common Street, Montreal.

Ontario.

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

BERLIN.—Tenders will be received until Thursday, October 28th, for paving King Street. A. H. Millar, town clerk; Wm. Mahlon Davis, C. E., town engineer. (Advertised in the Canadian Engineer.)

BRANTFORD.—Tenders will be received until Wednesday, October 27th, for the construction of concrete and pile abutments for a bridge over Big Creek, near Kelvin, Ont. W. H. Fairchild, C. E., 54 Market Streeet, Brantford, Ont.

LATCHFORD.—Tenders will be received until Thursday, October 28, for the construction of a Dam and Sluiceways across the Montreal River at Latchford. Plans and specifications can be seen at the office of J. G. Sing, district engineer, Confederation Life Building, Toronto, and on application to the Postmaster at Latchford. Napoleon Tessier, secretary, Department of Public Works, Ottawa.

OTTAWA.—Tenders are invited for a supply of pipe, 42 inches in diameter, to cost about $64,000. Mr. N. J. Ker, City Engineer.

PORT COLBORNE.—Tenders are invited by this municipality for a pump with a capacity of 400 gals. per minute, in connection with waterworks extensions that are being made. Tenders for a 30 h. p. electric motor are also wanted.

TORONTO.—Tenders will be received until November 2nd for the construction of a gate house to be built over the South Tunnel Shaft at the Island. Joseph Oliver (Mayor) Chairman, Board of Control. (Advertised in the Canadian Engineer.)

TORONTO.—Tenders will be received until Thursday, October 28, for turbine pumps. Further particulars may be had from the city engineer. (Advertised in the Canadian Engineer).

TORONTO.—Tenders will be received until Thursday, October 28, for electric motors. Further particulars may be had from the city engineer. (Advertised in the Canadian Engineer).

TORONTO.—Tenders will be received until Wednesday, 10th November, for all the cherry, birch, maple, spruce, hemlock and other classes of timber, estimated to contain over fifty million feet of hardwood, and over fifty million feet of soft wood, on a tract situated on the Georgian Bay at Beaverstone River. McCarthy, Osler, Hoskins & Harcourt, Toronto, Solicitors.

WESTON.—Tenders will be received until Monday, November 1st, for (a) laying 23,600 lineal feet of water mains, (c) steel water tower and foundation, (d) cast iron pipes and special castings, (e) fire hydrants, gate valves, valve boxes, etc., (l) sedimentation basin. R. J. Bull, Reeve; Willis Chipman, consulting engineer, 103 Bay Street, Toronto.

Manitoba.

WINNIPEG.—Tenders will be received up to Monday, November 1st, for supply of one motor hose wagon for the Fire Department, capable of carrying 2,000 feet of 2½ in. cotton, rubber-lined fire hose, approximate weight 2,200 lbs., and six men, approximate weight 1,020 lbs. M. Peterson, secretary, Board of Control.

Saskatchewan.

MOOSE JAW.—Tenders will be received for a supply of coal from the date of acceptance of the tender to the first of July, 1910, for the operation of the power plant of the city of Moose Jaw up to Monday, the 25th October. John D. Simpson, City Clerk.

MOOSE JAW.—Tenders for Laboratory Fittings will be received up to October 30th. J. W. Sifton, Secretary.

Alberta

TABER.—Tenders will be received up to 31st October, for the construction of a Waterworks System in the town of Taber. Geo. C. Millar, Secretary-treasurer.

British Columbia.

VANCOUVER.—Tenders will be received until November 9th, for building a large bridge over False Creek, this city. Messrs. Waddell & Harrington, consulting engineers, Kansas City, Mo. (Details advertised in the Canadian Engineer.)

CONTRACTS AWARDED.

Quebec.

MONTREAL.—Tenders for the reconstruction of the bridge over the railway tracks on St. Catherine St., east, were:—Dominion Bridge Company, Montreal, $63,091; E. G. M. Cape, Montreal, $63,886. The contract was not awarded.

MONTREAL.—The new Royal Arthur School will be erected by Mr. C. E. Deakin, for $82,452.

