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Volume 21. Toronto, October 5, 1911 Contents of this issue on page 399

The Canadian Engineer

An Engineering Weekly.

INDUSTRIAL COAL.

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Recent years have seen the large coal consumer consider the question of coal quality prior to coal quantity; and at the present time the question has assumed gigantic proportions in the minds that govern many of our largest and more prosperous manufacturing plants and municipal centres. That the scientific control of the coal bin will demonstrate itself on the dividend sheet has been proved beyond doubt, and it is toward the untiring and intelligent effort of chemists that this change has occurred.

Coal is probably one of the most dissimilar substances used in commerce, even specimens taken from the same section varying to astonishing figures when an analytical report is presented; it is, therefore, of the utmost importance that buyers should have a report on a specimen that represents, as far as possible, the average composition of the bulk.

Once the manufacturer has derived benefits from buying coal on analysis and specifications it will be but a step further when he starts to burn his fuel scientifically. Under proper and well regulated conditions a coal should deliver its heat by polluting the flue gases to an extent of not less than 12%. Flue gases frequently contain as little as 2% or 3% of CO_2 and under this condition much heat is utilized for no other purpose than heating air.

A report on a coal analysis should present to the purchaser the following points: moisture, volatile matter, fixed carbon, ash, and for certain industrial problems sulphur and phosphorus. The moisture determination should imply natural moisture, as the writer in a recent experiment found that certain soft coals could be dampened artificially to such an extent as to appear to carry 16% of moisture; of course an analysis allowing this as natural would give the fuel a false value, and would be of little or no use in making a comparison. When coal is to be purchased on specifications the following method will be found quick, economical and capable of yielding satisfactory results to purchaser and vendor. When a number of specimens are being examined care should be exercised to have the various determinations made under precisely the same conditions.

To secure a sample, take about 5 pounds, break this up and quarter it down until a sample weighing approximately 100 grams (about 3 ounces) is left. This should be finely powdered and stored in an air-tight jar until the analysis has been secured. This operation should be conducted with all possible haste to prevent the absorption or loss of moisture.

Estimation of Moisture.

Coal cannot be dried in the usual manner, owing to a peculiar property possessed by this fuel, viz.: that when heated to a temperature of 105° C. or thereabouts it loses weight for a time and then increases. To secure concordant results all samples (which for this determination should be in a bulk weighing 1 gram) should be heated together in the air bath. Place the samples in uncovered crucibles and maintain the oven temperature at 104° to 107° C. for 1 hour; the crucibles should be dried in a desiccator, the resulting weight in milligrams subtracted from 1,000 and the result divided by 10 gives percentage moisture.

Volatile Combustible Matter.

The sample for this factor should also weigh 1 gram, and is placed in a crucible * having a tightly fitting cover. Enclose the sample by the cover and heat over a Bunsen flame for 7 minutes. The flame should be quite substantial, about 6 to 8 inches. This determination should be conducted in a place free from extensive drafts; when the crucible has been cooled and dried in a desiccator the weight is ascertained in milligrams, and from the gross loss the weight of moisture is deducted, leaving, when divided by 10, the volatile combustible matter in percentage. This determination should always be made on a fresh sample of coal, and not on the one used to determine moisture.

Fixed Carbon and Ash.

It is usual to consider this operation as a continuance of the determination for volatile combustible matter. The crucible lid is drawn slightly to one side, the crucible supported in an inclined position and a good flame from the Bunsen burner directed from below. The metal crucible for this operation doubtless has many advantages over the porcelain article, mainly through its superior heat-conducting qualities. Whichever form is adopted it is probable to be somewhat of a prolonged task, but may be hastened by allowing the mass to cool from time to time and stirring while heated with a short length of platinum wire. When the carbon appears to be burned out heat for a few minutes longer, then cool in a desiccator and weigh; the loss from the weight when volatile combustible matter was determined represents fixed carbon and the remaining matter is reported as ash.

This long operation may be simplified to a considerable extent by powdering the coke left behind when the volatile combustible determination was disposed of; the mass is then placed in a previously weighed dish, platinum preferred, and three to four c.c. of alcohol poured in and the coke allowed to become thoroughly moistened, the dish is shaken laterally and the pasty mass run up on the side of the containing vessel. If the layer is too thick in any one spot it may be thinned by blowing through a glass tube; a match is lighted and the wetted mass ignited, the dish being supported on a metal triangle. When the alcoholic flame ceases, a blast lamp flame is directed from below, which causes the ash to fall from the side into the bottom of the dish; it is then cooled and weighed. By this method carbon and ash may be determined in 15 minutes, as against an hour or more over the first method described.

For many industrial purposes an analysis containing the foregoing factors will be sufficient, but many other coal consuming processes require sulphur at least, if not phosphorus, to be determined. Assuming, however, a purchaser or vendor to be in possession of a report containing the percentage

*Many text-books and chemists advise the use of platinum crucibles throughout the various manipulations, but it is doubtful if thin porcelainware will not, in many instances, give entire satisfaction.

of moisture, volatile matter, carbon and ash, he may calculate the calorific value of his fuel to a very satisfactory degree of accuracy by the following method, proposed by Goutal:—

Calorific power (calories per kilo) $= 82C + aV$, where C = percentage of fixed carbon, V = percentage of volatile matter, and a = a valuable factor depending on the ratio of volatile matter to the total combustible matter in the fuel. The value of a may be ascertained by consulting table No. 1. To find the ratio of V to V + C, calculate thus $\frac{V \times 100}{C + V}$

The use of these factors may be demonstrated by assuming an analysis to read:—

Moisture	1.20%
Volatile combustible matter	23.20%
Fixed carbon	62.40%
Ash	13.20%
Sulphur	1.10%

Then $\frac{V \times 100}{V + C} = \frac{23.2 \times 100}{23.2 + 62.4} = 27$. Thence a, by the table, has a value of 101. Then the calorific value of the fuel would be $82 \times 62.4 + 101 \times 23.2 = 7,460$ calories or 13,428 B.t.u.

Table No. 1 showing value of a variable factor being the ratio of V to V plus C.

Ratio.	(a)	Ratio.	(a)	Ratio.	(a)
1-4	100	16	115	28	100
5	145	17	113	29	99
6	142	18	112	30	98
7	139	19	110	31	97
8	136	20	109	32	97
				33	96
9	133	21	108	34	95
10	130	22	107	35	94
11	127	23	105	36	91
12	124	24	104	37	88
13	122	25	103	38	85
14	120	26	102	39	82
15	117	27	101	40	80

The British thermal unit (B.T.U.) is that quantity of heat required to raise 1 pound of pure water one degree Fahrenheit, at or nearly 39.1° F. The calorie is the amount of heat necessary to raise one kilogram of pure water from 4°C to 5°C.

The relation existing between calories and B.T.U. may be readily calculated since 1 kilo is equivalent to 2.205 pounds, and one degree C equal to 9/5 of one degree F. The calorie is equivalent to $9/5 \times 2.205$ or 3.969 B.T.U., and the B.T.U. to 0.252 calorie. To reduce calories per kilogram to B.T.U. per pound, multiply by 9/5 or 1.8, to reverse the calculation multiply by 5/9 or .555.

Estimation of Sulphur.

The amount of this element present in coal and coke often enters seriously into the consideration of the metallurgist and to a lesser extent the foreman or superintendent of the factory or mill. The methods used in reporting this ingredient are several in number, but generally depend on the final precipitation of the sulphur as $BaSo_4$; the amount of this sulphate in milligrams multiplied by 0.1373 will give the amount of sulphur in the sample.

The fushion method is detailed below and will be found excellent, doing away with unpleasant odors of bromine, which are sometimes present when other systems are used. One gram of the powdered sample is mixed with 9 grams Na_2CO_3 and 5 grams KNo_3 thoroughly in a mortar and transferred to a large crucible; cover this and heat it over a Bunsen burner, applying a gentle heat at first, and then increasing, observing the contents from time to time to ascertain that the heated mass does not boil over; when the contents of the crucible are in a quiet state of fusion give the crucible a slight turning motion to bring the mass well up on the interior sides and allow the whole to cool.

Dissolve the fused mass out with hot water and disintegrate it by boiling, filter off the insoluble matter and wash it on a filter with warm water, add a few drops of hydrochloric acid and evaporate to dryness, the dryness is then moistened with hydrochloric acid and dissolve in 100 c.c. of water, the whole being brought to boiling point over a burner. The liquid is then filtered and diluted to 350 or 400 c.c, again brought to the boiling point and the sulphur precipitated by adding 15 c.c of a 10% solution of barium chloride. The sulphur is collected on a filter, washed, dried and weighed in the usual manner. For precise results it is best, when using chemicals of doubted purity, to run a blank determination deducting any results obtained from the final determination.

Estimation of Phosphorus.

Secure the ashes from 10 grams of the sample and treat with hydrochloric acid, dilute with water and filter. Dry the collected matter and fuse with a little sodium carbonate (Na_2CO_3), dissolve the fusion in hot water, filter and wash any collected matter. (A) Add sufficient hydrochloric acid to render the filtrate distinctly acid, and evaporate to dryness. Drop a little hydrochloric acid on the residue, then dilute with 100 c.c. of water, boil a few minutes and filter; wash the insoluble material in the filter paper and add this to that obtained at A. To the combined filtrates add a few drops of ferric chloride (C.P.) adding just enough ammonia to give an alkaline condition; then add acetic acid and boil for one or two minutes, when a precipitate will form containing all the phosphorus. Filter and wash this precipitate and then dissolve it in hydrochloric acid and reduce to a small bulk by evaporation, using extreme caution to see that an insoluble scale of iron oxide does not form. Add 5 c.c. of nitric acid ($H\ No_3$) and dilute with 30 c.c. of water. Filter this into a flask and wash the collected matter with a 2% solution $H\ No_3$, then add 30 c.c. of strong ammonia solution to the filtrate, and dissolve the precipitate formed by concentrated nitric acid, adding a very slight excess. The solution is now heated to 85°C and 60 c.c. of ammonium-molybdate solution added while being vigorously stirred; in a few minutes a yellow precipitate will form; consisting of ammonium phosho-molybdate, which contains 1.31% of phosphorus. Phosphorus, as a rule, is determined in coals used in metallurgical operations, and very seldom enters into the ordinary routine coal analysis. The heat determinations by calorimeters has been omitted; this mode of ascertaining the heating values calling for considerable expenditure. The calculation methods will yield better results than a poor or even middle grade calorimeter.

The purchase of coal under specification is a marked onward step in the conservation of natural resources; this form of purchase being conductive to the use and purchase of lower grade coals. The poorer grades find a market by actual comparative competition with the better grades, not by the price per 2,000 pounds, but as to the actual heating values, which is indicated by the number of heat units it contains per pound of coal.

In purchasing coal for any power plant the aim should be to obtain a fuel which, all things considered (such as equipment, price of coal, and cost of labor and repairs), will produce a horsepower for the least cost.

It would appear from experiments that almost any fuel may be burned with a reasonable efficiency in a properly designed apparatus. The recognized requirements are as follows: (1) A uniform and continuous supply of fuel to the furnace; (2) an air supply slightly in excess of the theoretical amount required for complete combustion; (3) a temperature sufficiently high to ignite the gases that are driven off from the fuel; (4) a complete mixture of these gases with the air supplied before they reach a cooling surface, such as the shell or tubes of a boiler.

Earthy and other impure matter are classed as ash; in a commercial coal this material may range from 4 to 25 per cent., those containing the smaller ash percentage being the most valuable, owing to their higher heating qualities and small resistance to the free and uniform distribution of air through the heated mass in the furnace. A coal having a low ash percentage will offer considerable reduction in furnace work over one containing a high percentage of such matter.

Sulphur may be present in a coal in the free state, or, as is more common, in combination with iron or other elements. Other impurities with sulphur often form a clinker that shuts out the air and increases the labor of handling the furnaces. It is possible, however, to burn coals containing up to 5 per cent. of sulphur without great difficulty from clinkers. A little steam introduced under the grate will relieve much of the trouble. Clinker may be due to other causes than sulphur, as any constituents of the ash which are easily fusible may produce it. There is need of further investigation to determine the influence of sulphur and the elements that form ash in furnace fires during combustion; such an investigation, resulting favorably, would doubtless prove of great interest and usefulness.

Recent tests would indicate that, other conditions being equal, coals of similar composition are of value in proportion to the British thermal units, and the determination of these units in any coal will give approximately its value. It should be remembered, however, that the value of a coal for any particular plant is influenced by the character of the furnace, for all furnaces are not equally suitable for burning the many grades of coal. Aside from this factor, coals may be compared in terms of the British thermal units obtained for 1 cent, or on the cost per million heat units.

The reader will readily see from the foregoing that when a purchase of coal is made attention should be given to the character of the furnace equipment and the load, the character of coal best suited to the plant conditions, the number of heat units obtainable for a unit price, the cost of handling the coal and ash, and the possibility of burning the coal without smoke or other objectionable features.

This latter condition has been commented upon recently by a British authority, (Sir William Ramsay), who stated that twice as much coal is used to-day on the average factory fire and six times as much in domestic fires as is theoretically required for the production of the desired results.

The emission of smoke from factories has been the subject of parliamentary inquiries on several occasions, and legislation has been instituted from time to time with a view to minimizing the inconvenience from smoke. The public Health Act of 1875, followed by local acts in the large provincial cities, also served as a check, but the private production has always been treated as merely a public inconvenience, and not as an extravagance.

Sir William Ramsay leaves it "open to argument" whether it might not be wise to hasten the time "when smoke is no more by imposing a sixpenny fine for each offence," evidence being provided by instantaneous photographs. As though fearing the drastic nature of his penalty, he adds that "the imposition of the fine might be delayed until three warnings had been given by the police." But why all this kindness? Smoke prevention was undertaken far more seriously in the Middle Ages, as may be judged from the fact that in 1306 a citizen was tried, condemned and executed for burning "sea cole" in the city of London.

The following is an extract from a publication of a foreign government:

Specifications are drawn with a view to the consideration of price and quality. For manufactured articles and materials of constant and uniform quality they generally can be reduced to a clear and simple statement of what is desired, but for coal, which may be considered a finished product when loaded on the railroad cars at the mine, the great and obscure variation in character makes a simple requirement impracticable. Under these specifications bidders are requested to quote prices on the various sizes of anthracite, a definite standard of quality being specified for each size, and to state the standard of quality and price for bituminous coal. Awards are then made to the lowest responsible bidder for anthracite and to the bidder offering the best bituminous coal for the lowest price, the amount finally paid being determined by the tests made under the terms of the specifications. The specifications become part of the contract, and payment for coal delivered is made according to the standard of quality fixed. The actual quality and value of coal delivered is determined by analysis and test of representative samples taken in a specified manner by agents of the government and analyzed in the government fuel-testing laboratory. For coal of better quality than the standard the contractor is paid a bonus proportional to its excess of value. For coal of poorer quality than the standard, deductions are made from the contract price proportional to its deficiency in value."

In order to show how the lowest bid is determined, the proposals for supplying coal to the federal buildings under the Treasury Department of the United States Government have been selected.

All bids are received on official proposal blanks, in sealed envelopes, in response to advertisements inserted in the daily papers.

In order to make a proper award of contract it is necessary to reduce the proposals to a common basis for comparison. This may be done in several ways, but the method chosen is to adjust all bids on a given lot of coal to the same ash percentage by selecting as the standard the proposal that offers the coal containing the lowest percentage of ash. Each 1 per cent. of ash content above that of this standard is assumed to have a negative value of 2 cents a ton, the amount of the penalty which is exacted under the contract requirements for 1 per cent. excess of ash. The proposal prices are all adjusted in this manner and are so tabulated. On the basis of the adjusted price, allowance is then made for the varying heat values by computing the cost of 1,000,000 British thermal units for each coal offered. In this way the three variables—calorific value, percentage of ash, and basic price per ton—are all merged into one figure, the cost of 1,000,000 British thermal units, by which one bid may be readily compared with another.

For example, take two bids as follows:

Table 2, showing price computations based on determined ash and calorific values:

Bid	Determinations. B. t. u. per pound.	Ash (per cent).	Price per ton (2,240 pounds). As bid	Plus ash difference.	Computed cost of 1,000,000 B. t. u.
1	2	3	4	5	6
E...	14,327	5.91	$4.19	$4.19	$0.13056
B...	14,200	7.12	4.30	4.3242	.13595

The percentage of ash (column 3) in E is taken as a standard of comparison, and the determined ash in B is shown to be 1.21 per cent. higher. Each 1 per cent. of ash difference from the contract standard is so rated as to make 2 cents difference in the price per ton; 1.21 per cent. of ash is valued at $0.02 × 1.21, or $0.0242; bid B is therefore increased to $4.3242 per ton (column 5). The two bids are then on an equivalent basis, so far as ash is concerned.

The heating values being different, it is desirable to compute the calorific cost by the formula:

$$\frac{1{,}000{,}000 \times \text{price per ton}}{2{,}240 \times \text{B. t. u.}} = \text{cost per } 1{,}000{,}000 \text{ B. t. u.}$$

This computation shows the cost of 1,000,000 B. t. u. to be—

In the case of E—

$$\frac{1{,}000{,}000 \times \$4.19}{2{,}240 \times 14{,}327} = \$0.13056.$$

In the case of B—

$$\frac{1{,}000{,}000 \times 4.3242}{2{,}240 \times 14{,}200} = \$0.13595.$$

In like manner the cost of 1,000,000 British thermal units is calculated for each bid received under the proposal, and the results are entered for ready comparison in column 6 of the table.

The necessity for having such a basis of comparison will be readily seen when a number of tenders are at hand.

Coal Industry in Canada.