QUEBEC.—Messrs. Simonean & Dion have been given the contract for building the Quebec Technical School, for $233,800.

Ontario.

TORONTO.—The Canada Foundry Company has secured a half-million-dollar contract from the Dominion Steel Company of Sydney, N. S. The work to be done is the extension of the Bessemer blast furnaces and plants, with two open hearth furnaces.

TORONTO.—The contract for one 650 kilowatt, 120 r.p.m. engine type alternator, together with switchboard, steam driven exciter and motor generator set, has been awarded to the General Electric Manufacturing Company of Sweden, through their representatives, Messrs. Kilmer, Pullen & Burnham, Toronto.

TORONTO.—The Dickson Bridge Company of Campbellford, Ontario, has been awarded a contract for the steel superstructure of the Wilton Avenue bridge. Their tender is for 875,644 pounds of material at $4.09 per cwt., $35,809. Sir William Arrol, of Glasgow, Scotland, whose tender was $45,645, estimated that the structure would require a million pounds of steel. His tender is at $4.41 a pound. F. H. McGuigan, of Toronto, bid $51,725, while the Motherwell Bridge Company of Motherwell, Scotland, offered to do the work for $64,872. The Cleveland Bridge & Engineering Co., of Darlington, England, would do the work for $45,562.50. This tender was next to the lowest. In all, seven bids were received.

TORONTO.—On Wednesday, the controllers awarded the following asphalt pavement tenders: To Godson Contracting Co., Cecil St., Henry to Beverley, $1,629; Trinity Square, Yonge to 220 feet west, $970. To Barber Asphalt

Co., Lennox St., Bathurst to Manning, $4,655; Maple Grove, Brock to O'Hara, $1,653. To City Engineer, Glen road, bridge to Highlands, $1,839; Russell Hill. Clarndon to St. Clair, $6,507; Heath St., Yonge to Avenue road, $11,077, Roxborough St., Edgar to Binscarth, $12,707.

TORONTO.—The following tenders were received by the city of Toronto for 1,080 lengths of 16-inch cast iron water pipe:—

	Per length.
The National Iron Works	$27.45
The Canada Foundry Company	30.67

Other tenders, $31, $31.12, $32.30.

The National Iron orks, the company recently incorporated by Mr. Cawthra Mulock, will receive the contract. The material is to be delivered next spring.

Manitoba.

PORTAGE LA PRAIRIE.—The tender of L. B. Merriam of Merriam, Hyland & Plummer, Winnipeg, $10,530 for completing the needle dam here has been recommended by Mr. W. G. Chace, of Smith, Kerry & Chace, for acceptance.

WINNIPEG.—The Western Construction Co'y have the contract for the trench work in connection with a six-mile pipe line from the Red River at St. Boniface, to the N. T. Railway shops at Winnipeg. The 12" pipes with wooden bands will be supplied and installed by the Canadian Pipe Company of Vancouver, B. C.

Saskatchewan.

MAPLE CREEK.—A. P. Burns of Medicine Hat, Alta., has been awarded the contract for building about five miles of sewers here. Mr. C. M. Arnold, of Lethbridge, was the consulting engineer.

Alberta

CALGARY.—The order for four 750 k.v.a., water-cooled step-down transformers for the Calgary Power & Transmission Company has been awarded to the General Electric Manufacturing Company of Sweden, through their representatives in Canada, Messrs. Kilmer Pullen & Burnham, Toronto. Messrs. Smith, Kerry & Chace. Toronto, consulting engineers.

CALGARY.—The contract for about 8,000 lbs., of wire for the balance of this year's electric light work was let to the Canadian General Electric Company, who have just opened a branch in Calgary, at $17.20 a hundred, with a discount allowance of the half of 1 per cent. for 30 days' cash. The tender of the Northwest Electric company was $17.70 with no discount, and that of the Enterprise Electric Company, $18.50. All these prices are f.o.b. Calgary.

British Columbia.

VICTORIA.—The Westminster Marine Railway Company's tender of $20,000 has been accepted by the Columbia Coast Mission for a boat with a 100 h. p. gasoline engine.