It is gratifying in no small measure to observe the steady increase of this industry in our own Dominon. There appears to be a lack of knowledge on the part of our citizens regarding this important question, notwithstanding our vast deposits of this valuable asset. The chief coal deposits are situated in the extreme east and west, the central provinces being without coal deposits so far as is known at present. The provinces of Ontario and Quebec in the year 1909 consumed the major portion of 43.4% of 18,625,202 tons, this being the total consumption; this was mostly imported from the United States, and from this it is gratifying to know that 56.4% of Canada's estimated coal consumption for the year 1909 was of domestic origin. Deposits of lignite have been uncovered by prospectors at various sections throughout Northern Ontario, but these have little commercial value. Quebec is a fairly large consumer of Nova Scotia coal, but it is to be regretted that anthracite varieties are not found in Eastern Canada. The production of coal in Western Canada yield the supply for an increasing ore smelting industry and, in addition, exports largely to the United States.

Coal of the bituminous variety forms by far the largest proportion of Canadian coals, but anthracite is found and mined at Bankhead, near Banff, Alberta. Table 3 shows the coal actually sold from Canadian mines during the year 1909:—

Table 3.

	Tons (2,000 lbs.)	Value.
Nova Scotia	5,652,089	$11,354,643
British Columbia	2,606,127	8,144,147
Alberta	1,994,741	4,838,109
Saskatchewan	192,125	296,339
New Brunswick	49,029	98,496
Yukon Territory	7,364	49,502
Total	$10,501,475	$24,781,236

THE IMPORTANCE OF PURE WATER SUPPLIES.*

By Dr. Meredith Young, D.P.H., &c.

Quite apart from the commercial point of view of the enormous invested capital, both public and private, in waterworks undertakings (the loans sanctioned by the Local Government Board for water supply purposes on the application of urban and rural district councils in England and Wales during the ten years 1900 to 1909 amounted to no less than £6,394,212), there is the great importance of such undertakings to the public health. Whilst a marked lowering of the general death-rate has almost universally followed in the wake of an improved water supply, there are instances enough of considerable outbreaks of enteric fever during the past few years which have been unquestionably caused by sewage-polluted water supplies. To quote only some of the more serious recent epidemics, the Tees Valley underwent one of enteric fever due to this cause in 1890 and 1891 in which 1,463 cases came under notice, Paisley in 1893 suffered under an outbreak involving about 800 cases, and again in 1898 from one in which about 280 cases occurred, Maidstone in 1897 had no fewer than 1,786 cases, Worthing 1,261 cases in 1893, Philadelphia 1,927 cases in 1897-8, and Lincoln in 1905 had close upon 1,000 cases.

This is by no means the whole tale, however, for it is beyond doubt that many isolated cases of enteric fever and many outbreaks too small to attract public attention have occurred and are likely to go on occurring which owe their origin to a contaminated water supply. Enteric fever, of course, is not the only illness which is thus engendered by a polluted or vitiated water supply, but the case based on enteric fever is so clear and specific that it affords the best argument for the necessity of measures of precaution. That a water supply should be under all circumstances preserved from pollution has been for years accepted on all hands as the merest truism, but in spite of this thousands of cases of typhoid fever are seen to have occurred within the past twenty years amongst enlightened communities caused by more or less gross pollution. Although water has been primarily responsible for the more serious epidemics, several cases which have been before the courts recently have demonstrated that its potentiality for mischief does not end amongst the direct consumers, but may manifest itself in other quarters owing to contamination of milk, and possibly other food products, such as water-cress, shell-fish, &c. River supplies, of which we have many in Cheshire, have been chief amongst the water causing these outbreaks, and pollution of rivers, directly or indirectly (particularly the latter) in such a way as to endanger water supplies, though not in such a way as to render successful action possible under the Rivers Pollution Prevention Acts, is one of the most difficult matters with which one has to deal. This has been borne in on me by a considerable number of inspections made recently in connection with your council's opposition to the Chester Water Bill. Quite a large number of cases came to light during this inspection in which sewage pollution from houses, or small groups of houses, was taking place on tributaries or sub-tributaries of the river Dee, or ditches communicating often very indirectly, and after considerable windings and wanderings through fields with this river. In a considerable number of these cases no one could with any show of reason attempt proceedings for breach of the Rivers Pollution Acts, but considered as possible sources of specific contamination of a public water supply, the case assumes a very different aspect indeed. The public are well

*Abstract from Annual Report of Cheshire County Medical Officer.

protected in this particular instance by the elaborate precautions taken by the water company, and measures will, it is anticipated, be shortly carried out which will render the supply even safer still—indeed, as safe as that furnished to the seven millions or more of people consuming London water.

The question is, however—Is it enough, from the broad point of view of public health, to leave the precautions which shall be taken to ensure a pure and wholesome water supply in the uncontrolled hands of water companies? True their reputation is always at stake, but the fact of their possessing compulsory areas of supply detracts somewhat from this argument, which is otherwise a quite genuine one to use. It is a moot point as to whether water companies are in the position of vendors under the Sale of Goods Act, and could be held liable for any implied breach of warranty that the article supplied by them was of good quality. Even granting that they are so liable, the question of proving that reasonable diligence in the provision of a pure supply had not been exercised would in the case of certain forms of pollution be an exceedingly difficult one. The case is virtually the same on this issue where the water supply is in the hands of the municipality or district council. The most direct remedy against carelessness or negligence in such a matter as this would be to legalize the imposition of penalties at the instance of private consumers on either companies or sanitary authorities who failed to supply pure and wholesome water without reasonable cause shown, the onus of proof of purity or wholesomeness and of the employment of reasonable and proper diligence to rest on the body supplying the water.

It is submitted that a better and more universal standard of purity of water would be secured if all water undertakings were under the supervision of some central representative and independent bodies, such as county councils, who should have powers of entry for purposes of inspection, of taking samples from reservoirs, filters, mains, &c., and of enforcing local measures for the prevention of pollution. It should be further made compulsory on all purveyors of water, public or private, to have frequent periodical and systematic chemical and bacteriological examinations carried out of all their sources of supply, and of the water as delivered to the consumer from their works, and the medical officer of health of the county council, and of any district council within the limits of supply, should at all times have free access to the records of such examinations, and should have power to call for copies of such records as he may deem it necessary to have on payment of a small fee to cover the clerical labor involved.

Some such course as this was advocated by Mr. Chaplin, when president of the local government board in 1898, in connection with a number of private bills then before parliament; but unfortunately no powers of this kind existed in any general act of parliament, and the objection was taken that for this reason such could not be conferred in any private bill. Clauses were subsequently suggested by the local government board to cover the various points named, but so far they have not become law, and private consumers are thus left to the unsatisfactory remedy of waiting until the tardy opportunity arrives of bargaining with water purveyors by the expensive process of opposing in parliament any application for further powers which may chance to be made. Such leisurely and uncertain methods do not at all adequately meet the case. Quite enough is known now-a-days of the serious actual and potential dangers of impure water supplies and of the means of averting such dangers to justify parliament in granting powers on the lines indicated above. The fact, too, that in a few instances, at all events, certain of these powers have been wrung out of parliament in the face of strenuous opposition, and have been successfully operated without injury to the water purveyors concerned is an additional argument for their speedy generalization.

To pass to another aspect of this question of water supply. In almost all districts, urban or rural, in the county, it is quite a common thing to find new houses being built outside the reach of a public water supply and being compelled to sink wells for water. Such wells are sunk on the land which has been purchased for the site of the house, and they are sunk in such a situation and of such construction that a contaminated supply will almost certainly be the result either immediately or after some little time. The council of the district have no power of compelling any adherence to rules as to propriety of site or method of construction such as may prevent possibilities of pollution; the owner may put his well where he likes and build it as he likes, and, so long as he can show temporary compliance with the requirements of the Public Health Water Act, 1878, in rural districts or in such urban districts as have adopted this act, his well may within a very short time become as full of potentialities for mischief as it is of water. The inclusion of a by-law specifying the situation and mode of construction of a well to supply drinking water would, it is fairly certain, be struck out by the local government board as outside the scope of the authority given by Sec. 157 of the Public Health Act, 1875, for the framing of by-laws. True, the construction of cesspools, &c., within a certain distance of a well or source of water supply may be prohibited under building by-laws, but I have never heard of a by-law prohibiting the construction of a well within any specified distance of a cesspool or other possible source of pollution. Here, in my opinion, a little elasticity in the interpretation might usefully be extended to local authorities in the making of by-laws.

In a large number of instances samples of water have been submitted to the county analyst for analysis and report, and arrangements have now been made under which a copy of every such analysis is forwarded to me at the same time as it is furnished to the district council requesting the analysis. Whilst this saves valuable time in most instances, there are still a few local authorities who apppear to think that the county analyst will, in some obscure manner, be influenced in forming his opinion on the analytical results obtained by a knowledge of the source from which the sample has been taken. Although this is obviously a ludicrous inference, the practice is still continued in some districts of labelling the samples with a mere number with the apparent idea that only in this way can an absolutely impartial opinion be obtained. This, looked at in the most obvious way, constitutes a fairly direct and totally unwarrantable aspersion on the methods of the county analyst. As a matter of fact it might easily happen that the withholding of information as to the source of supply might lead to the formation of a totally fallacious opinion on the suitability or otherwise of the water for domestic use; this has indeed happened in not a few instances within my knowledge.

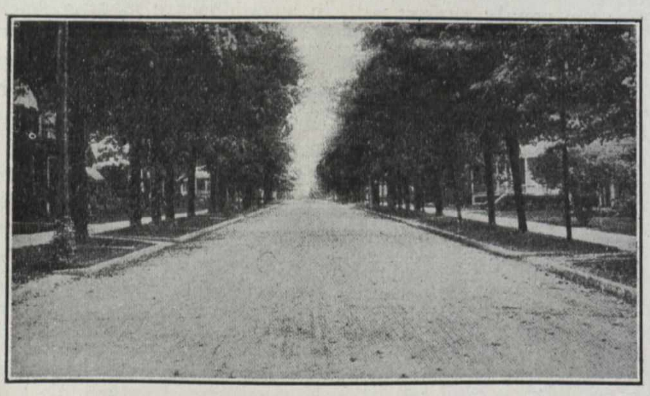
It cannot be too strongly impressed that a knowledge of the source and surroundings of any water supply is essential for the formation of a true opinion of its fitness or otherwise for consumption, and personally I would rather trust to an opinion formed as the result of careful local inspection than to one formed on chemical or bacteriological examination alone. Both chemical and bacteriological examination of water supplies have their uses, but also have their limitations. The "personal equation" of the operator is a factor of considerable weight, and it is by no means the only factor in the case. Lest I be misunderstood let me say at once that the chemist or bacteriologist who makes a single individual analysis of a water supply without any knowledge of the source or surroundings may be and often is quite right in the interpretation he puts upon his findings, but he is almost as often liable to be quite wrong. The case is totally different with a chemist or bacteriologist who has for a considerable period carried out systematic and frequent analyses of a certain water whether he knows the source and surroundings or not; and departure from the average or normal contents at once strikes him and a proper note of warning will not fail to be sounded.

A CONCRETE PAVEMENT WITH THIN WEARING SURFACE OF BITUMEN.

During the past few years a distinctly new type of pavement, consisting of a properly constructed concrete base and a thin wearing surface of bitumen and sand, has been developed and extensively used on several streets in Ann Arbor, Michigan, and to a more limited extent in other places.

The city engineer, E. W. Groves, describes this pavement and we here reproduce his statements in abstract form:

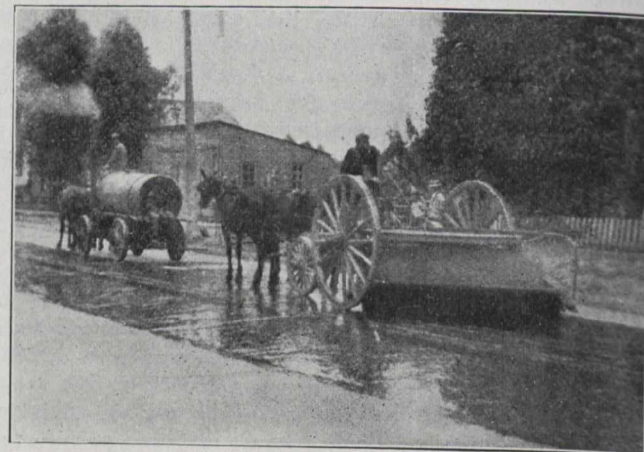
About five years ago, the writer, in order to prolong the life of certain streets paved with asphalt blocks, which at that time showed considerable wear, tried an experiment of covering the surface of the pavement with a thin layer of hot coal tar and sand. After being subjected to various conditions of traffic for about two years, this thin wearing surface proved to be so satisfactory that it was determined to try it for new construction work on a concrete base. During the summer of 1909 one block on a residence street, having about 1,800 sq. yds., was paved with concrete, a layer of coal tar and sand being placed thereon as a wearing surface. In the spring of 1910 this was so satisfactory that petitions were presented asking for approximately 18,000 sq. yds. of similar pavement, which we laid during that year. Before the end of the season of 1910 petitions were presented asking for 61,000 sq. yds., which we are laying this year, and at the present time there are on file petitions asking for approximately 100,000 sq. yds. for the season of 1912. All petitions presented ask for this form of pavement, and there seems to be no difference of opinion among the property owners as to the kind of pavement that should be laid. This is probably a revelation to those who are familiar with the letting of paving contracts.



View of Street in Ann Arbor, with Wearing Surface of Bitumen.

The concrete is laid in strips one-half the width of the street, and 25 ft. long, an expansion joint ¾ to 1 in. being left every 25 ft. across the street, perpendicular to the axis and at each curb. The surface of the concrete is given a wood float finish and roughened by brooming and indenting the surface with a tamp arranged for that purpose. After finishing a section as described the form at the center of the street is removed, and the pavement for the other half of the street is laid, the new concrete being deposited against that which has been previously laid, so that while there is a joint at the crown of the street it is hardly perceptible. This would be objectionable were it not for the bituminous covering, which completely covers it.

After the concrete has hardened and is thoroughly dry and clean, the surface is covered with hot bitumen and No. 4 Torpedo sand. The bitumen is applied from a sprinkler wagon designed for that purpose, having a fire box under the tank for heating the material to a temperature of about 200° F. The bitumen is immediately distributed evenly over the surface of the concrete with an ordinary street sweeper, with a well worn broom, and the surface well covered with torpedo sand. Approximately ½ gal. of bitumen is used per sq. yd. of surface and a cu. yd. of sand will cover approximately 250 sq. yds. making a wearing surface about ⅜ in. thick.



Sprinkling and Spreading Bitumen

The writer has experimented with various materials for the wearing surface, as follows: Crude coal tar, asphalt, tarvia, and these of various degrees of viscosity. It was finally decided to have a bitumen distilled for this special work and this is being done by the Barrett Manufacturing Co., of Chicago, and is being sold under the name of Dolarway bitumen. The results obtained with this material are satisfactory and produce a pavement resembling the better class of bituminous pavements with a base second to none.

The work at Ann Arbor is done by the city, which has its own equipment, purchases material and hires the labor. With labor at $2.00 for nine hours, cement at $1.10 to $1.30 per bbl., and gravel at the mixer at $1.00 per load of 1⅓ cu. yards, this pavement is put down for less than $1.00 per sq. yard.

The reasons for the popularity of this pavement are cheapness and durability. The writer has long been of the opinion that pavements for our cities have been costing entirely too much, and I believe that in the matter of cost this pavement solves the paving problem as completely as concrete solved the sidewalk problem. I also believe that this pavement is the only one which has been discovered which is suitable for country highway work. It would cost much less than any other permanent pavement that could be laid, and the cost of maintenance would be reduced to a minimum.

It meets the demand for a low cost, durable pavement, approximating in cost that of an ordinary macadam road and in durability that of our better types of street pavements.

DESIGN AND CONSTRUCTION OF THE MERIDIAN, IDAHO, WATER WORKS SYSTEM, WITH SOME COSTS.*

By EDMUND M. BLAKE.

The village of Meridian, with a population of about 1,000, is located in the heart of the Boise valley, about nine miles west of the city of Boise, on the Oregon Short Line R.R. It is the centre of a rich fruit, grain and hay district, and is also on the line of the Boise Valley Interurban Ry.

Up to the year 1910 the local supply of water for domestic use had come from private wells and dissatisfaction with this supply, coupled with outbreaks of typhoid fever, led the village to bond itself for the installation of a municipal water works system in 1910 for domestic use and fire protection.

The geological formation of the valley near Meridian was fairly well known, good supplies of soft, non-mineralized water being obtainable at a depth varying from 200 to 300 ft. There being no gravity supply available and the Boise river being too far to the north for the use of filtration galleries sunk into the river gravel along its banks, a deep well supply was the only recourse. A location was selected at the highest point directly in the centre of the village where a lot 60x120 ft. was purchased, for well, pumping station and tower tank. Here an 8-in. well was driven to a depth of about 212 ft. and then 6-in. tubing driven on down to the 252-ft. level where the flow was encountered in a deep stratum of coarse gravel underlying a 4-ft. stratum of very tough clay. The various strata met with in driving the well were as follows:

	Feet.
Top soil, lava ash	7.0
Sandy gravel	10.0
Cemented gravel, hard	23.0
Solid clay, hard	5.0
Sandy clay	30.0
Solid clay, hard	27.0
Sandy and gravelly clay	90.0
Tough, solid clay	20.0
Sand and fine gravel	36.0
Tough, solid clay, hard	4.0
Coarse, water-bearing gravel stratum at	252.0

The water rose to a point about 60 ft. below the surface, giving a depth of about 192 ft. of water, which level has been practically maintained up to the present time. Samples of this water were analyzed by the State Chemist and pronounced of an exceptionally fine character, being non-mineralized, extremely soft, free from ammonia contents, and with a constant temperature of about 52° F. as drawn directly from the well.

An air lift installation was decided upon, the size of the tubing, 6-in., being one of the factors against a deep well pump installation. An old air compressor, operated by a gasoline engine, was secured for purposes of test and cleaning out the well, the results of which were very satisfactory, indicating a practically inexhaustible supply and demonstrating the entire feasibility of lifting the water by compressed air.

The water works system, outside of the pumping plant, consists of about 20,000 ft., or nearly 4 miles of 4-in., 6-in. and 8-in. extra heavy, wood stave, wire-wound water pipe, manufactured by the Washington Pipe & Foundry Co., of Tacoma; 18 bronze mounted Ludlow fire hydrants; 8 controlling gate valves dividing the system into sections for repair work; a steel water tower tank built and erected by the Chicago Bridge & Iron Works, (see Fig. 1), with a capacity of 60,000 gals. and 110 ft. high from top of foundations to water surface when full; and a pumping station building constructed of white, sand-lime brick, containing besides the machinery room, a room for the fire department apparatus consisting of 1,000 ft. of 2½-in. rubber lined fire hose, two 1⅛-in. smooth Underwriter's play pipes, and a substantial hose reel—and a third room which is used as a council chamber by the village Board of Trustees.

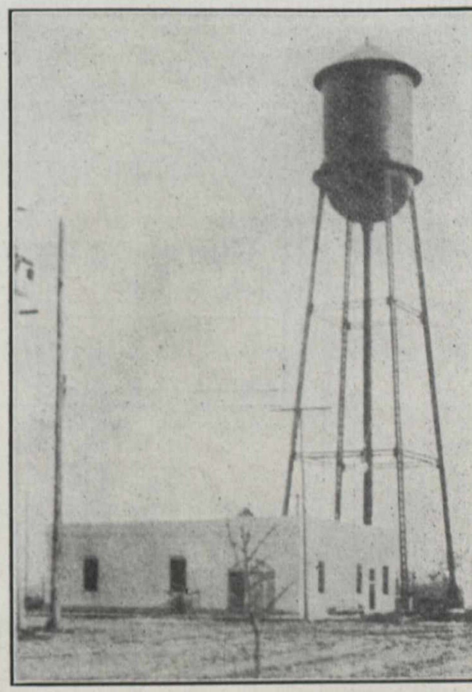


Fig. 1.—Exterior View of Pumping Station and Elevated Tank.

The following unit costs of some of the above materials are of interest:

4-in. wood pipe—	
Cost of pipe per ft	$0.21
Cost of laying per ft	0.14
Total cost per ft., laid	$0.35
6-in. wood pipe—	
Cost of pipe per ft	$0.31
Cost of laying per ft	0.16
Total cost per ft., laid	$0.47
8-in. wood pipe—	
Cost of pipe per ft	$0.43
Cost of laying per ft	0.17
Total cost per ft., laid	$0.60
Ludlow fire hydrants, each	$34.10
60,000-gallon tower tank, erected	$3,900
Foundations, in place	350
Total cost of tank and foundations	$4,250

The pumping plant (see Fig. 2) consists of the following parts:—A concrete receiving basin, containing about

*From Engineering and Contracting.

8,000 gals. One 6-in. deep well with one 6-in. outlet into the receiving basin and one 6-in. outlet for discharging to waste into an outside ditch, each outlet being fitted with controlling gates. One 4-in. by 5-in. Byron-Jackson two stage centrifugal pump with a capacity of about 625 gals. per min., with the tank full at 1,120 revolutions per minute. This pump takes water from the receiving basin and discharges it into the tank and the distributing system. It is fitted to start automatically by the operation of a float and weight (when the water reaches a fixed level in the receiving basin) which acts by a system of levers on the friction clutch throwing in the pump shaft. One 50 h.p., 3 phase, 60 cycle, 220 volt alternating current Westinghouse motor with starting compensator, direct connected to the centrifugal pump by means of the above friction clutch coupling. One 10x12-in. Sullivan air compressor, operated by belt from the above motor at 165 revolutions per minute and fitted with a 3½-in. Jarecki Automatic Unloading valve and a 36-in. x 6-ft. vertical air receiver. Under ordinary conditions this compressor delivers air to the well at about 40 lbs. per sq. in. pressure. The air is sent down 170 ft. into the well through a 1½-in. air pipe suspended in the 6-in. tubing and fitted with a reverse elbow at the bottom so that when released the air acts directly in lifting the volume of water.

The maximum capacity of the well was found to be about 225 gals. per minute with air at 38 lbs. pressure.

The capacity of the centrifugal pump with the tank full was found to be about 625 gals. per minute. The static head on the pump is about 112 ft. and the suction lift not over 8 ft.

The time required to fill the basin up to the point where the pump starts automatically was found to be about 34 minutes.

When the pump starts there are about 7,500 gals. in the receiving basin. It was found to require about 18 minutes to empty the basin when full with the air compressor discharging from the well at the same time. By throttling the gate on the force main, the capacity of the pump can be reduced so that in case of a bad fire a supply of about 220 gals. per minute can be kept up indefinitely.

In early July it required about 64,000 gals. of water every 24 hrs. to supply the demand. The village sprinkler carts were using about 15,000 gals. per day.

The system supplies water to 91 takers through 81 taps of which 30 per cent. are metered, and it is closely estimated that from between 450 and 500 persons are thus supplied with water.

Based upon meter measurements and a study of the families supplied, the estimated actual daily consumption per capita was between 90 and 100 gals. in early July, or a domestic daily consumption of between 40,000 and 45,000 gals.

The water unaccounted for, therefore, lies between 4,000 and 9,000 gals. per 24 hrs. If this loss is taken at 8,000 gals. per 24 hrs., the line loss is about 2,000 gals. per mile of pipe for 24 hrs. When it is taken into account that the line loss, or water unaccounted for any other way, in a well constructed and carefully maintained cast iron pipe system with lead joints will average between 2,500 and 3,000 gals. per mile of cast iron pipe per 24 hrs., it is seen that Meridian has a wood pipe distribution system which is more efficient than the average cast iron pipe system. The joints in the Meridian pipe were very carefully laid under the supervision of a skilled superintendent, the trench was puddled from the irrigation ditches, the tenon ends of the pipes were painted with boiling asphaltum tar before being driven into the couplings and the pipe itself was the best product of the Washington Pipe & Foundry Company, of Tacoma, where it was all personally inspected during its manufacture by the writer. It was shipped in box cars and kept from sunlight until laid. I can see no reason why it should not be good for a life of at least 40 years.

The entire system cost in the neighborhood of $24,000, and its fire protection features have already resulted in substantial reduction in insurance rates. The health or Meridian has never been better and the activity in building has been very marked since the system was put in operation.

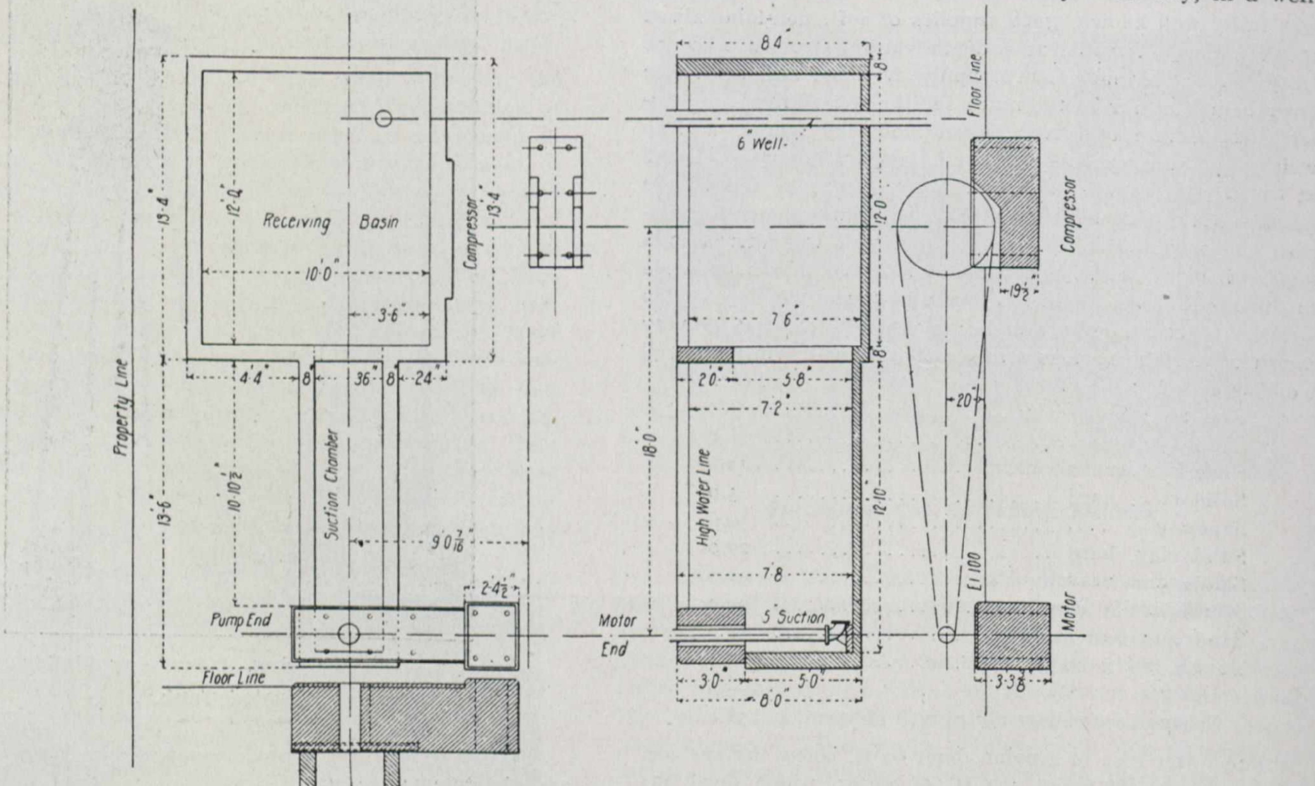
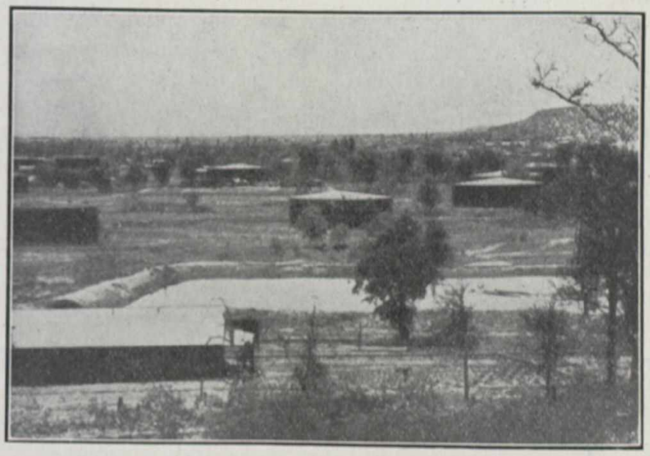


Fig. 2.—Details of Pumping Station.

PETROLEUM—ITS ORIGIN, PRODUCTION, AND USE AS LOCOMOTIVE FUEL.

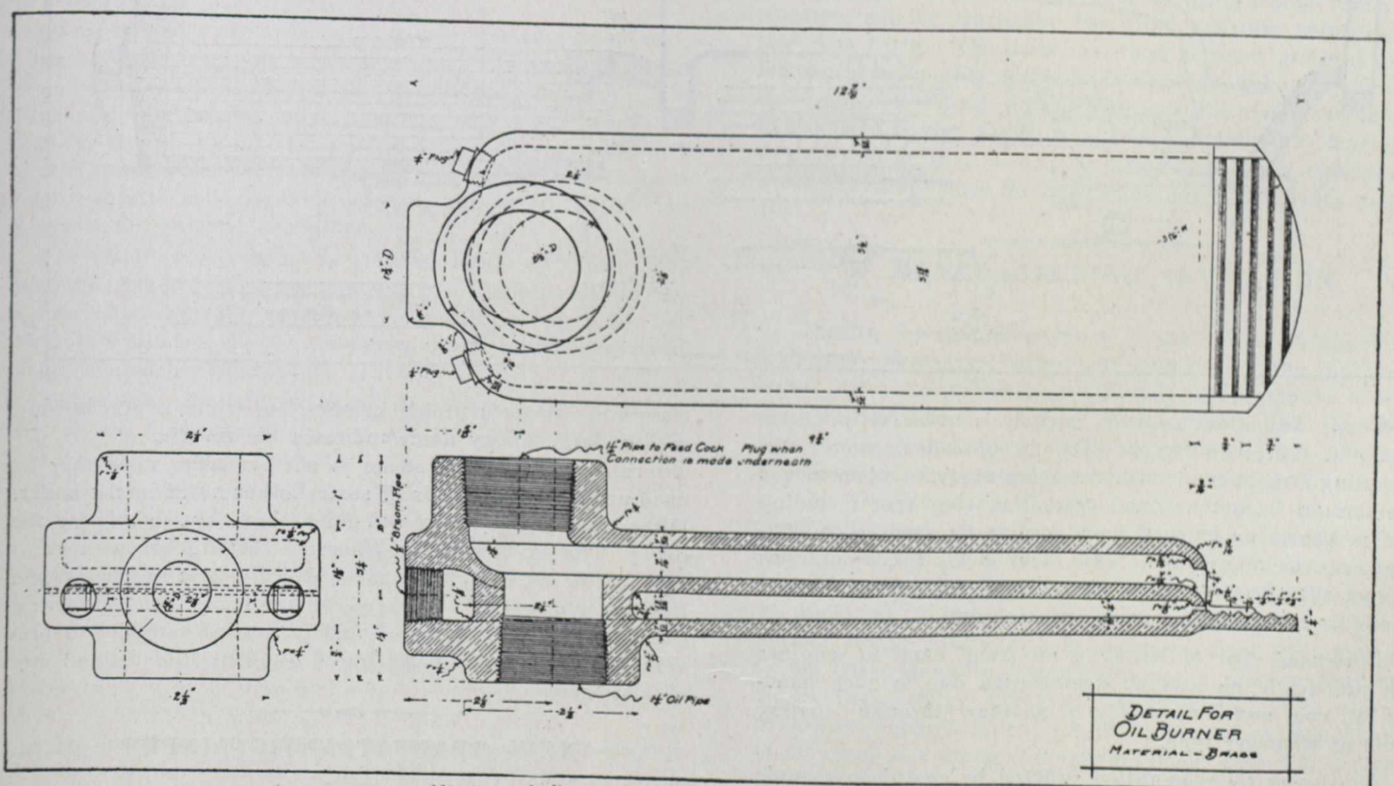
The production of petroleum in small quantities began in Japan and India about two thousand years ago, according to Mr. Eugene McAuliffe, General Fuel Agent, San Francisco Lines. Its use was restricted to remedial purposes. Needless to say, its curative properties were overestimated and its tremendous value as an illuminant and fuel were unknown. Crude petroleum is a natural bitumen composed mainly of combustible elements, carbon and hydrogen. In appearance it is a brownish-black viscous fluid, frequently shading into green, its average specific gravity 86 degrees or about 14 per cent. lighter than water. By subjecting petroleum to heat the lighter and more volatile portions are separated, the denser portion of the residuum splendidly adapted for furnace fuel purposes, the continued application of heat eventually creating a final residuum known as petroleum coke, an extremely hot fuel.

To Russia is due the credit of first using petroleum for fuel purposes. Earlier experiments were made in the direction of burning oil, the open pan method frequently employed, the results, however, unsatisfactory. Almost simultaneously an Englishman, Aydon by name, an engineer by profession, and Spakovsky, a Russian photographer, invented what they then called a "pulverizer," an apparatus which was the forerunner of our present burner and which atomized the oil, reducing it to a vapor which was blown into the furnace in gaseous form. Mr. Aydon used superheated steam to atomize "astatki," i. e. "mazut" or residuum, while Spakovsky used a jet of heated air for which he subsequently substituted a jet of steam at ordinary temperature and pressure. Aydon was the first to put his burner into actual service; his burner was the forerunner of those now in use in the United States; one slight change, that of using an elongated flat opening in the place of a small round one, has been introduced by the United States users. Of more importance than the types of burner is that of placing and keeping it in proper alignment, attempting to see that the proper volume of air necessary to proper combustion is admitted at the right place, it is most important that the point and volume of admission of air admits of such complete admixture of the oxygen and petroleum vapor as will not only effect full combustion but at the same time fill the fire box and flues with burning gases.



—Copyright Photo by C. Jack, Tulsa, Okla.

Oil in Earthen Storage, Glenn Field, with Steel Storage Tank in Background.



Representative Type of Burner Patented.

No serious attempts were made in the United States toward using petroleum as a locomotive fuel until the Spindle Top field came in when the Texas roads immediately took up the work of adapting locomotives to burn crude oil; the development of the California fields bringing the railroads of the Pacific coast states into line as oil burners, the consumption of fuel oil by the railroads of the United States with the mileage figures as follows:

	Length of mileage under fuel oil.	Total mileage made by oil burning locomotives.	Total barrels used.
1906	.....	....	15,577,677
1907	13,573	74,079,726	18,855,002
1908	15,474	64,279,509	16,889,070
1909	17,676	72,918,118	19,939,394
1910	.....	....	*23,000,000

The mileage figures for 1906 are not obtainable and those for 1910 are not yet completed, consumption for 1910 estimated and largely predicted on the increased consumption by the railroads of California oil, which, for 1910 was 12,775,000 barrels, or 3,000,000 barrels more than was used in 1909. Out of 77,697,568 barrels of petroleum produced in California in 1910, a total of 50,720,000 barrels were used for fuel purposes, oil practically displacing coal as a railroad, steamship, and manufacturing fuel on the Pacific coast.

Some of the principal advantages incident to burning oil as compared with coal can be summed up as follows:

Cost. This item depends entirely on relative price at mine and well plus freight to point of consumption. In computing freight haul tariff rates must govern when moved over foreign lines the actual cost of moving (not including what is known as fixed charges) ordinarily used in computing cost over home rails. In making these computations the fact that from 1,000 to 1,500 pounds of oil equal 2,000 pounds of coal must be taken into account.

Decreased cost of handling oil from cars to engines with practically no loss by depreciation due to such handling, all coal suffering badly in passage through coaling plants of whatever type.