SEWERAGE AND WATERWORKS.

Ontario.

OTTAWA.—Mr. N. J. Ker, city engineer, has been authorized to proceed with the construction of a pipe line from the end of the new aqueduct to the intake at Nepean Bay, a distance of one mile. The estimated cost of the pipe, whose inside diameter is to be 42 inches is $64,000.

WESTON.—Tenders are invited until Monday, November 1st, for the construction of waterworks. Mr. Willis Chipman, of Toronto, has charge of the work.

British Columbia.

VICTORIA.—The water pipes for the new distribution system in the municipality of Oak Bay have arrived, and the council have decided to lay them by day labor.

RAILWAYS—STEAM AND ELECTRIC.

New Brunswick

ST. JOHN.—The Drummond Company, which is operating the iron mines in Gloucester County, N.B., have fifteen miles of the railway already graded, and the rails are now being laid. All the work will be finished by spring. At present 400 men are at work on the railway construction, and if it were possible to secure laborers the number might be doubled. About fifty men are at work at the mine putting in tracks and spurs and turning out the ore. The heavy mining machinery cannot be taken in until the railroad is completed.

Quebec.

MONTREAL.—Farnham car shops, in connection with the C.P.R. have been closed and the men and plant will be moved to Montreal to become part of the Angus shops. At the C.P.R. headquarters it was explained that the change was in the interest of economy and efficiency. Four hundred men are affected.

Ontario.

OTTAWA.—The Canada Gazette, this week, contains notice of a large number of applications to Parliament for new railway charters and for extensions of time for the construction of lines previously authorized. The Canadian Northern Railway asks for authority to construct eleven new branch lines and for an extension of time on fourteen lines in the west. The new lines proposed are from Dundee to the Winnipeg River; from Portage la Prairie southerly to township 2, range 7; from Hartney westerly to township 5, range 7; from Moose Jaw to Bienfait; from Davidson northwesterly to a point on the Saskatoon-Calgary line; from Lashburn, westerly to a point between Camrose and Edmonton; from a point on the Saskatoon-Calgary line to the Rocky Mountain House; from a point on the Saskatoon-Calgary line near the crossing of the Red Deer river north-westerly to Yellowhead Pass; from Winnipegosis southerly to the south end of Lake Manitoba; from a point on the authorized Prince Albert to Battleford line to the Great Slave Lake; from the east end of Lake Manitoba, via the Narrows, to the Grand View and Roblin branch.

OTTAWA.—The Dominion Government section of the Grand Trunk Pacific has cost to date $51,950,717, the National Transcontinental Railway Commission reports. During the twelve months ending March 31 last $24,892,772 was expended in construction between Moncton and Winnipeg. At the end of March there were 725 miles graded and 345 miles of track laid.

OTTAWA.—The toll of death in construction work on the National Transcontinental Railway during the last fiscal year was 68, while 22 men suffered serious injuries. The fatalities were, for the most part, caused by carelessness on the part of the men handling dynamite. Most of the killed were Italians or Swedes. There were over 12,000 men in the army of railroad builders during the past year.

TORONTO.—The Temiskaming & Northern Ontario Railway recently placed with the Canadian Locomotive Company, Ltd., of Kingston, Ont., orders for four freight, two passenger and two switching engines. The freight and passenger engines are 10-wheelers, 19 × 24-inch, weighing 146,000 lbs. in working order, of which 114,000 lbs. is on the drivers, and 32,000 lbs. on the trucks. The driving wheel base is 13 feet 6 inches; the total wheel base of engine 23 feet 8 inches. The passenger and freight engines are the same, with the exception of the driving wheels, which, for the passengers are 63-inch diameter, and for the freights 57-inch diameter. The switching engines are the usual 6-wheel type (0-6-0); weight in working order 128,000 lbs.; cylinders 19 × 26-inch; driving wheels 51-inch diameter, wheel base 11 feet 1 inch.

WINDSOR.—The removal of the bulkheads on Monday from the tubes at the Canadian end of the Michigan Central tunnel under the Detroit River, completely opened the subaqueous passage. Officers of the construction company made a trip of inspection under the river and found the passage practically free of water. The next work will be the electrical installation.