The losses by evaporation suffered by coal do not apply to oil, neither does loss by theft in transit occur, oil reaching engine tenders unimpaired as to quality and undiminished in quantity.

Saving of time at terminals and increased mileage per engine, it being unnecessary to cut engines out for fire cleaning; the oil capacity of tender approximating 150 per cent. of that of coal, making longer runs possible.

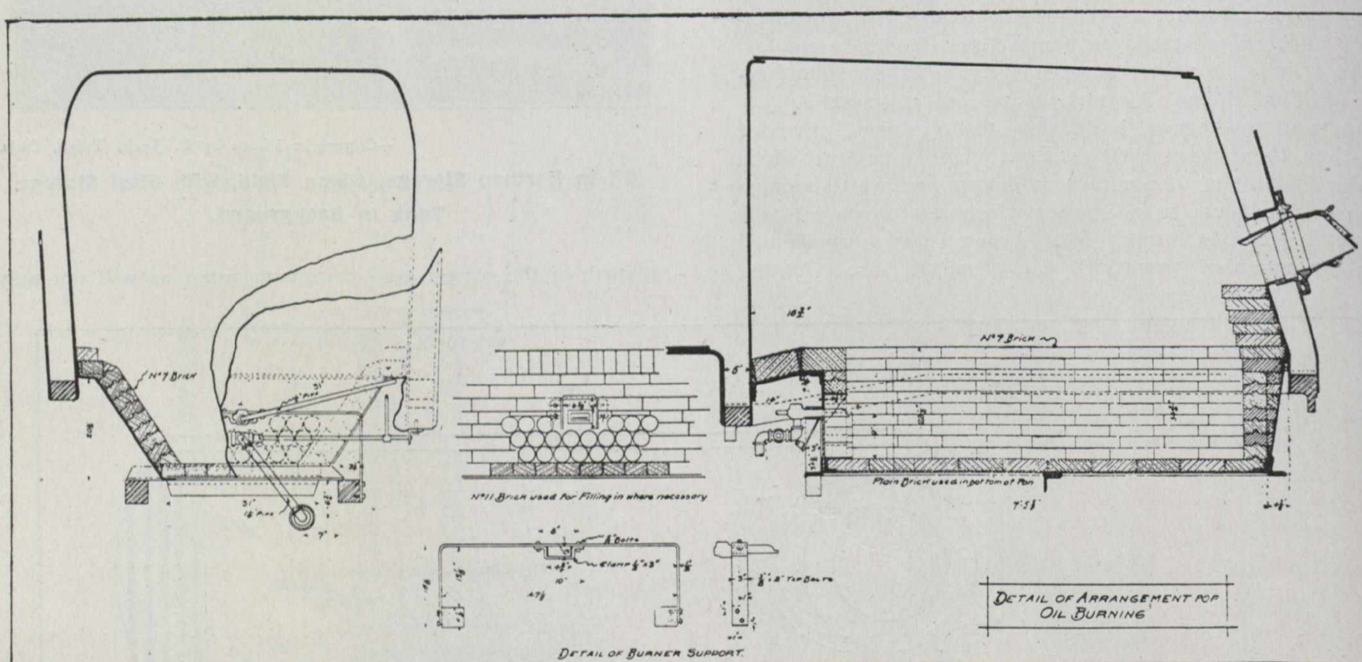
*Estimated.

Freedom from physical failure of firemen in extreme hot weather, the fireman's work actually lighter than that of the engineer.

The main consideration to be taken to account in operating under the minimum chance for accidents, appears to be in the adjustment of the mixing chamber or space.

The fire should not be started in an engine until the oil in the tender is heated to a temperature that will insure a good flow to the burner. This can be done by means of the steam line in the roundhouse, if necessary, by connecting roundhouse steam pipe to blower pipe cock on the smoke arch and manipulating the proper valves to apply direct or indirect heat to the oil in the tank. In the event of the fire going, or being put out, it should be relighted by using a piece of ignited waste. No attempt should be made to relight the fire from the heated bricks and the practice of so doing should be prohibited, as it is almost sure to cause an explosion which will damage the brickwork and perhaps injure severely the person attempting it.

The condition of the fire should be observed by means of sight hole in the furnace door. A fire having a bright, clear color denotes proper combustion, while a fire burning with a dark, smoky flame indicates the reverse.



Detail of Arrangement for Oil Burning

In firing up where steam is not available, wood may be used until twenty pounds of steam is generated in the boiler. (Less than this pressure will not be sufficient to atomize the oil.) The wood must be placed in the fire box with great care, so as not to damage the brickwork, and in using wood for this purpose it should all be consumed before starting out. Further, the engine should be started carefully to prevent the wood sparks causing fires along the right-of-way or elsewhere.

NEW TRANSATLANTIC LINERS.

The Allan Line directors are planning the inauguration of a fast service from Montreal to Liverpool, and hope to have it in operation early in 1913. Tenders have been invited for the construction of two new liners, in which speed is to be the necessary consideration. The ships will be somewhat larger than the turbine vessels, the Victorian and the Virginian, which are 520 feet in length. They will have a minimum speed of 18 knots per hour, and will have large first and second class passenger accommodation.

TREATMENT OF TIES.

The report of the Committee on Treatment of Ties, as presented by the chairman, Mr. J. H. Lynch, at the Convention of the Roadmasters and Maintenance of Way Association, held at St. Louis, Mo., in September, is abstracted below. Mr. Lynch says:

As chairman of committee to report on the feasibility of treated ties, I have consolidated all the data received from the different members. Our ideas vary considerably on the subject, which is, of course, to be expected, as the members of this committee cover practically every corner of the United States. And in looking over the different committees' work, in my opinion, this is by far the most serious and delicate subject before the association this year, as almost the entire attention of every railroad man in charge of maintenance and ties supply to-day has been directed toward preparing ties for the greatest resistance to decay and to the most effective means of handling ties to bring about this result. Yet unhesitatingly some of us may say, or think, that hardwood is hardwood and softwood is softwood, and the treatment of ties with creosote, zinc chloride, or any other solution, is the same in New York State as it is in California, the same in Oklahoma as it is in Minnesota, yet there is a vast difference and the point to be brought before this association, in our opinion, for the most serious consideration, is the lasting qualities of the different kinds of treatment of ties, the different kinds of timber, the endurance from climatic conditions in the different parts of the country and the best method for the least money for handling and taking care of treated ties from the time we receive them in the cars until the time they should be and are properly placed in track.

Ties treated with creosote, as a rule, are just in infancy when received from the treating plant. In treating those ties, the tie is gotten to a certain temperature and the oil is forced into the wood, under pressure, a certain length of time for the oil to soak into the wood as far as possible and to seal all the pores thoroughly to prevent decay, and to keep out all insects and vegetable growth, and to be better able to resist the climatic conditions.

In many cases, owing to various kinds of timber and numerous other causes, the amount of oil admitted into the tie varies considerably, and the amount of oil in a tie not yet absorbed when the tie is received from the treating plant is unquestionably noticeable.

Then, the question is when tie is received from plant, what is the best way to handle, with the least evaporation, and what is the most economical and best way for oil to absorb into tie until it is put into track, and when? We are of the opinion that when creosoted ties are received from plant, particularly for a roadbed of gravel, rock ballast, burnt gumbo, of such nature that track gets a box dressing and tie is practically covered up and surrounded with material to prevent admission of air and climatic conditions to any great extent, it would be the most economical and opportune time to put them in track and that ties would then practically absorb all the creosote.

Yet we must admit that in many events and for reasons unnecessary to explain it is impossible to get ties in track immediately after receiving, so we now arrive at the next step—piling ties.

Piling ties has been discussed for some time, and particularly ties treated with creosote. The ties treated with creosote, the closer they are piled to exclude air, rain, etc., it is generally conceded, the better. But one very important question which now confronts us is the expense of handling the most economical way in spending the company's money. in piling ties, and then getting them to where we want them in track. As soon as unloaded they should be piled to suitable high ground, and care should be used on single track, wherever possible, not to unload on same side as telegraph wires, and if so, not closer than 50 ft. to telegraph poles, or crossings or station signs, to eliminate danger in case of fire.

Unlike the untreated or zinc chloride tie, we do not consider it necessary to place old ties on ground under creosoted ties. The sod should be removed from around ties for a distance of at least 15 ft. to prevent fire. The number of ties unloaded along section depends on the number of ties per mile to be placed in track, and that to some extent should govern size of the piles. But most railroads have a standard of piling creosoted ties by placing two ties as sleepers and then piling them in close layers, cross box style with about 77 or 88 ties in each pile.

We want to have considered the method of piling them all one way, either length-ways or cross-ways with track, first placing two ties for sleepers and then all other ties piled opposite way in layers, each row one tie less from bottom and tapering to top with one tie.

In putting 78 ties in a pile place 12 ties on bottom, on the two sleepers, and if smaller piles are desired, place 11, 10, nine or any number desired at bottom, according to the size of pile wanted.

Another feature about piling them this way is that they are more easily discovered if taken away or stolen; or if it is desired to protect them, all outside ties can be protected with wire, etc., fastened to the entire outside of pile with one strand.

Ties treated with zinc chloride should be piled so as to be exposed as much as possible, to bring about rapid absorption, and be practically free from moisture before being placed in track. The drier the wood becomes after treating, the more thoroughly it becomes impregnated with the zinc chloride, and the tie suffers less from climatic conditions, particularly if ties are put in a soft roadbed, or during a wet season, or in a damp country. This has a tendency to wash away and cause the chemicals to evaporate very materially.

A MANUFACTURING INVITATION.

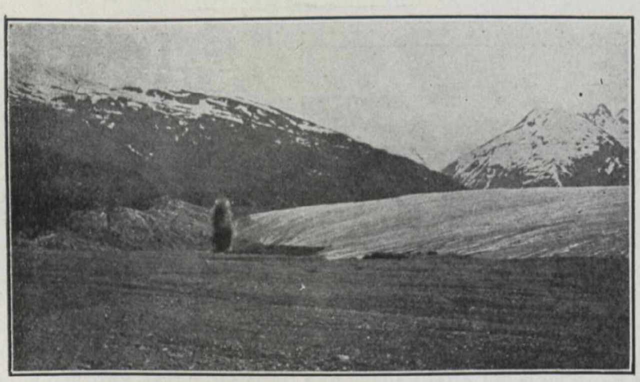
During the annual meeting of the National Association of Colliery Managers, which was held during the run of the recent British Exhibition, the British Westinghouse Electric and Manufacturing Company, Ltd., extended to the members of this association a cordial invitation to pay a visit to their works and inspect some of their apparatus particularly suitable for mines. A fairly large number of members availed themselves of this offer, and made a tour of the shops under the guidance of several Westinghouse engineers. A special exhibition of mining switchgear had been arranged, including a complete line of 750, 3,300 and 6,600 volt mining switch pillars, also examples of Type "S" gate end switch boxes specially designed for use in shallow headings; oil switches, circuit breakers, auto-starters, liquid starters, controllers, rheostats, etc. A large variety of switchboards of all types was going through the shops, and full access to all the details of manufacture was freely given. There were also on view steam turbines, condensers with Leblanc air pumps, turbo-blowers, R. T. Moore turbine-driven high lift pump for 400 g.p.m. against 827 ft. running at 3,000 r.p.m., large and small gas engines, motors, generators and other apparatus, including two-speed motors 1.80 h.p. 400 volt D.C. driving a Worthington hydraulic pump 250 galls. per minute, 800 lbs. per sq. in. for London and North-Western London-road Station. The visitors were afterwards entertained to tea by the company.

ALASKA NORTHERN RAILWAY.

Railway construction and operation in Alaska, contrary to general information, does not present any insuperable difficulties. Alaska is not, as some have imagined, entirely a land of icebergs and everlasting snow. The necessity for railways is very great, and it is probable that in the not very distant future numerous lines will be built to reach the mining districts and agricultural sections of that territory. The Alaska Northern is a good example of what can be accomplished in railway building in the far north. Its first division of 20 miles from Seward, the southern terminus, to Lake Kenai, was built at an average cost of $14,000 a mile, part of the track being laid in January at a temperature ranging up to 20 deg. Fahrenheit.

The terminus at Seward has an admirable harbor on Resurrection Bay, resembling a large bottle in shape, 11 miles long and 3 miles wide. The harbor has a depth of 500 ft., providing practical anchorage at the north end, is land locked by hills 2,000 to 4,000 ft. high, and is free of ice at all seasons. Nine years ago the site of Seward was a forest of spruce and hemlock. The town to-day contains more than a thousand people, and is connected by cable with the outside world.

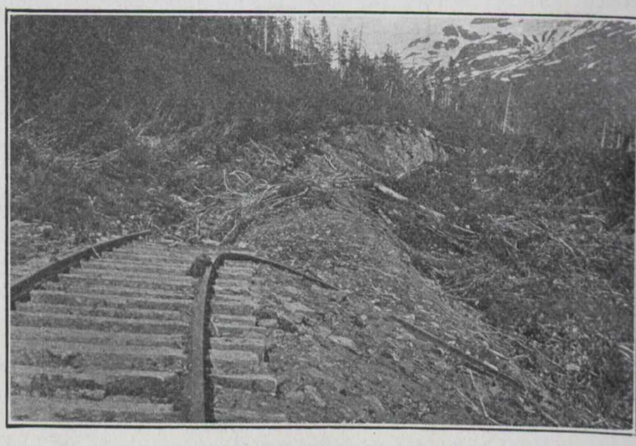
Leaving this terminus, according to the Railway Gazette, the line passes through a heavy timbered section broken occasionally by a homestead farm and leads into the Lake Kenai valley, a region popular with hunters and fishermen, owing to the abundance of moose, mountain sheep, black, silver tip, grizzly bears, and salmon and trout of many varieties. From this region the road takes a course which gradually descends to the Placer river valley, passing through seven tunnels, by huge cataracts, and along the edge of a deep gorge. The open valley of the Placer river winds along the foot of the Spencer glacier for a mile. Fig. 1 is a view of this glacier. At a point 62 miles from Seward the line reaches tide water, touching the east end of Turnagain Arm on Cook's inlet.



Blasting New Channel for Underground Streams at Foot of Spencer Glacier.

The traffic resources of the country are being gradually developed, many small stamp mills having been built in the last two years with satisfactory financial results. The whole country from Seward to the Talkeetna mountains, 250 miles, is more or less auriferous, the micaceous schist formation being split by numerous quartz veins carrying free milling gold. The road has been definitely located to Fairbanks, on the Tanana river, 457 miles from Seward.

Alaskan railways can be operated throughout the year. There are a number of difficulties to be overcome, but all the problems connected with railway operation have already been successfully solved. The annual snowfall ranges from one to ten feet, but there are no blizzards and very little drifting snow, so that a good rotary plow can easily maintain an open track throughout the most severe winter. The avalanches from adjacent mountains are most to be feared. The force of a large avalanche is almost irresistible, as shown in Fig. 2, where the track was carried out bodily, 70-lb. rails being broken. Snow slides occur occasionally in March and April. At a point near mile 54 a slide which occurred last year covered the track for a distance of a quarter of a mile to a depth of 70 ft. It was necessary to dynamite the snow in places and a great deal of it was removed by collecting a convenient mountain stream in sluice boxes.



Damage Done by Avalanche; Alaska Northern.

There is no difficulty in securing labor in Alaska for railway construction and maintenance. The prevailing rate of pay is $2.50 to $4.50 a day for laborers and mechanics. Provisions and supplies for building the new road were secured from Seattle and Portland, the ocean freight amounting to $5 to $10 a ton. Passenger rates on the Alaska Northern are 15 to 20 cents a mile, freight rates varying from $5 to $20 a ton for the 72-mile haul.

CONSERVATION OF WATER POWER.

Investigations of possible sites for developing water power on the public domain are being pushed by the United States Geological Survey, with resulting withdrawals of land from entry where it is found that valuable sites exist. In July 31,725 acres of such land were withdrawn, including a great number of power sites. No estimate has been made of the horse power involved, but owing to the character of the power sites withdrawn it is believed to be very large. These July withdrawals make a total outstanding area withdrawn of 1,546,258 acres, based on the examination and recommendation of the Geological Survey, and involving thousands of power sites and doubtless millions of horse power. Congress, which shall provide for the fullest possible development of these enormously valuable properties and at the same time guard the public interests.

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.

Managing Director.—James J. Salmond.
Managing Editor.—T. H. Hogg, B.A.Sc.
Advertising Manager.—A. E. Jennings.

Present Terms of Subscription, payable in advance:

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

Copies Antedating This Issue by More Than One Month, 25 Cents Each.
Copies Antedating This Issue by More Than Six Months, 50 Cents Each.

ADVERTISING RATES ON APPLICATION.

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

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

Winnipeg Office: Room 404, Builders' Exchange Building. Phone M. 7550. G. W. Goodall, Business and Editorial Representative.

London Office: Grand Trunk Building, Cockspur Street, Trafalgar Square, T. R. Clougher, Business and Editorial Representative. Telephone 527 Central.

Address all communications to the Company and not to individuals.

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

The Canadian Engineer absorbed The Canadian Cement and Concrete Review in 1910.

NOTICE TO ADVERTISERS.

Changes of advertisement copy should reach the Head Office two weeks before the date of publication, except in cases where proofs are to be submitted, for which the necessary extra time should be allowed.

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

Vol. 21. TORONTO, CANADA, OCT. 5, 1911. No 14

CONTENTS OF THIS ISSUE.

FURTHER EDUCATION ON FIRE WASTE.

"The battle against flames has been a losing fight, all things considered." In these words Mr. Edward F. Croker sums up his observation of twenty-five years' service as chief of the New York Fire Department. This was said, although the department's equipment, steadily improved since 1884, is "the most scientific and complete in the world," the department being "greater than the combined departments of the next five largest cities." In spite of all this, the fire losses in life and property and the dangers of frightful holocausts in New York are, he declares, steadily increasing.

That is a serious indictment, not of fire-fighting men or apparatus, but of fire-causing circumstances—national carelessness of fire and national indolence in not changing methods of house-building. In describing two fatal fires in manufacturing buildings in Newark and New York, respectively, the one an old, the other a new building, the former fire chief says: "In both we have an awful example of how our national carelessness with fires nullifies our efforts to reduce our annual tribute to the flames."

In a comment upon the series of articles Mr. Croker is producing on the "Losing Fight Against Fire," a sensible New York critic declares the simple fact to be "that we are neglecting the only real remedy, the prevention of the fires themselves. It is the lesson so long taught in the countries of Europe. In German cities this loss is barely a tenth of our own, and in those of England scarcely a fifth." Fire underwriters in Canada, as well as the States, recognize that there is something more for them to do than to pay losses when they come. They have to co-operate with others for the repression of fire. Since the destruction by fire still keeps pace with the means for its quelling, there is still need for the further education of the people of this continent on fire dangers and the necessity for improvement in building

BUYING OF COAL.

In an Editorial Comment in our issue of September 7th we drew attention to certain remarks of Sir William Ramsay's regarding Britain's coal supply.

While these remarks applied to Britain, they are also applicable to other parts of the Empire. This question of coal supply is now beginning to assume something of the importance due it, and Sir William Ramsay's statements on this point draw well-merited attention to it, for he speaks only after sober deliberation on the question.

There have been vast improvements in boilers and the various forms of power production in order to obtain efficiency, but there has been little done in connection with the scientific purchase and consumption of coal. In this department there are great opportunities for further cost reduction in the operation of manufacturing plants. We realize that more attention should be devoted to this question, and for that reason we are presenting in this issue an article on "Industrial Coal," which, we believe, will be of aid to those dealing with the coal question.

The writer compiled this article with the intention of instructing purchaser and vendor in the method of economical coal purchase, and, while realizing that the report of a chemist would be necessary in the event of a dispute, nevertheless endeavoring to instruct a purchaser who is in possession of but a limited knowledge of chemistry.

The mode of calculating fuel value will doubtless appeal to purchasers as being fairer than the older method of purchase by weight, which does not take up the question of whether he is purchasing carbon or slate and sulphur.

The writer notes that it is only a step from the scientific purchase of coal to its scientific use in firing.

This is a subject of great importance, and we feel that this article will be a distinct aid to those interested in the purchase of coal.

TO PREVENT POLLUTION OF THE WATERS OF THE GREAT LAKES.

At the close of the International Municipal Congress, held last week in Chicago, a meeting of City Health Officers and Sanitary Engineers from a number of the important cities in the United States and Canada gathered together to form a Municipal Society, to be known as the International Pure Water Association. This, no doubt, is the nucleus of a great organization, having for its object the prevention of the pollution of the water of the Great Lakes.

Dr. C. E. Ford, of Cleveland, Ohio, City Health Commissioner, was chosen temporary president, and Dr. Charles J. Hastings, Medical Health Officer of Toronto, temporary vice-president of the new organization.

The delegates to the new association are to be chosen by the Governors of each State and by the Premier of each Canadian province bordering on the lakes. These delegates will then form a permanent organization, who will elect regular officers.

It was decided that one of the first moves of the Association would be to secure legislation making it a criminal offence to dump waste material into the lakes at any point. It is also planned to interest physicians throughout the country in the work, particularly with a view of putting a check to the gradual increase of typhoid fever, which is becoming so prevalent in the towns and cities bordering on the Great Lakes.

This association deserves hearty support, for such an organization will do a vast amount of good in carrying on a system of education in bringing the public to appreciate the dangers of water pollution. It will require constant and continuous effort on their part, however, before any tangible results can be obtained.

BOTTLED WATER IN TORONTO.

A statement, issued this week by Dr. Nasmith, the City Bacteriologist of Toronto, showing the results of analyses of bottled waters sold by six private companies, the analyses being made in the City Hall laboratories, reveal a condition of affairs which is decidedly alarming.

Dr. Nasmith in his report says that analyses have been made in the laboratories of the Civic Health Department of the various brands of bottled waters being supplied to the people of Toronto. The bottles were bought in the open market, just as they are bought by the citizens every day. People have been buying these waters with the idea that they are much superior in quality to the city water, and much safer. As these companies have been making the most of the fact that Toronto's water supply has at times not been pure, and some of them made capital out of this fact in their advertising, it is only fair that the public should know how these waters actually compare with the water which the city is supplying.

"The standard methods of examination of the American Public Health Association have been used, and exactly the same methods and media have been used with the bottled waters as with the Toronto water. The colon bacillus has been isolated and proved out in each case when found. The results are, therefore, strictly comparative with Toronto water, the samples of which have been taken from the tap during the same period that the bottled waters were being examined, that is, from September 6th to 20th.

"The following is a summary of the analyses made:—

Name of Bottled Water.	Number of specimens examined.	Average number of bacteria per c.c.	Number of specimens showing B. coli.	Percentage of specimens showing B. coli.
No. 1	8	2,408	2	25%
No. 2	16	5,279	4	25%
No. 3	8	13,820	2	25%
No. 4	10	419	1	10%
No. 5	12	21,977	6	50%
No. 6	10	4,500	4	40%
Toronto water, laboratory tap	37	82	0	0%

"The results indicate that in general the majority of these waters are no better, and frequently not as good, from a bacteriological standpoint, as the water from the taps.

"Analyses were made early in the summer of the bottled waters then on the market, and they were found to be free from B. coli, though the bacteriological counts were sometimes high.

"The conclusion of the laboratory men is that carelessness in handling and cleaning the bottles is probably responsible for the contamination."

The above report indicates that the public of Toronto, in buying bottled water with the idea of obtaining it pure, are laboring under a misapprehension. Their alarm at this state of affairs will hardly be allayed by statements made by representatives of these companies, that there is an animus in the remarks of the City Bacteriologist, and that after all it is only one purveyor of water criticizing its competitors.

The report of the City Bacteriologist indicates that, of the specimens of water examined, from ten to forty per cent. showed B. coli, and, to draw the proverbial red herring over the trail in the shape of an attack on Toronto tap water, will not head off the discussion.

To our mind the great danger in buying bottled water is not that the water has been contaminated at the source, but in its carrying agent. The bottles are carried back and forth through dust-laden streets, and, unless thoroughly sterilized before filling, they are an absolute menace to the health of the users of the water. The great danger in their use, too, is the fact that people in buying have confidence, whereas in the use of the city water they are at all times cautious.

As we have said, the companies must find other means of defence than statements that Toronto's tap water is diluted sewage.

EDITORIAL COMMENT.

At the end of the present year new rules for electric wiring will come into force. Under these the wire to be used will be of a much better character, and similar to that used in England. The cheap grade that has been known as "rubber insulated wire" will be barred by the wiring inspector.

Mr. H. F Strickland, Chief Electrical Inspector of the Canadian Fire Underwriters' Association, states that a limited time will be given contractors to use up what stock they may have on hand of the old wire, but he advises against any purchase of stock of the kind of wire that was used in the past.

Rule 50 of the requirements of the International Board of Fire Underwriters for electric wiring and apparatus applies to rubber-covered wire.

* * * *

It is a fact often lost sight of that too much reliance must not be placed upon isolated examination of water supplies. Purity to-day does not of necessity guarantee the same standard on the morrow or next week. It cannot be too clearly understood that the analyst's opinion on a supply only refers to the sample actually examined, and, therefore, indirectly to the supply at the time only when the sample was taken. The Medical Officer of Roxburgh, Dr. M. J. Oliver, asserts that it is impossible to obtain positive evidence of the good quality of a water, all that it is possible to say being that evidence of contamination has not been found. The meaning of this is that an analyst is on sure ground when he condemns a water as impure owing to the presence of sewage matters, but when he reports that a water is pure he is on most uncertain ground, because all that he really means is to say that he has not found evidence of the existence of sewage in a particular sample.

MEETINGS OF CANADIAN SOCIETY OF CIVIL ENGINEERS.

1911-1912.

Meetings will be held in the rooms of the society, 413 Dorchester Street West, Montreal, at 8.15 p.m., as follows:—

1911.

Oct. 12th. Monthly meeting.
Oct. 26th. General Section meeting.
Nov. 9th. Monthly meeting.
Nov. 23. Electrical Section meeting.
Dec. 7th. Mechanical Section meeting.
Dec. 14. Monthly meeting.

1912.

Jan. 11th. Mining Section meeting.
Feb. 8th. Monthly meeting.
Feb. 22 General Section meeting.
Mar. 8th. Monthly meeting.
Mar. 22nd. Electrical Section meeting.
Apr. 12th. Monthly meeting.
Apr. 26th. Mechanical Section meeting.

The monthly meetings of the society as listed above are those arranged for in accordance with the desire of the society, expressed at the last annual meeting.

The Committee on Papers consists of Mr. H. H. Vaughan, chairman, the officers of sections and the chairmen of branches.

The Engineers' Club of Toronto

96 KING STREET WEST

MEMBERS' TELEPHONE, M. 468
OFFICE, M. 4977

Programme for October, 1911

FRIDAY, 6th, 8 p.m.

Meeting of Toronto section of American Institute of Electrical Engineers. Business meeting and paper. "Notes on Construction of Fourth Avenue Subway, Brooklyn, New York," illustrated with lantern slides, by Mr. Parker H. Kemble.

THURSDAY, 12th, 8 p.m.

Opening meeting of the season.
Address by the President from the chair.
Informal discussion of Club affairs, introduced by the First Vice-president.
Coffee and sandwiches.

THURSDAY, 19th, 8 p.m.

"A Talk on City Planning for Toronto," by Mr. J. P. Hynes. Illustrated by lantern slides.

THURSDAY, 26th, 8 p.m.

Meeting of Toronto Branch of Canadian Society of Civil Engineers. Address by Mr. T. H. Hogg, B.A. Sc., editor of "The Canadian Engineer," on "Hydraulic Power Plant Regulation."

R. B. WOLSEY,
Secretary.

HYDRAULIC POWER IN CANADA.

In a recent report Mr. J. B. Challies, Hydraulic Engineer, Railway Lands Branch, gives the following figures as an estimate at the present time of the water power resources of Canada:

	Possible horsepower.	Developed and in course.
Yukon	470,000	55,000
British Columbia	2,065,500	150,100
Alberta	1,144,000	12,000
Saskatchewan	500,000	.....
Manitoba	504,000	160,000 about.
Northwest Territories	600,000	.....
Ontario	4,308,479	350,000
Quebec (exclusive of Ungava)	6,900,000	125,000 about.
New Brunswick	150,000	9,080
Nova Scotia	54,300	13,300

Mr. Challies adds that more accurate information is being secured daily of the water powers in the various provinces and the amount of developed water power is changing so rapidly that it is extremely difficult to arrive at a satisfactory compilation of either the amount of developed or undeveloped power throughout Canada. The only attempt at a complete compilation of our water powers is that of the Commission of Conservation, which has had several engineers for over a year engaged in preparing a detailed, accurate report of all the developed water powers in Canada and as complete as possible estimate of the undeveloped powers.

IMPORTANCE OF STREET PAVING IN CITY LIFE.†

By IRA O. BAKER, C.E.*

Good street pavements are necessary for the highest development of the commercial, sanitary and æsthetic life of a city; and as it is the purpose of the exposition in connection with which this convention is held, to stimulate interest in municipal matters and to disseminate knowledge concerning efficiency in municipal affairs, we will do well, at the opening of the topic of the hour, to direct attention to the importance of good pavements to the life of the city.

Total Cost of Pavements.

Measured by the amount of money invested in them, street pavements belong in the first rank of importance in municipal affairs. According to a recent publication of the Department of Commerce and Labor the value, in 1907, of the pavements in cities having a population of 30,000 or over was $380,000,000, exclusive of the cost of curbs, gutters, sidewalks and "other highway improvements." The cost per capita does not vary much with population, and the average cost per capita is $16.35. There are many pavements in cities having a population of less than 30,000, but the census gives no data for cities of less than 30,000 population. Computing the cost of pavements in cities having a population of 8,000 by proportion, and adding this result to the one already stated, gives the total cost of pavements in cities having a populaton of 8,000 or over as $478,000,000, exclusive of the cost of curbs, gutters, and "other highway improvements." If the cost of curbs and gutters, which are properly a part of the pavement, were included, the total cost of the pavements in cities of 8,000 or more population would be more than $500,000,000. Therefore, measured by the money invested, street pavements are probably the most important of any single class of engineering construction except steam railroads. Further, the annual expenditure for pavement in cities of 30,000 or more is $1.91 per capita, being $2.16 in the largest cities and $1.52 in the smaller. Then, by an easy proportion, the total annual expenditure for pavements in cities of 8,000 or over is about $35,000,000. Hence, merely as a financial question, street pavements deserve the most careful attention and systematic study.

Advantages of Pavements.

But pavements have a far greater importance in municipal life than their mere financial value. They have such an important and far-reaching effect upon the commercial, sanitary, and social life of a city, that no enumeration is likely to include all of the benefits; but nevertheless it will be of advantage to enumerate some of the more important of the benefits resulting from the construction of pavements. Briefly the principal advantages are:

1. Good pavements lessen the tractive power and decrease the cost of transportation.

2. They increase fire protection by facilitating the transportation of the fire engine.

3. They establish a permanent grade, which is an important matter when other improvements are to be made.

4. Pavements add to the appearance of the street by giving a uniform surface instead of the irregular one of an unpaved street.

5. They increase cleanliness, since the pavement is less dusty in a dry time and less muddy in a wet time than an unpaved street.

6. They increase healthfulness by removing holes filled with mud and filth.

7. Pavements permit pleasure driving at all seasons, and facilitate social intercourse.

8. Pavements allow the use of bicycles, which furnish cheap transportation and healthful recreation to many.

In discussions of this subject it is customary to include the enhanced value of the property as one of the advantages of a pavement; but the increase in the value of the property is simply a measure of the benefits enumerated above, and hence should not be again included.

The first three benefits above may be regarded as financial advantages, and the last four as sanitary and æsthetic. It is impossible to compute even approximately the financial, much less the sanitary and æsthetic value of good pavements; but it is safe to say that they are an absolute necessity to both the business and the resident districts of the larger cities and also for the business districts of the smaller cities, and that on residence streets of small cities good pavements add greatly to the health, comfort and pleasure of life.

Selecting the Best Pavement.

Pavements being so important in the life of a city, it is very desirable that this meeting do all it possibly can to disseminate correct information concerning (1) the best method of selecting of the form of pavement best adapted to a particular situation, and (2) the proper method of constructing and maintaining pavements. In the past not unfrequently the pavement on a particular street or a part of a street has been regarded as a local improvement and little or no attempt has been made to consider the relations of the particular pavement to the needs of the remainder of the city. Again, in many states and possibly in most, the abutting property holders have by law the power to determine the kind of material to be used and the width of the pavement to be laid; and consequently the essential features of the pavement are liable to be determined by the idiosyncrasy of one or more property holders, or by the personal interest of the promoter of some particular form of pavement, without much or any attention to the engineering or economic principles involved. Seldom is any attempt made to determine the form of pavement best adapted to the city as a whole or even to any particular classes of streets. At best, a committee of the city council or of the abutting property holders under the guidance of a promoter make a trip to neighboring cities to inspect a particular kind of pavement.

No one kind of pavement is equally well suited to all cities or even to all streets in a city. Each street or group of streets should have the kind of pavement most available and best suited to its particular needs. To determine the best pavement for a particular street, a study should be made of the relative location, the traffic, the present and prospective uses of the street, and the cost and durability of the different paving material available in that locality. Few if any cities have taken a census of the travel on any of their streets, and yet such a record is of great value in determining the best pavement. For the lack of such statistics

†Paper delivered to International Municipal Congress, held in Chicago September 18-30, 1911.

*Professor of Civil Engineering, University of Illinois, Urbana.

many cities have wasted large sums by an injudicious selection of the kind of pavement to be laid, and thus repeated the mistakes of other cities. The sums thus lost are often many times the cost of securing a competent expert to advise about the best kind of pavement.

As an illustration of the waste due to a failure to adopt the form of construction best suited to the local conditions, a quotation may be made from a carefully considered and conservative report published a few months ago by a citizens' association concerning pavements in one of the largest cities in this country. In this particular city it is the custom in laying asphalt pavements to use the same thickness of foundation and of the asphalt wearing coat on resident streets as on business streets, regardless of sound theory and practical experience in other cities to the effect that on light traffic resident streets, both the foundation and the asphalt wearing coat can be considerably thinner than upon heavy-traffic business streets. This report estimates, with abundant show of reason, that this city in the asphalt pavements it laid in 1910 could have saved something over $200,000 or 19% of the total cost by using a thinner foundation and a thinner asphalt coat. A somewhat similar saving could have been made in wood block pavements. The total amount thus virtually wasted last year in this city in its asphalt and wood block pavements was $226,000. The saving possible in this one item becomes more significant from the fact that it is expected that an equal amount of these two kinds of pavement will be laid annually for several years to come, and that a corresponding saving can, therefore, be effected each year.

Width of Pavements.

Again, money is often virtually wasted by making the width of the pavement greater than is necessary, particularly on purely residence streets and on business streets in small places.

It is wise to make the streets of residence districts of liberal width for sanitary and aesthetic reasons; and also because the future of the street cannot be certainly foreseen,—the residence street may become a business street, or an unfrequented street a thoroughfare. However, it is not necessary that the whole width should be devoted to wheel-ways and sidewalks, particularly in small cities. A grass plat between the sidewalk and the pavement, in which shade trees are set, adds to the beauty of the street and to the comfort of the residents by removing the houses farther from the noise and dust of the pavement. The grass plat or parking also affords an excellent place in which to place water and gas pipes, telephone and electric-light conduits, etc. In large cities where the street front is built up solid with houses of several storeys, it may be necessary to dispense with the grass plat, and to devote the entire street to sidewalks and roadway.