Manitoba.

DAUPHIN. — Steel laying and driving piles for the bridges on the Ste. Rose branch of the C.N.R. east of Ochre river was commenced on October 13th, by the Mackenzie and Mann Construction company. This work will be rushed to completion before the winter. The first regular train service was inaugurated on October 14th, on the Hudson Bay line of the C. N. R. This service will be weekly from Hudson Bay Junction to the Pas Mission, the present end of the steel which is 90 miles north of Prince Albert.

WINNIPEG.—Chief Engineer Schwitzer, of the C.P.R., stated a few days ago that the new branch line across the prairies from Saskatoon to Wetaskiwin will be completed in less than a week. There is but sixteen miles to lay on this

stretch, which is 330 miles in length, and which has been under construction for the past two years. The new line runs parallel with the G.T.P. and C.N.R., and opens up a fine stretch of country, which already is well settled.

WINNIPEG.—The active work of locating the line of the Hudson Bay Railway has begun. Mr. W. J. Clifford, with a large party have commenced work at the Pas Mission. Other parties will be sent out later. It is the intention to push the location line as fast as possible. The parties will work out all the winter, and supplies will be transported by dog trains.

Alberta.

EDMONTON.—The Great Waterways Railway has made an actual start on the work of locating a line from Edmonton to Fort McMurray, 400 miles. On Saturday last sixteen surveyors were sent out, and they will commence operations about 15 miles north of the city.

EDMONTON.—Mr. C. R. Stovel, right of way agent for the C. N. R., was recently in the Stettler district, to obtain right of way for the line from Vegreville to Calgary. The grading from Camrose to Stettler is practically completed.

British Columbia.

VANCOUVER.—Winter weather notwithstanding, the work of surveying for the transcontinentals now entering British Columbia is to be pushed with vigor during the next few months. A Grand Trunk Pacific party is in the territory between Nicola Lake and Kamloops, while the Canadian Northern outfit, which has been on the North Thompson all summer, is preparing to push on from Cranberry Lake. Another party will work in the Yellowhead all winter for the same company.

VICTORIA.—Mr. H. Fry, representing the British Columbia Government, and W. J. H. Holmes of the E. & N. Railway Company are in charge of parties which have been sent out to re-survey the northern boundary of the E. & N. railway lands.

NELSON.—The street railway by-law was carried almost unanimously. The company's plans as to initial equipment and extension comprise: Motor generation set, including sheds, switchboard and necessary cable from substation to trolley mains, $11,000. Two double-truck four-motor cars and two trailers, $12,000. Car barns, machine shop and full line of repair parts, $2,500. Rotary broom and apparatus necessary to attach same to core, $1,200. Belt line extension, $16,000. Total, $43,700.

VICTORIA.—Track-laying on the Alberni line of the C.P.R. is being rushed. The branch has been graded to a point about five miles beyond French Creek, and by the end of the year the company hopes to be operating trains to Cameron Lake.

CEMENT—CONCRETE.

Ontario

THOROLD.—Messrs. Battle will shortly erect a building here for the manufacture of concrete blocks.

Manitoba.

WINNIPEG.—The Manitoba Gypsum Company are pushing ahead with the construction of their new plant. The main building is 66 × 160 feet, of reinforced concrete and brick. The plant will, on completion, afford another evidence of the progress being made in substantial buildings for the manufacturing industries of Winnipeg.

TELEPHONY.

British Columbia.

PRINCE RUPERT.—The G.T.P. will install an up-to-date telephone system here shortly. Mr. A. B. Smith, manager of the Telegraph Department, is making arrangements.

LIGHT, HEAT, AND POWER.

Ontario.

OTTAWA.—The power house of the Hull Electric Railway Company on Lake Deschenes was destroyed by a fire on Tuesday, October 19th, which damaged the plant. The street car service has been temporarily suspended, but arrangements are being made with the Ottawa Electric Company for a temporary supply of power.

British Columbia.

VICTORIA.—Messrs. Sanderson and Porter, of New York and San Francisco, represented by Mr. R. Carpenter, have charge of the installation of the 10,000 horse-power electric generation plant which is being erected by the British Columbia Electric Railway at Jordan River, near here, at an approximate cost of 1½ millions. The company expects to have the work completed in 18 months.

FINANCING PUBLIC WORKS.

Debentures were recently sold by the following municipalities:—

Kingston, Ont.—$33,400 local improvements.
Niagara Falls, Ont.—$6,426, sewers.
Osgood, Ont.—$4,429, drainage.
Guelph, Ont.—$20,000, sewerage.
Unity, Sask.—$8,000, local improvements.
Manor, Sask.—$3,000, sidewalks.
Saskatoon, Sask.—$68,250, local improvements.
Amaranth Township, Ont.—$7,800, bridge.
Nelson, B.C.—$10,000, local improvements.
St. Boniface, Man.—$100,000 local improvements.
Hamilton, Ont.—$80,000, schools.

Ontario.

EAST TORONTO.—The Township of Scarboro unanimously passed a by-law to raise $16,000 by debentures for a school building and site north of Munro Park, Toronto.

GALT.—A by-law to provide $5,000 for water-works extension was defeated by a vote of 84 for to 98 against. This is the smallest vote registered in the history of the town.

GODERICH.—The by-law to guarantee the bonds of the Good Roads Machine Company, of Hamilton, to the extent of $40,000 carried by a substantial majority.

LONDON.—A by-law for storm sewers will probably be submitted at next election here.

OWEN SOUND.—A new addition will be built to the General and Marine Hospital, costing $12,000 or $15,000. The town council have passed a resolution authorizing the raising of $400,000 for a railway, either by creating a debenture debt or by guaranteeing bonds.

PETERBOROUGH.—A by-law for a new hospital to cost fifteen or twenty thousand dollars will be submitted to the ratepayers at an early date.

PORT COLBORNE.—Waterworks and electric light extensions whose estimated cost is $2,600 have been sanctioned by the town council. Debentures will be issued.

SALTFLEET.—This municipality will issue $9,000 debentures for cleaning drains.

Manitoba.

HAMIOTA.—Tenders are invited until November 5th by Joseph Andrew, secretary-treasurer of the municipality, for $13,000 telephone debentures.

Saskatchewan

YORKTON.—High school debentures amounting to $16,000 will be voted on by the ratepayers of Yorkton.

MOOSE JAW.—Mr. J. W. Sifton, secretary of the municipality invites tenders for $25,000 school debentures, until 26th October.

SASKATOON.—The by-law to provide $18,000 for a footbridge at Twentieth Street will be voted on on November 18th.

Alberta.

CALGARY.—The Langevin bridge by-law, for a 30-foot bridge over the Bow River at Fourth Street East, was sanctioned by 237 for to 13 against.

STRATHCONA.—Raymond R. Houghton, secretary-treasurer of this municipality, invites tenders for $15,000 telephone debentures, until November 1st.

British Columbia.

NELSON.—The street railway by-law was carried practically unanimously, and the company will shortly be placing orders for equipment.

NEW WESTMINSTER.—The ratepayers of Richmond have passed by-laws to raise $350,000 by a debenture issue. The sum of $275,000 was asked for waterworks extensions, of which $150,000 is for a distributing system, and the balance will be paid the City of New Westminster for a main

and joint system from Coquitlam Lake. The sum of $75,000 was also asked for road improvements.

VANCOUVER.—The Burnaby Council have passed the by-law allowing the British Columbia Electric Railway to construct and operate a line through the municipality from Hastings Township to New Westminster. The line is to run from Boundary Road along the south side of Burnaby Lake to the North Road and through to New Westminster.

MISCELLANEOUS.

Quebec.

MONTREAL.—Improvements to streets and other works, estimated to cost $33,665, have been authorized by the council. The work will be done by day labor.

Ontario.

OWEN SOUND.—Mr. R. McDowall, C. E., has estimated the cost of constructing a drydock here, at $225,000.