It is universally admitted that pavements are desirable; but often, owing to the unwillingness of at least some of the people to pay for them, it is difficult to secure them. Except for the cost, the wider the pavement the better; but length is more valuable than width. An excessive width is a needless expense, and delays or prevents the getting of any pavement at all; hence one help toward securing pavements is to make the pavement only wide enough to accommodate the traffic. Not infrequently the pavements of suburban and residence streets are needlessly wide. A narrow pavement not only costs less to construct, but also costs less to clean and sprinkle; while the cost of maintenance depends chiefly (or, with a pavement not subject to natural decay, wholly) upon the amount of travel, and hence is nearly (or entirely) independent of the width.

It is not wise to consume time here in an attempt to lay down definite rules for the width of pavements, for much depends upon the width of the street, the amount of travel, and the other local conditions, and particularly whether or not there are one or more car tracks on the street.

Inspecting Construction.

The value of a pavement, particularly its durability and smoothness, depends greatly upon the efficiency of the inspection during construction. Not many cities have a trained force of inspectors, and most cities appoint as inspectors men without practical experience or technical training; and consequently the inspection is poorly done. It is not a very serious reflection upon a contractor to say that he will do work only as well as required by the inspector. If the inspector does not know the character of workmanship or material required, or does not care, neither the contractor nor his men are likely to be very particular in these matters. Not unlikely in many cases a contractor will do better work on honor without an inspector than under an ignorant or indifferent inspector. Many otherwise intelligent men seem to think than anyone can inspect the construction of a pavement; and until public opinion demands more efficient inspection, it is useless to expect much better pavements than are usual at present.

To make more clear the preceding remarks about inspection, one or two examples will be given. One of the most glaring and most serious defects in pavements is that due to the improper back-filling of trenches in the streets. It is often held that if the trench is back-filled a year or more before the pavement is laid, it will not settle; but this is certainly not true, and is perhaps not usually true. The condition of the back-filling of all trenches should be carefully tested before any pavement is laid.

Another serious defect due to carelessness and inexcusable neglect is the leaving of loose pieces of stone upon the surface of the concrete foundation of a pavement. It would be unwise to attempt here to state specific rules for the inspection of pavements; but it is perfectly safe to say that even a little care and consideration in selecting the inspector and in inspecting the construction of the pavement will richly pay in durability and the smoothness of any pavement.

Conclusions.

Fundamentally, the defects and failures in the general method of securing pavements is due chiefly to the imperfections in our form of municipal government, and also largely to the indifference of the intelligent and honest citizenship to municipal affairs; and the result has been that our cities have not to any considerable extent availed themselves of the services of men who have made a study of matters relating to street pavements. Private corporations are usually ready to employ the best experts that can be found, and often pay them what some regard as fabulous salaries; but public municipalities are usually unwilling to avail themselves of the services of experts at any price, and as a result many branches of the municipal service are carried on carelessly and wastefully. A few examples have been cited of the carelessness and waste in pavement construction. The financial, sanitary and aesthetic value of pavements is so important in the life of any city as to be worthy the careful, thoughtful consideration of the most intelligent men in the community, and to justify the securing the services of an expert in that branch. To this end it is hoped that all who hear this address will do all they can to create a healthful and helpful public sentiment along this line.

A SUN POWER PLANT.

Mr. Frank Shuman has recently completed a number of experiments tending toward the goal of utilizing the heat carried by sun rays. Mr. Shuman's researches cover a space of years at an expense exceeding $100,000. His recent efforts have been to complete a large plant which is to be shipped to Egypt, but is temporarily working at Tacony, Philadelphia. The result of his contrivance indicated a power of 3,000 gallons of water per minute raised 33 feet; this, however, might safely be considered as a minimum, as in tropical localities the designer anticipates two if not three times this power production.

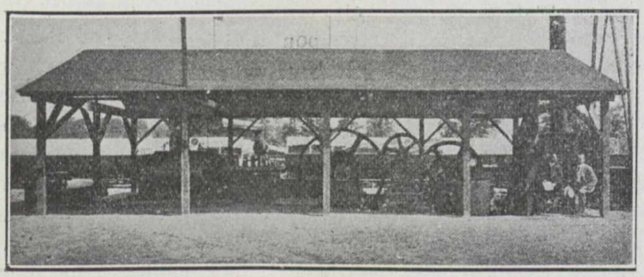


Fig. 1.—View of the Engine, Auxiliaries and Water Pumps.

The principle on which Mr. Shuman's "motor" operates depends upon certain observations made by himself, wherein he found that if a vessel were so arranged that the sun's rays could impinge upon it, and if all heat losses by conduction, convection and radiation were prevented by a theoretically perfect method of insulation, the temperature within the vessel would rise very high without any attempt being made to concentrate the rays of the sun. For commercial purposes it is impossible to secure any form of insulation which approached the theoretical requirement. However, the main object is to produce commercial power at low cost by well-known cheap insulating materials.

Were no steam made in the vessels as they are arranged in the present plant, the temperature therein would go up to 350 deg. Fahr. in latitude 40 north, possibly to 450 deg. at the equator. The production of steam at atmospheric pressure, however, keeps the temperature in the vessels down to 212 deg.; and whatever excess of heat is produced by the sun's rays over and above that lost is converted into steam and may therefore be utilized. The engine used in the present plant is a low pressure reciprocating type of great steam economy, connected to a condenser, and the usual auxiliaries. The water from the forming in the condenser is forced to the absorber. Fig. 1 shows the general arrangements of engine, etc.

The absorber is a series of units, each containing a flat rectangular water vessel enclosed in flat wooden box, covered with two layers of glass which provide an air space around the sides; the bottom is insulated by a 2-inch layer of regranulated cork and a double layer of waterproof cardboard.

Fig. 2 illustrates a battery of these absorbers supported about 30 inches above ground, which is sufficient height to enable them to be perpendicular to the sun at the meridian.

Plane mirrors are supported on two sides of each and every box with a view of absorbing the maximum amount of sun rays and reflecting them upon the water surface in the water vessel, which is connected at one end to a feed pipe and to a steam pipe at the other. The steam pipes from the various units feed into one main 8 inches in diameter and through this conduit the steam is directed to the engine.

From tests made in Philadelphia in August it was found that from the absorber of 26 banks of units, each containing 22 single units and having a light absorptive area of 10,296 sq. ft. and an actual area of 5,148 sq. ft., there could be developed during eight hours 4,825 lb. of steam. The power produced was much lower than normal to the plant, as it was built for tropical use and was entirely unfitted for commercial work in northern latitudes; however, Fig. 3 shows a blow-off at the safety valve at ½ pound above atmospheric pressure.

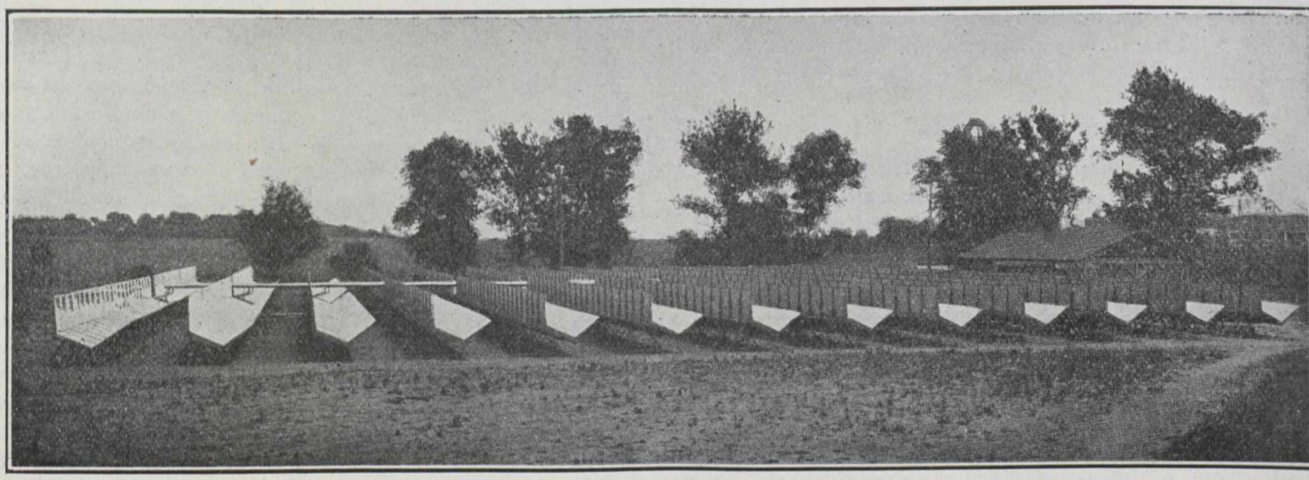


Fig. 2.—Group of Sun Heat Absorber Units.

During the seven years of development of this plant the inventor reached the conclusion that the apparatus is practically indestructible, except for the deterioration of the creosoted wood and the breakage of glass. Using the data as to the life of these parts, which experience indicates to be fair, the field of usefulness of the sun power plant has been

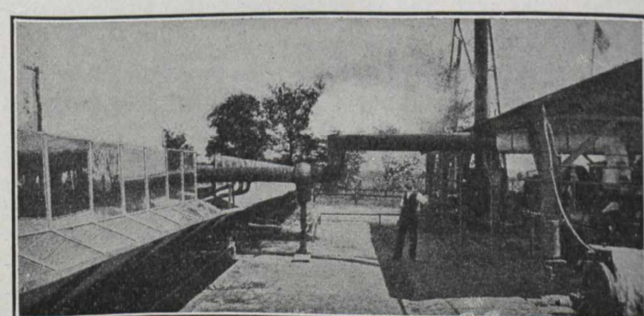


Fig. 3.—Safety Valve Blowing Off.

stated as follows by Mr. Shuman, the capacity of the plant being 100 h.p. and its operation to be confined to 8 hours daily for 350 days a year.

The sun power plant will cost $20,000. The interest on this sum at 5 per cent. is $1,000, depreciation at 5 per cent. is $1,000 and an engineer at $5 a day will call for $1,750, making a total of $3,750.

A compound condensing engine and pump will cost $10,000. Interest at 5 per cent. and depreciation at 5 per cent. will amount to $1,000, and an engineer will require $1,750, as before, making a total of $2,750. The minor supplies of oil and other lubricants will of course be similar to a coal heated plant.

THE DIESEL OIL ENGINE.

A paper on the Diesel Oil Engine was delivered to the Engineering Section of the British Association for the Advancement of Science, at their last meeting, by Chas. Day. We publish an abstract of the paper as follows:

The economical generation of power for industrial purposes depends mainly upon the following factors:

1. (a) The attainable economy of working at different loads of the prime mover itself, including boiler or gas producer, and all accessories such as condensers, feed pumps, water pumps, &c.

(b) The degree to which this attainable economy can be practically maintained under the conditions of working, and the load factor.

2. The stand-by losses, i.e., the expenditure necessary to keep the plant ready for work when wanted.

3. Wages of engine-room attendants, stokers and other men employed about the power house

4. Expenditure on lubricating oil, cleaning, waste and sundry stores.

5. Cost of repairs and of the maintenance of all parts of the plant in good working condition.

6. The cost of water for condensing, and for boiler feeding in the case of steam plant, for the engine water jackets, and for the gas producer in the case of gas plant, or for the engine water jackets in the case of Diesel plant.

From the mere enumeration of these items, it is very obvious that tests either on makers' works, or on site, even though the tests extend for a week or so, do not form a sufficient guide as to the real value of the engines for industrial purposes, and that a far safer, in fact, the only safe conclusion, can be formed from a study of results obtained in actual practice. For instance, it matters not how economical an engine may be in regard to fuel if the expenditure in other directions more than out-balances the gain in fuel consumption.

In actual service it is not to be expected that power plant can always be kept and worked at its highest efficiency. The average results actually obtained over a term of years differ considerably from those attainable under the very best of conditions.

The great difficulty most buyers find is in securing reliable figures of power costs from people engaged in trade, except in the case of electric supply stations. The writer does not know of any body of large power users who systematically prepare accounts showing their power costs on a uniform basis and publish them. This practice in connection with electric supply stations fortunately does give an independent and authoritative basis from which valuable deductions can be made. The figures published in the Electrical Times cover practically almost all the supply stations in Great Britain, and this information, combined with information obtained direct from station engineers, has enabled the author to determine the average results obtained in such stations. With different types of plant these averages, for stations having a plant capacity not exceeding 1,000 h.p., are as follows:

Table I.—Average Cost Per B.T.U. Sold.

Type of engine.	Fuel.	Lubricating oil, waste, stores and water.	Wages.	Repairs and maintenance.	Total works cost.	Load factor.
Steam	.45d.	.06d.	.25d.	.26d.	1.02d.	14.7
Gas	.43d.	.09d.	.28d.	.24d.	1.04d.	15.3
Diesel	.23d.	.04d.	.19d.	.07d.	.53d.	14.3

The limit of 1,000 kw. was fixed owing to there being as yet no large electricity supply stations equipped solely with Diesel engines or gas engines. Of course, better results are obtained when driving machinery which gives a better load factor, but the causes which produce loss are, as a rule, the same, though modified in extent. The general conclusion formed from a study of electricity stations holds good for the great majority of power users, though, perhaps, not applicable to some special trades, where engines can be run continuously on almost uniform loads. It is also necessary to point out that the figures include some items which should not strictly be charged against the power plant. For instance, the wages items include figures for men working on cables, street lamps, and in sub-stations, whilst the repairs items include repairs to such parts. Also it is necessary to mention that the figures give the costs per unit sold and not per unit generated.

From the averages it is clear that a substantial gain is obtained by the adoption of Diesel engines, as against either gas or steam engines, the figures being beyond doubt substantially accurate. It is also noticeable that the gain is not only on fuel consumption, but is practically in the same proportion on the other items of expenditure.

The great saving shown by these average figures is confirmed by repeated experiences of the author. In many cases, although the figures guaranteed with Diesel engines have been no better than figures previously guaranteed, and obtained on tests, with existing steam and gas engines, the Diesel engines have shown over extended periods a saving of 50 and 60 per cent., and in some cases an even greater percentage, the result being due to the fact that the Diesel engine's average working results were very much nearer to the guaranteed figures than with gas or steam engines, combined with the fact that the relatively high cost of working at light loads with gas or steam had not been sufficiently taken into account when considering the guaranteed figures.

When going through cost records to prepare the average figures previously given, the author noticed very wide differences of cost per unit, particularly in the case of the steam plant. He therefore had the average cost calculated for steam stations of different capacity, and as the results are interesting, they are given separately in Table II.

The table shows the great improvement which follows increase of size with steam stations, or expressed in the reverse direction it shows how great is the disadvantage of small stations when steam power is used.

It is further to be noted that even with the largest steam stations, the costs per unit generated are no better than for quite small stations using Diesel engines, and this in face of the improved load factor. This is a most important point, and shows that small Diesel stations can profitably supply at prices hitherto thought to be obtainable only in densely populated centres having large power stations.

In all cases the figures which have been given are works cost, and do not include anything for interest on capital and depreciation. It is hardly possible to give a definite statement showing the cost of constructing and equipping power houses of different types, as there are so many variable factors. However, the author's experience of a considerable number of estimates indicates that up to a capacity of, say, 1,000 kw., there is generally little difference between the gross capital expenditure required, whether steam, gas or Diesel engines be adopted.

Having now dealt with what may be termed the commercial aspect, it may be well to study briefly the constructional features desirable in engines for dynamo driving. For speeds which are not slow, engines of the multi-crank type

Table II.—Average Works Cost Per B.T.U Sold on Steam Stations of Different Sizes.

Capacity of station not exceeding.	Fuel.	Lubricating oil, waste, water and stores.	Wages.	Repairs and maintenance.	Total.	Load factor.
kw	d.	d.	d.	d.	d.	
250	.63	.09	.35	.36	1.43	13.2
500	.56	.06	.27	.29	1.18	13.3
750	.43	.05	.23	.24	.95	15.4
1,000	.40	.05	.23	.21	.89	16.8
1,500	.42	.04	.17	.18	.81	16.9
2,000	.37	.04	.16	.21	.78	17.7
3,000	.33	.04	.15	.17	.69	17.4
4,000	.40	.03	.14	.20	.77	18.8
5,000	.34	.03	.11	.16	.64	18.7
7,000	.36	.04	.13	.20	.73	17.9
10,000	.26	.03	.09	.13	.51	22.6
20,000	.30	.03	.11	.16	.60	19.6
50,000	.23	.02	.10	.11	.46	20.56

become desirable, otherwise serious vibration is likely to be caused. For the same reason it is important that the distance between the centre lines of the cylinders of an engine be reduced as much as possible, and on this account the vertical construction is much more suitable than the horizontal, and gives much better accessibility. The vertical design is also better from the point of view of piston wear.

Very complete enclosing, combined with forced lubrication, is in the author's opinion an absolute essential for high-speed engines, whether steam, gas or oil. With the first few oil engines to which forced lubrication was applied, a portion of the lubricating oil got drawn up into the cylinders. Improvements in construction have, however, completely overcome this, and now the oil consumption is quite as low with the forced lubrication as with the ordinary systems. For moderate speeds of revolution, ring lubricating bearings are thoroughly satisfactory, combined with centrifugal lubrication to crank pins. With such an arrangement less complete enclosing meets all requirements of cleanliness.

There is another point in regard to the multi-cylinder design of engine which should be mentioned, viz., that with this design a smaller diameter of cylinder is required for a given power than with a single-cylinder engine. With internal combustion engines this is of great importance, as, after a certain size, every enlargement of cylinder diameter brings with it increased constructional difficulties, and a greater liability to breakdown.

Turning now to the particular features of the Diesel engine itself, Carnot enunciated the conditions required for a perfect heat engine, and Diesel propounded a scheme which to a certain degree met the Carnot conditions. The original cycle has become modified to that now adopted, which may therefore be claimed to be the nearest to the Carnot cycle which present day practical limits admit.

The heat efficiency of the Diesel engine, though far from perfect, is still much better than that of any other heat engine, as is readily seen from the fuel consumption, which is 0.44 lb. of fuel oil per B.H.P. per hour. The fuel consumption is also low at partial loads, viz.: ¾ load 0.45 lb., ½ load 0.47 lb., and ¼ load 0.62 lb. per B.H.P.-hour.