CHIPPEWA.—Favorable progress is being made on the buildings which are being erected here by Messrs. Fitzgerald and Bennie.

CURRENT NEWS.

Ontario.

WELLAND.—Mr. D. H. Philip, C.E., of Ottawa, Mr. R. Chatfield Ross, of Pt. Robinson, and Mr. Wm. Hoff, of Chippewa, are at Welland. They will make surveys in connection with the proposal to raise the level of Lake Erie. Estimates of land damages are being prepared.

Quebec.

MONTREAL.—A merger has just been consummated between the Rhodes, Curry Co., of Amherst, N.S., the Canada Car Co., and the Dominion Foundry Company, of Montreal. Mr. N. Curry of Amherst will be general manager of the company, whose capital will probably be $8,500,000.

PERSONAL NOTES.

MR. J. W. CALDER, B.A. Sc., formerly of Blyth, Ont., is now located at Guelph, Ont.

MR. A. B. WALKER, formerly with the Canadian Fairbanks Company, is now with H. W. Petrie Co., Limited, of Toronto and Montreal, in the machinery department.

MR. ROBERT CREELMAN, formerly commercial agent of the Canadian Northern Railway, was last week appointed to the position of assistant general passenger agent.

MR. L. MERRIMAN, consulting engineer, of Chicago, who was recently in Regina looking over the waterworks, has been appointed by the Town of Dauphin, Man., to outline a scheme for waterworks there.

MR. KICKI KOBORI, M.E., chief electrical engineer of the Nji River Electric Company, at Kyoto, Japan, was at Niagara Falls last week inspecting the works of the power companies, with a view to gathering information as to the installation and operation of power plants. His company will construct the biggest plant in Japan.

OBITUARY.

MR. GEO. TAYLOR, a well-known railway contractor, died at Brockville, Ontario, on October 13th. Mr. Taylor was a former traffic manager of the Canada Atlantic Railway, and built many sections of the Grand Trunk, Canadian Pacific and Intercolonial Railways, and also a part of the Soulanges Canal. He was unmarried, and 58 years of age.

MR. E. ELSTNER FISHER, until a few weeks ago, general manager and chief engineer of the T. H. & B. Railway, Hamilton, Ontario, died on Wednesday, October 13. Mr. Fisher was a member of The Canadian Society of Civil Engineers, and has been connected with the T. H. & B. in the capacity of general superintendent since the road was built, fifteen years ago. He was educated at the United States Academy at Annapolis, and before beginning his railroad career held a commission as lieutenant in the United States navy. Later he was resident engineer with the Pennsylvania road, and then joined the staff of the New York Central, leaving that road to become superintendent of the T.H. & B. He soon made for himself a reputation as a thoroughly efficient railroad man, and under his management the T. H. & B. Railway became a very popular line. He also showed a fine public spirit, ever ready to give his assistance to any movement for the benefit of the city of his adoption. He took a prominent part in athletics, and was a lover of every honorable sport. Personally he was clear sighted, honest, far-seeing and enthusiastic, and made friends easily. He was 56 years of age on Sunday last.

LATE CONSTRUCTION NEWS.

RAILWAYS—STEAM AND ELECTRIC.

Ontario

COBOURG.—The Toronto & Eastern Railway, through Mr. F. L. Fowke, M.P., will apply for a charter to build an electric railway from Cobourg to Toronto, via Bowmanville, Whitby and Oshawa.

LONDON.—The South-Western Traction Company's line, running between London and Lake Erie at Port Stanley, was sold by auction on October 20th, to Mr. J. E. McDougall, of London, representing a syndicate of London, Toronto and Hamilton capitalists. He paid $455,000 in cash and assumed $80,000 indebtedness, the total price being $55,000 above the reserve, C. C. Giles, Montreal, the next highest bidder, running it up to $450,000 and $80,000 debt. Mr. Giles, represented the bondholders, the majority of whom live in Edinburgh, Scotland. The London Street Railway Company, of which H. A. Everett, Cleveland, is president, had a cheque in for $350,000.

The Chicago, Milwaukee & St. Paul has ordered 250 all-steel passenger cars, of which 160 are for the western coast extension and 90 cars to be used on the old lines. The St. Paul is the first western line to place a big order for the expensive steel cars of the non-telescoping type. The Harriman lines have recently ordered 600 such cars and the Pennsylvania road in the east was a pioneer in buying 500 cars of the improved kind.

MARKET CONDITIONS.

The market for pig-iron, especially for steel making iron, continues very strong in the United States. Bessemer grades have advanced 50c. per ton during the past week, as a result of the very heavy turnover. Basic grades have been liberally dealt in, the advance being about 25c. per ton. Foundry grades are not quite as active as during the previous few weeks, but there is still a large turnover at firm prices. English iron is commencing to come in at Atlantic coast points and this has a tendency to prevent further advances in prices of domestic grades in that section. On the whole, the market has a very healthy tone, not only for pig-iron but for all classes of iron and steel material, the feeling amongst the trade being strongly in the direction of gradually advancing prices and a continuance of good orders. The railway systems are not only placing heavy rail orders but have come into the market with several large orders for locomotives, cars, etc., thus materially strengthening the market.

England and Europe continue about as before, the tendency of prices being in the upward direction. Advances, however, have been immaterial, save on pig-iron, manufactured articles being sold for prompt shipment at prices which have prevailed during the past two or three months. The tendency is, however, to ask higher prices for future deliveries.

Locally, the market is in excellent condition, not only as to prices but also as to the tonnage changing hands. Makers are heavily booked ahead and are being pressed to take on further orders. Prices are advancing, and the likelihood is that next year will see them considerably higher, as costs and material will be dearer than they were the present year. It is expected that iron ore prices will be advanced at least 50c. per ton, which is $1 or more per ton on pig-iron.

Coke prices have shown an advance of at least $1 per ton, which will add another dollar to pig-iron, besides which, dealers are face to face with a further reduction in government bounties, which will add practically $3 to the cost of production of pig-iron in 1910, as compared with 1909. Makers will naturally desire to recoup themselves for this additional cost and consumers will be compelled to pay higher prices.

The markets for finished and semi-finished products were all very steady again this week, as will be seen from the following list:—

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

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

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

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

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

Chain.—Prices are as follows:—¾-inch, $5.10; 5-16-inch, $3.95; ⅜-inch, $3.55; 7-16-inch, $3.35; ½-inch, $3.20; 9-16-inch, $3.05; ⅝-inch, $2.95; ¾-inch, $2.90; ⅞-inch, $2.85; 1-inch, $2.85.

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 14½ to 14¾c.

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

Galvanized Iron.—The market is steady. Prices, basis, 28-gauge, are:—Queen's Head, $4.40; Comet, $4.25; Gorbal's Best, $4.25; Apollo, 10¾ oz., $4.35. Add 25c. to above figures for less than case lots; 26-gauge is 25c. less than 28-gauge, American 28-gauge and English 26 are equivalents, as are American 10¾ oz., and English 28-gauge.

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

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

Laths.—See Lumber, etc.

Lead.—Prices are about steady, at $3.50 to $3.60.

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

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

Nails.—Demand for nails is better, but prices are steady at $2.30 per keg for cut, and $2.25 for wire, base prices. Wire roofing nails, 5c. lb.

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

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

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

Plates and Sheets.—Steel.—The market is steady. Quotations are: $2.20 for 3-16; $2.30 for ⅛, and $2.10 for ¼ and thicker; 12-gauge being $2.30; 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 $30.50 to $31 is given for 60-lb. and 70-lb.; 80-lb. and heavier, being $30; rails, per gross ton of 2,240 lbs., f.o.b. mill. Re-laying rails are quoted at $27 to $29 per ton, according to condition of rail and location.

Railway Ties.—See lumber, etc.

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

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

Spikes.—Railway spikes are steady at $2.35 per 100 pounds, base of 5½ x 9-16. Ship spikes are steady at $2.85 per 100 pounds, base of ⅝ x 10-inch, and ⅝ x 12-inch.