These are not records, but everyday figures, and are for engines of quite moderate size. With larger engines the fuel consumption per h.p. is rather lower, but increase of size does not give anything like the improvement in fuel consumption that occurs with steam engines. This is a point to be remembered when fixing the size of engine to be adopted in a station. With steam plants the size of engine should be kept up, whilst with internal combustion engines the size within certain limits can with advantage be kept down.

Owing to the high economy at light loads it is often found distinctly advantageous to run a Diesel engine in preference to using a storage battery.

The oil generally used is residual petroleum, i. e., the residue left from petroleum after the lighter oils have been distilled off. The increased demand for petrol will certainly tend to increase the further supply of residue, whilst the opening up of new oil wells in various parts of the world is steadily increasing the oil supplies. Not only is residual petroleum used for Diesel engines, but residue shale oil and gas works tar oil are now much used.

The fuel oil used can be almost any of the fuel oils which are used for boiler firing, and a wide variety of oils can be used with no alteration of the engine, this being probably explained by the fact that a pulverizer which will sufficiently pulverize a thick, viscous oil can easily pulverize the thinner oils. The use of oil fuel carries with it certain advantages in the way of ease of handling and of cleanliness. With coal it is difficult to avoid dust, and this must be particularly objectionable in the case of steam plant where the engines are carried on the boilers, thus placing a considerable quantity of moving machinery in the neighborhood of the coal. With oil there are no ashes to cart away, and thus handling of gritty materials is entirely eliminated. Usually the oil is pumped from an outside storage tank to the small tanks near the engines.

The question may naturally be asked whether Diesel engines are suitable for long periods of continuous running. In reply to this, the following instance may be quoted:

At the Birkdale electricity works a Mirrlees-Diesel was put down a little over four years ago. The station engineer recently made a return, which showed that the engine had on the average worked 23¾ hours out of every 24 hours throughout the four years, or an average stoppage of about 1¼ hours each Sunday.

Numerous cases could be given of large savings effected, but the figures already given substantially prove this, and are, perhaps, more appropriate for a paper of this kind.

Diesel engines of the Mirrlees make have been fitted on board many warships and first-class cruisers, for driving dynamos; also some have been used for boat propulsion. It might be of interest to mention that the first Diesel engine made in Great Britain was a Mirrlees-Diesel engine, and was made over 14 years ago, consequently the present Mirrlees-Diesel engines represent quite a long experience; and the present appreciation of this engine is not a temporary boom, but is based on substantial experience.

CORRECTION.

In our issue of September 21, we published an article on German Accident Statistics, and we neglected to credit the Electric Railway Journal, from whose columns the article was taken. We take pleasure now in correcting this oversight.

THE DRAUGHTING ROOM.

Mr. Frank G. Woollard in "Some Notes on Drawing Office Organization" in the Journal and Transactions of the Society of Engineers, deals in an interesting manner with the personnel of the drawing office. He says:—First of all, it is necessary to have men who are intelligent, progressive in thought, and facile in expression. A knowledge or experience outside their actual work is desirable, tending, as it does to broaden the outlook. Most necessary, indeed, is an outside interest which will detract from the high-pressure work of the day. The men who fill our drawing offices to-day are young—mostly too young. The drawing office is merely an incident, as a rule, in the training for a specialized post. This is to be regretted (when viewed from the point of drawing office organization). It means that the older draughtsmen are frequently regarded as failed candidates for better positions, inasmuch as they are put into competition with an increasing number of men, fresh from technical colleges, who are in a position to accept a pittance in order to obtain a start in their profession. All this is in the natural order of the reversion from the old apprenticeship system to the college-trained engineer. It is necessarily difficult to ensure smooth and even results when drawing offices are peopled with an ephemeral staff. To combat this tendency to rapid change it seems necessary to offer a wage inducement rather above the average at present paid to draughtsmen. This is, judging by the mechanical engineering trades standard, somewhat under the rate set for a mechanic. The wage inducement that could be offered would not, of course, restrain the man who was to make a mark in his profession, but would simply tend to steady the market in good draughtsmen. What the actual wages should be must be left to the individual employer to settle, the author preferring to leave the further discussion of this point to the economist.

It is in connection with this floating population in the drawing office that properly organized routine proves its value. All new comers are obliged to toe the line in conformity with the regulations of the office, and, as previously explained, information cannot be omitted without the checker being aware of it. A phenomenon noticed by all who deal in systems is that system, although just, is absolutely ruthless where a waster is concerned.

The next factor to consider is the hours that the staff should spend at work. There are a great number of factories, the managers of which are of opinion that draughtsmen, being a link between the factory and the office, should work factory hours. This, on the face of it, is apparently just. It is certainly a matter of expediency, since it is frequently troublesome to have a department, to whom all have to turn for information, out of office when the factory is at work. To have need to resort to the drawing office at all hours of the day or night (for overtime has to be considered) simply argues insufficient staff or mis-management. It should be remembered also that although a draughtsman's work is not physically arduous, it involves an attitude of mind continually on the alert, receptive of new ideas, and quick in embodying them; hence work at high pressure over 7 to 7½ hours per diem, with the necessary occasional spells of overtime, is sufficient if the desirable high standard of excellence is to be maintained. In the author's personal experience the greatest number of mistakes met with have been with staffs working full factory time, viz., 54 hours per week.

The question of temperament is probably the hardest to deal with. In order to obtain that smooth running conducive to the best work not a little attention must be paid to the psychological aspect of organization. It may be taken for granted that the office is well ventilated, of equable temperature, and as comfortable as can be reasonably expected; for the company that houses its staff badly, and expects the best result in the matter of work is in the same class as the man who permits his machinery to rust in the open, and is surprised to find that its efficiency is impaired. Such a firm is an anachronism in these days, probably existing only because of its own inertia, and likely to be relegated to limbo with all other antiquated stock in the course of a generation or two.

Given, then, that there is no physical cause for dissatisfaction, that remuneration is reasonable, there still will be (it is humanly impossible to avoid it) times when one or another will become discontented. To obviate discord it is necessary, whilst dealing firmly with any breach or misdemeanour, to discover why and how the grievance had originated, and if possible to remedy any defect in the system that may be brought to notice. There is one almost infallible method of preventing dissatisfaction, and that is to give all the staff some real interest in the work that they are carrying out.

This happy result is probably best secured by discussing the work with the individual preparing the drawings, by pointing out the advantages of the line of thought pursued throughout the work, as opposed to other perhaps more obvious methods. By showing how costs can be kept down, by the exercise of thought, how certain adaptations may render machining unnecessary, a hundred and one other points of interest will occur readily enough to anyone in charge of design work.

The great object served by all this is the avoidance of secretiveness. Secrecy is usually unnecessary, and should not be encouraged. It leads to the construction of those watertight compartments to which reference has been made. It is quite impossible, for instance, for anyone to take an intelligent interest in cheapening production if, on application to the piece-work or estimating departments for a comparison of prices or times, he is told to mind his own business. This does occur, and often, and although perhaps it is a small grievance, it is a very real one; the man thus rebuked probably retires to his drawing-board in a huff, and does not trouble about costs at all in the future. It is not, of course, suggested that such information should be given in bulk, or to irresponsible persons, but when one is endeavoring to mould the mind of the workshop one must not refuse to supply data. It may be as well to remember that under modern conditions such data is really of little value in the employment market, and that trade secrets are scarcely existent to-day.

Unfortunately, it is necessary occasionally to reprimand an individual. This is a matter that should be between chief and subordinate alone. Slight as the reproval may be, it should be administered privately; to reprimand a senior in the presence, or to the knowledge, of a junior is simply inviting insubordination. Occasionally it is necessary, as a salutary measure, to make public comment on some action, but this power, if seldom used, has a most healthy deterrent effect when it is put into force. Beyond all things it is good to put away all remembrance of these unpleasant incidents. It is not accounted for as forgetfulness, although it may be regarded as a sign of clemency; in any case it puts the delinquent on his honor not to repeat the offence.

A few words on the state of the trade, in a general sense, the race with competitors, and the likely trend of events are enormous factors in manufacturing enthusiasm All these may be minor points, but they are just those points that will repay for recognition.

In arranging the work to be done it invariably falls out that certain individuals are more fitted to certain tasks. In the main it is a good plan to allow this natural aptitude to settle the choice of the man for the job. Care has, however, to be exercised that a just proportion of the interesting work shall be allowanced to all. Even with such care it is dangerous to let men specialize too thoroughly; not only does it tend to cause the work to run in grooves for the want of a fresh outlook, but should several of the staff be absent, for instance, on military duty, during the annual holiday, or from epidemic illness, the extra work on the remaining staff may mean disorganization for several days, and perhaps months of hard labor to pull things straight again. Every chance, then, should be taken to render the individuals on the staff as interchangeable as the performance of their duties and their natural ability will permit.

MINE TIMBERS OF DOUGLAS FIR.

In a report by Messrs. McGarvey Cline and J. B. Knapp, on the "Properties and Uses of Douglas Fir," published as Bulletin 88 of the U. S. Forest Service, it is stated that Douglas fir is used as a mine timber, both in the square and round forms, to a large extent in the western states. Squared mine timbers of Douglas fir also go to Pennsylvania and to foreign countries. It is frequently preferred to all other available species, because of its durability and strength, and because of the desirable sizes in which it may be obtained. Where a supply of this timber is at hand, it also goes largely into temporary work, such as lagging, sills, posts and caps. When it can not be conveniently procured, substitutes are frequently found in lodgepole pine and western yellow pine.

In the square form, Douglas fir has no competitor for shaft and tunnel timbers in regions where it is plentiful. Few of the large western mines use any other wood for that purpose, especially in permanent work. Its particular and most common use in the square form is for caps, sills and posts in tunnels, and for square sets in stopes.

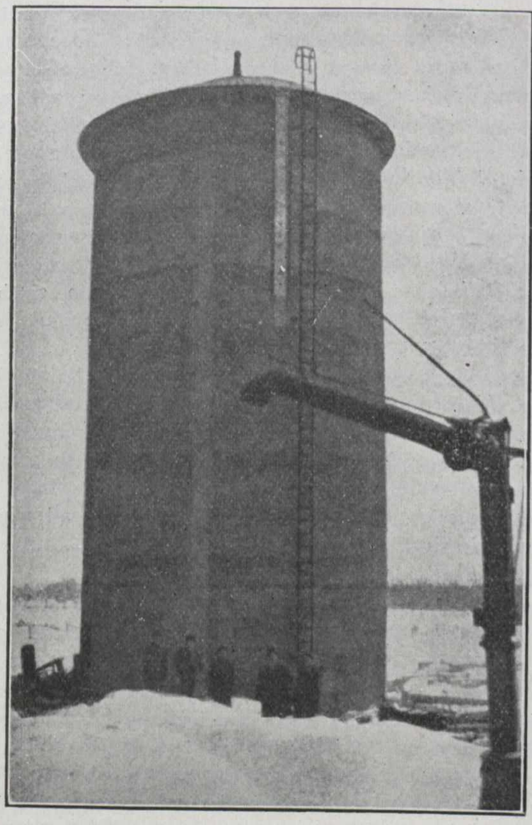
The round form of mining timber seems to be most common in Colorado, where the local species of Douglas fir, commonly called "red spruce," is used. Even in this region the coast fir is preferred for permanent work. In the southwestern section of the country, where western yellow pine is the prevailing local species, mine operators think that Douglas fir is much better, and they bring the square forms sometimes from a distance of more than 1,000 miles.

Both square and round timbers of Douglas fir are in some cases treated when used in permanent mine work. The treatment generally consists in impregnating the wood with creosote, but carbolineum and zinc chloride have been used. Round timbers are easily treated, because the soft sapwood readily absorbs the fluids. The wood should be peeled clean of bark before treatment. In the square form, the impregnating of Douglas fir with preservative fluids has never been entirely successful, because the density of the heartwood hinders the penetration of the preservative. Of late years, however, considerable progress has been made in developing a successful treatment of Douglas fir heartwood by the boiling process, followed by pressure. When treated with zinc chloride, a 3% solution is generally used. The timber is first steamed for the purpose of seasoning, and is then impregnated with the solution.

RAILWAY WATER TANK OF CONCRETE.

In a recent bulletin of the Universal Portland Cement Company we note a description of a water tank of concrete The tank is a 54,000-gallon tank at Austenburg, Ohio, and was built by the Steel Concrete Construction Co., of Harrisville, Pa., with steel forms. It has a tank 16 feet deep by 24 feet in diameter and is of concrete raised 32 feet above the track level. The walls are 8 inches thick at the bottom, tapering to 6 inches at the top.

No special means were used to make this work waterproof, except the use of a fairly rich mixture and a set of water-tight steel forms. The owners feel that their success in this and in many other similar tanks has been due to the use of the tight steel forms which retain in the concrete the water which carries the finest of the cement, holding this in the mass of the concrete, rather than allowing it to drain out through small openings in the wooden forms as ordinarily used. The contractors state that the costs of these tanks average twice that of wooden or steel tanks of equal elevation and capacity.



Reinforced Concrete Railway Water Tank.

The only evidence of there being water stored within this tank is at one point where the newly poured concrete was slightly frozen during construction, which was carried on during November and December of a severe winter. Here a slight seepage occurred, which has stained the surface.

Concrete railway water tanks are comparatively new, but in a few years it is probable that reinforced concrete round houses, reinforced concrete tanks and concrete posts for right-of-way fencing will become common. The railroads plan to use permanent construction methods rather than materials and methods good for a few years only and requiring continual painting and costly up-keep.

STANDARDIZED STREET WIDTHS.

Much has been written recently about city streets and planning. The following paper by John Nolen, which was read before the National Conference on City Planning, in Belfast, will be of interest as giving definite dimensions as against the generalities of so many of the writers on this subject.

Permanent progress in city planning will not result usually from spectacular schemes for the sudden transformation of our cities, nor from revolutionary programmes and proposals. Advances will come more often from a patient but open-minded and scientific study of such problems as are represented by the title of this paper, followed by a close co-ordination of one subject with another in a comprehensive plan, thus recognizing the unity of the city and the interrelation of all its parts. At the present time an average of 20 to 40 per cent. of the total area of cities is devoted to streets, rising in the case of Washington, D.C., to 54 per cent. Therefore, even a slight variation in the width of the streets of a city becomes a matter of importance, not only in the area of land involved, but also in hindrance to traffic caused by too narrow streets and the enormous sums required for future widening.

Some students of this subject are of the opinion that the existing difficulties connected with street widths are due, in part at least, to the fact that city councils or other municipal authorities have heretofore fixed upon a certain number of feet, usually 40 ft., 50 ft. or 60 ft., as standard widths for all streets. Undoubtedly such action has proved a handicap to many a city. Not standardization itself, however, but the arbitrary and unintelligent character of that standard is the evil, and the remedy is not the abandonment of all standards, but the adoption of more intelligent standards.

It would seem that street widths could be satisfactorily standardized because the facts upon which such widths rest are capable of definite classification, and it is practicable to collect scientific data concerning these facts and from these data to reason to sound conclusions with a considerable degree of confidence.

The facts which should determine street widths are:—(1) The width required for "a line of vehicles," thus fixing roadway units; (2) the width required for "a line of pedestrians," thus fixing sidewalk units; (3) the classification of the streets of a city according to the traffic requirements put upon them, or the other functions that they are to serve; and (4) an estimate of the present and future traffic of the streets of any given class, the width required to meet that traffic, and then the standardization of that width.

(1) It is not yet possible with scientific accuracy to determine the width required for a line of vehicles, partly because the data as to the average width of present-day vehicles are inadequate, and partly because that width is just now in process of change, due mainly to the increasing size and use of the motor truck. Nevertheless, the conclusions on this point are already fairly definite. One set of investigators holds that 9 ft. or thereabouts should be fixed as the width required for a line of vehicles, basing their opinion upon the fact that some motor truck bodies to-day have a width of 8 ft., and that the tendency of manufacturers is to increase the width of trucks. The margin for safe clearance, taking into account average skill in driving, would require about another foot for each line of vehicles, making the total width 9 ft. Other investigators find that to-day very few vehicles, even large motor trucks, measure more than 6½ ft. or 7 ft. in width, and that conditions of construction or laws are likely to place a limit upon the advantageous width close to 7 ft. This view has the support of some of the vehicle companies who hold, in the interest of the manufacturer as well as of the public, that 6½ ft. or at most 7 ft., should be the maximum width.

As a matter of fact, not only the width of vehicles but also the load is likely to be standardized by law, so that the engineer, landscape architect, or city planner will have a definite maximum figure to work with. These limits may have exceptions, but the exceptions should be discouraged by a vehicle license tax, which would increase very rapidly on vehicles above certain dimensions. In addition to the space required for vehicles, allowance must be made on many streets for electric cars. Assuming double tracking, which is the most economical method usually, this allowance should be not less than 20 ft.

(2) Various methods have been devised and followed for determining the width of sidewalks. The most customary is to make the sidewalk some fixed proportion of the roadway, in some cases one-half, in others one-third. The latter appears to represent the most frequent practice, and has proved fairly satisfactorily. This method, however, appears arbitrary and, in some instances, would be unsound, because the use of the sidewalks does not necessarily increase and diminish with the amount of traffic on the roadway. Adopting the plan used for streets and fixing the width for a line of pedestrians at 2 ft., this allows for ten lines of pedestrians on a 20-ft. sidewalk. The proper width of sidewalks, the method of determining that width, and a more rigid control of encroachments upon sidewalks, all deserve more attention than they have heretofore received.

(3) The classification of the streets of a city according to the traffic requirements put upon them or the other functions that they are to serve is, of course, one of the fundamental requirements of any attempt to standardize street widths. European countries have made such classifications. The London Traffic Commission made five divisions, as follows:

Main avenues	140 ft.
First-class arterial streets	100 ft.
Second-class streets	80 ft.
Third-class streets	60 ft.
Fourth-class streets	40 ft. to 50 ft.