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

Telegraph Poles.—See lumber, etc.

Tar and Pitch.—Coal tar, $3.50 per barrel of 40 gallons, weighing about 500 pounds; roofing pitch, No. 1, 70c. per 100 pounds; and No. 2, 55c. per 100 pounds; pine tar, $8.50 per barrel of 40 gallons, and $4.75 per half-barrel; refined coal tar, $4.50 per barrel; pine pitch, $4 per barrel of 180 to 200 pounds. (See building paper; also roofing).

Tin.—Prices are unchanged, at 33½ to 34c.

Zinc.—The tone is steady, at 5¾ to 6c.

Toronto, October 21st, 1909.

In metals and hardware warehouses business has increased in volume. The demand for steel and iron is strong, and prices are firm all over the list. Such heavy merchandise as iron pipe, boiler tubes, black sheets, and galvanized iron are now in seasonable request by country manufacturers. We have not made many alterations of price, only nails and spikes, galvanized sheets and a few other items. An advance in iron pipe was noted last week; it is far from improbable that a further advance will come, so that the present is a rather inviting time to buy such goods.

United States advices show great activity in demand for railway rails, which cannot be overtaken for months because steel mills are behind in their orders. "The billet, bar, plate and shape mills have failed to keep pace with the finishing plants. * * * The capacity of the country, apparently, has broken down in the middle (October 17th), for pig-iron and coke are still to be had, while billets nad steel bars cannot be bought, even at a premium, for prompt delivery."

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

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

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

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

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

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

Building Paper.—Plain, 30c. per roll; tarred, 40c. per roll. Demand is fairly active.

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

Broken Stone.—Lime stone, good hard, for roadways or concrete, f.o.b., Schaw station, C.P.R., 60c. per ton of 2,000 lbs., 1-inch, 2-inch, or larger, price all the same. The supply is excessive; hence the lowered price. Broken granite is selling at $3 per ton for good Oshawa.

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

Coal.—Retail price for Pennsylvania hard, $6.75 net, steady. This price applies to grate, egg, stove, and chestnut; only pea coal is cheaper, namely, $5.75. These are all cash, and the quantity purchased does not affect the price. Soft coal is in good supply, American brokers have been covering the ground very fully. In the United States there is an open market for bituminous coal and a great number of qualities exist. We quote. Youghiogheny lump coal on cars here, $3.70 to $3.80; mine run, $3.60 to $3.75; slack, $2.65 to $2.85; lump coal from other districts, $3.40 to $3.70; mine run 10c. less; slack, $2.50 to $2.70; cannel coal plentiful at $7.50 per ton; coke, Solvey foundry, which is largely used here, quotes at from $5.25 to $5.50; Reynoldsville, $4.50 to $4.75; Connellsville, 72-hour coke, $5.25 to $5.50.

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

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

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

Roofing Felt.—An improvement in demand of late, no change in price, which is $1.80 per 100 lbs.

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

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

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

Iron Pipe.—The expected advance has come; we now quote, black, ¼-inch, $2.03; ⅜-inch, $2.25; ½-inch, $2.63; ¾-inch, $3.28; 1-inch, $4.70; 1¼-inch, $6.41; 1½-inch, $7.70; 2-inch, $10.26; 2½-inch, $16.39; 3-inch, $21.52; 3½-inch, $27.08; 4-inch, $30.76; 4½-inch, $38; 5-inch, $43.50; 6-inch, $56. Galvanized, ¼-inch, $2.86; ⅜-inch, $3.08; ½-inch, $3.48; ¾-inch, $4.43; 1-inch, $6.35; 1¼-inch, $8.66; 1½-inch, $10.40; 2-inch, $13.86, per 100 feet.

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

Lime.—Retail price in city 35c. per 100 lbs. f.o.b., car; in large lots at kilns outside city 22c. per 100 lbs. f.o.b. car. Demand is good.

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

Nails.—Wire, $2.25 base; cut, $2.60; spikes, $2.85 per keg of 100 lbs.

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

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

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

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

Ready Roofing.—An improved request is noted lately, at catalogue prices before quoted.