No street was to be less than 40 ft. This standard classification, applying to London and its suburbs, is a great advance over the London Building Act of 1894, which put the average width of streets "in the public interest" at 40 ft. or 20 ft. from the centre of the roadway to the nearest external wall; and the council could not require a greater width than 60 ft.

The standard classification for German cities of the second size, cities like Leipzig and Frankfort, is as follows:

Main thoroughfares	85 ft. to 118 ft.
Secondary thoroughfares	50 ft. to 80 ft.
Local streets	35 ft. to 47 ft.

A Prussian law, in force since 1875, apparently drawn to meet the requirements of Berlin, fixes the following dimensions for the laying out of new streets and for the alteration of old ones:

Main thoroughfares	95 ft. or over.
Secondary thoroughfares	65 ft. to 95 ft.
Local streets	40 ft. to 65 ft.

The width of streets in different American cities varies greatly. There are very few that have adopted standards for the classification of streets according to traffic requirements. Probably the best classification is that of Washington, D.C., which is as follows:

Main thoroughfares	160 ft.
Secondary thoroughfares	120 ft.
Local streets	60 ft. to 90 ft.

The German city standards, given above, appear to be more reasonable and logical than those of London or Washington, and there is a distinct advantage in having more or less range within each classification, as against fixing the width hard and fast to a single figure. It ought to be practical to classify most of the streets of a city either as main thoroughfares, secondary thoroughfares, or local streets, and to apply to them one of the standard widths adopted for their respective classifications.

(4) To determine such classification, however, requires an estimate of the recent and future traffic requirements of the streets of any given class. It does not seem wise to begin by fixing the width of the street at, say, 50 ft. or 60 ft. or 100 ft., and then apportioning that width as favorably as may be between roadway and sidewalk. It is better to begin at the other end and try to decide what traffic capacity in roadway and sidewalk the street should provide for, thus determining which class it falls in; and then, applying the unit of measurement adopted for car lines, for vehicles, for pedestrians, for trees, &c., decide upon the required width. For example, here are three illustrations of this method:

I. An average main thoroughfare is to have, say,

A double-track car line	20 ft
6 lines of vehicles, 3 on each side of tracks, 8 ft. each	48 ft.
20 lines of pedestrians, 10 lines on each of the two sidewalks, 2 ft. each	40 ft.
Total for an average main thoroughfare	108 ft.

II. An average secondary thoroughfare is to have, say,

A double-track car line	20 ft
4 lines of vehicles, 2 on each side of tracks, 8 ft. each	32 ft.
16 lines of pedestrians, 8 lines on each of the sidewalks, 2 ft. each	32 ft.
Total for an average secondary thoroughfare	84 ft.

III. An average local street is to have, say,

Roadway for 3 lines of vehicles, 8 ft. each	24 ft.
12 lines of pedestrians, 6 lines on each of the two sidewalks, 2 ft. each	24 ft.
Total for an average local street	48 ft.

These are only averages, and are given simply as illustrations of the method of standardization proposed and its application. The range of street widths for such a classification might be as follows:

Main thoroughfares	from 90 ft. to 180 ft.
Secondary thoroughfares	from 60 ft. to 90 ft.
Local streets	from 40 ft. to 60 ft.

Such a standardization would naturally differ from city to city as conditions and requirements differed. Its advantages would be twofold: first, in fixing the range of normal street requirements of three or more important classes; secondly, indefinitely and conscientiously trying to determine in advance to which class a particular street belonged. Of course, even with such a classification there would be many exceptions—special streets having special requirements, and, therefore, calling for special provisions. But if no standards whatever are fixed—and this is the important practical point—there is danger that the normal differentiation of the streets of one class from those of another will be constantly overlooked, or that private interests through pressure and influence may succeed in securing action which is in conflict with the public requirements. It was largely to prevent these results that street width standards, in most cases unintelligent and undiscriminating, were adopted by cities in the past. Where no standards whatever have been adopted many illustrations can be found of the abuses that have crept in, particularly the failure to allow sufficient street width for main and secondary thoroughfares.

In the discussion thus far no reference has been made to trees, grass strips or other planting in the streets, or of space set aside primarily for the adornment of the street, or for ensuring the benefits of light and air and an appearance of spaciousness. Such reference was omitted merely to simplify the subject and bring it within the compass of a brief paper. Of course, trees are desirable, not only in residence streets, but also in most business streets. Of the many arguments against the greater use of trees in our business streets, the only sound argument in most instances is that there is no room for them. But as with traffic, so with trees. The same method should be applied. If we are to have trees, we must determine the width requirements of a line of trees or two lines of trees, or whatever else is needed. Except for temporary effects, it is not good policy to plant trees in a space that is needed for roadway or sidewalks; nor is it good policy to plant one or more lines of trees in a space that is inadequate for their successful growth. If, for instance, it is decided that six feet is the minimum space in which a line of trees of a given species can flourish, then we should standardize that width for that species of tree and provide it. Exceptions there would be undoubtedly to standards for trees as for roadways and sidewalks, but they would be recognized as exceptions and justified because of exceptional conditions.

The traffic and use of many city streets increase from year to year, tending to shift some streets from one classification to another. How to provide a method of meeting this increase is a difficult question to answer. The utmost foresight must be exercised, and then adjustments and widenings made to meet new conditions. The problem is how, by the exercise of skill and foresight to design and arrange streets to fulfil their functions, and then from time to time how to re-design and rearrange them to meet new requirements. In the case of streets where increased traffic is expected, the most practical method of providing for it, perhaps, would be to reserve some extra space between the roadway and sidewalk, or in the centre of the roadway, or between the sidewalk and the buildings utilizing this space temporarily as an area planted with trees and shrubs or merely with grass.

The evils that might follow from the adoption of an undiscriminating set of standards or from an unintelligent application of a discriminating set, have not been overlooked. They might be serious. But it is my opinion that under our present city organization such evils would ordinarily be less than those that almost inevitably follow from a lack of any established standards and from the policy of determining street widths piecemeal as each is presented for decision.

There is a prospect of at last having a satisfactory treatment of the low-grade zinc ores of southeastern British Columbia. The announcement is made that Dr. Gordon French's experiments looking towards a commercial process of the reduction of the refractory zinc ores of the Kootenay have been successful. These experiments have been conducted for a year at Nelson. If everything works out all right on a large scale it will mean much for mining in the Kootenay and Boundary districts.

WELDED STEEL PIPES.

During recent years welded pipes have come into general use for pipe lines in water-power plant to the exclusion of riveted pipes in cases where the latter cannot be constructed of sufficient strength to resist the high pressures employed, and welded mains, of large diameter, 2 ft. to 8 ft. and over for gas and sewage are rapidly taking the place of cast-iron mains. The chief reason for this change in engineering practice is the mechanical superiority of the welded pipe, coupled with its cheaper cost of production.

In a recent issue of the Engineering Supplement to the London "Times" the advantages of welded steel pipes and their manufacture are noted.

The tough steel of which these pipes are constructed gives greater tensile strength and ductility, conferring greater resistive power to internal and external pressures and reducing the chances of fracture to a minimum. Pipe sections can be made of any desired dimensions, and thus there are fewer joints, the risks of leakage are lessened, and the costs of laying are reduced. More secure joints can be made, giving greater elasticity. Manufacturing costs decrease with increase of pipe diameters, while the finished pipe is lighter than the hard and brittle cast-iron rigid-jointed pipes, which increase in price and weight with diameter.

The development of the welded steel pipe industry starts from the successful application of water-gas heating to plates and the improvement of welding machinery and other appliances. Previously, cast-iron pipes were in general use, though riveted pipes were adopted in the case of heavier pressures. Later lock-bar pipes followed. Riveted pipes with long seams have the inherent disadvantage of liability to start leaks in course of transport and handling, while their weight is increased by overlaps and rivets, which also increase their tendency to succumb to the corrosive action of air, water, and soil. Again, it is impossible to nest the pipes for long-distance transport except when the diameters are widely different. The joints are difficult to make, and the strength of a double-riveted seam is never more than 75 per cent. of that of the plate, which means that a thicker plate is necessary to ensure the required strength. Lock-bars entail increase of weight in addition to the disadvantages of long seams. When shipped the pipes cannot be adequately tarred and asphalted to prevent corrosion, and special machinery is needed for assembling the sections.

Welded pipes, being smooth and uniform in surface and without seams, are free from these disadvantages. The plate is the only additional weight, and the pipes can be completely finished at the works with adequate protection against possible corrosive influences. With relatively small differences of diameter they can be conveniently nested for shipment, and joints can be easily made by rolling the ends into sockets and flanges. It may be argued that cast-iron pipes are less susceptible to rust or corrosion. This is not so actually; though by reason of the thicker material used in their construction they resist corrosion for a longer period. Steel pipes are much less susceptible to electrolysis. Moreover, it is a cardinal principle in the manufacturing processes of welded steel pipes likely to be exposed to air, moisture, or soil that they are treated with a protective coating specially designed to resist corrosive influence.

The frequent bursting of water, gas, and drainage mains, entailing damage to property, danger to human life, and pollution to the surrounding soil, has decided the Berlin municipality to adopt welded steel pipes in place of cast-iron pipes. In cases where such mains are subjected to extraordinary strains, where, through subsidences due to undermining by coal working, &c., they are continually bursting and developing new leaks, or where heavy traffic is constant and increasing, welded pipes, by their srength and ductility offer a means of constructing mains capable of withstanding the severe strains encountered, since they have an elongation value of at least 30 per cent. They will buckle without fracturing, and only breaking of the joint can cause leakage. The tensile strength of the weld is at least 90 per cent. of the strength of the pipe material.

Modern hydraulic engineering, utilizing falls of several thousand feet, requires pipes of at least 1¼ in. thickness, but whether the pressure is very high or relatively low, welded steel pipes offer such advantages of strength, tightness, and convenient jointing that their claims to employment have been recognized in all cases other than those where very light pressures permit the use of thin plates with the cheaper kinds of single-riveted cast-iron pipes. The European demand for large welded steel gas, water, steam, and drainage mains, water-power conduits, digesters, boilers, tanks, shipmasts, &c., exceeds 120,000 tons annually, and a larger demand is yet to come. Despite the duty of 45 per cent., large quantities have been imported into the United States during the past three years.

Being a relatively new industry the manufacture of welded-steel pipes is at present just outside the range of general engineering concerns, and is practically in the hands of a select band of specialists, who manufacture but do not design new works. A German firm leads the way in practical manufacturing experience in this class of pipe, while a Swedish firm established in London and Toronto has largely pioneered the use of these pipes in the United Kingdom wherein at the moment no fully-equipped concern exists for the purpose of manufacture.

The plant required includes a welding machine with gas fires, for diameters ranging from 24 in. to 96 in., able to weld lengths of 30 ft. from one end without turning the pipe end for end. For hand welding, necessary in cases of irregular shaped objects such as pipe fittings and branches, ends, tanks, and receivers, special portable hand fires are needed. Specially adapted machine tools, charging machinery, gas fires for flanging and socketing pipe ends, asphalting and anti-corrosion plant, &c., are also necessary.

Assuming plate at $30 per ton, lock-bars at $30 per ton and rivets at $45 per ton, the actual costs of producing a pipe 20 ft. by 3 ft. in diameter made of ½-in. plate will be:

Welded-steel pipe—	
Finished pipe, 3,980 lb., at $28.80 per ton	$51.16
Weld-waste of plate, 15 lb., at $28.80 per ton	.19
Cost of 20 ft. weld at 8c. per ft.	1.60
Total cost of production	$52.95
Riveted pipe—	
Weight of plate in plain pipe, 3,980 lb., at $28.80 per ton	$51.16
Weight of 20 ft. double riveted longitudinal seam, rivets, and overlap, 204 lb., at $28.80, and at $43.20 per ton	3.06
Total cost of materials	$54.22
Ferguson lock-bar pipe—	
Weight of plate 3,940 lb., at $28.80 per ton	$50.66
480 lb. of lock-bars at $28.80 per ton	6.14
Total cost of materials	$56.70

It will be noted from these comparative figures that the total cost of production of welded-steel pipes is less than the cost of material for other types, and it should be understood that in the cases of larger diameters requiring several plates there are even greater differences in their favor. As regards the welded pipes, it may be mentioned that the daily wages of the chief welder are stated to be $4.80 and of two assistants $2.40 each, making the welding costs of ½ in. plate 8c. per linear foot.

In Germany, after the deduction of all capital charges, the net profit per ton has averaged $13.20, and in view of the growing demand it seems probable that a works equipped at a cost of $500,000 to turn out 15,000 tons annually, would prove a profitable venture. On the Continent there are several works of this capacity, and a score or so capable of a smaller output.

FIVE COAL FIELDS OF VANCOUVER ISLAND.

The five coal fields of Vancouver Island, Nanaimo, Comox, Suquash, Cowichan and Koskeemo, all bituminous fields, are the most valuable on the Pacific Coast of North America. Mr. D. W. Dowling, of the Geological Survey of Canada, considers the Nanaimo field the most important of these, and gives its area as 350 square miles, with an average thickness of six feet of coal, or a content of 1,344,000,000 tons. Comox is given an area of 300 square miles, and a similar thickness of coal to Nanaimo, giving its content as 1,152,000,000 tons.

Suquash has an area of 10 square miles, with an average thickness of 3 feet of coal, or 19,000,000 tons. Mr. Dowling made this estimate before any development work had been done outside that of the Hudson Bay Company in 1848. Recent development shows this field to have two seams of economic value, hitherto unknown, while diamond drilling shows the coal area to be much more extensive than formerly supposed.

The Cowichan field has an area of 9 square miles, averaging 4 feet of coal, or 23,000,000 tons.

The Koskeemo field is placed at five sc[illegible]
an average thickness of 3 feet of coal, or 9,000,000 tons. Cowichan and Koskeemo fields are the only two lying dormant. Attention has been paid to Koskeemo, diamond drilling and geological investigation having been employed with a view to ascertaining the prospects of opening it economically, but so far with little success, owing to the disturbed nature of the country tributary to the Sound. The Koskeemo field is a continuation westerly of the Suquash field, and it is not improbable that the two may be yet found to be continuous. The area is older than either the Comox or Nanaimo fields, and is co-related to the still older formation of Graham Island.

A new field is likely to be added to the above, namely, Alberni. It has been recognized as probable that coal might be found at Alberni, outliers of the Comox formation having been recognized there, and as a result the Alberni Land Company Limited, in disposing of its lands there, reserved the coal rights.

When the extension of the railway was under construction last fall, the steam shovel uncovered a seam of coal, and the company recently started development on it, with the result that so far as the slope has been run, about 170 feet, a continuous seam of coal of high quality, and of a width of 4 feet has been proved up.

It seems probable that the coal areas of Vancouver Island are good for about three billion tons of coal, or enough to supply 10,000 tons a day for 800 years, so that the people of to-day have not much need to worry over the possibility of the exhaustion of these great coal fields. The Vancouver Island coal fields have produced to date coal to the value of $70,000,000.

The Nanaimo field occurs in Upper Cretaceous formation, and has been proved by the developed mines and bore holes to be coal bearing over a length of 55 miles, by an average width of six miles. About a fourth is land area and the remainder submarine. The basin lies north-west and south-east and dips easterly. The average dip is from five to twelve degrees, with variations due to several faults. Its continuity is proved from the old Wellington mine north-west of Nanaimo, to Tumbo Island, near the south-eastern boundary of the Gulf of Georgia area of British Columbia, Mr. W. Blakemore, M.E., representing Mr. A. E. Hepburn, M.E., having proved by diamond drilling the extension of the field to the latter point. Over a considerable portion of the area the coal deposits are probably at too great a depth to be economically workable at present, but toward the western portion of the field they gradually rise to the surface, and their outcrops are traceable from the old Wellington mine to Oyster Harbor.

So far as proved up the Nanaimo field carries three seams of coal of such volume as to be available for economic operation. The lowest seam, known as the Wellington, outcropped at the old Wellington mine, at Nanaimo River and Extension. At Wellington and Extension it was operated by the Dunsmuir interests, since acquired by the Canadian Collieries, Limited, and in the vicinity of Nanaimo it is worked by the New Vancouver-Nanaimo Coal Company, Limited.

The Wellington seam is irregular in thickness, having been laid on a floor with numerous depressions and eroded channels, the coal-forming matter accumulating in the basins, accounting for swells in the seam, causing it to vary in thickness from two feet to 28 feet. The average width of the seam is probably nine feet.

The middle seam is the Lower Douglas, and lies on a horizon about 800 feet above the Wellington seam. It is narrower than the other seams, but very uniform in width, running from two and a half to three and a half feet in thickness. It is particularly well adapted to longwall mining. It outcrops at Nanaimo and South Wellington.

The Upper Douglas seam occupies a horizon varying considerably in its relation to the Lower Douglas, the two being found at depths apart varying from 22 feet to 120 feet. This seam also outcrops at Nanaimo and South Wellington. In characteristics it is almost a perfect counterpart of the Wellington seam, being laid on an uneven, wavy floor, and varying in thickness from two feet to 26 feet. The roof of the Upper Douglas seam is mainly shale, while that of the Lower Douglas is sandstone. The tonnage mined in the Nanaimo field last year was 1,615,160 tons.

PERSONAL.

Mr. Peter Gillespie has been appointed Associate Professor of Applied Mechanics in the Faculty of Applied Science, University of Toronto.

Mr. H. W. Price has been appointed Associate Professor of Electrical Engineering in the same Faculty, and Mr. G. R. Anderson, Associate Professor of Physics.

Dr. Robertson, the chairman of the Canadian Technical Educational Commission, returns to Canada this week by the Tunisian, after a most interesting tour of investigation through Europe.

Mr. C. R. Young, Lecturer in Structural Engineering in the University of Toronto, and late of Barber and Young, Structural Engineers, has opened an office as Consulting Structural Engineer at 318 Continental Life Building, Toronto. Mr. Young will give special attention to reviews of designs and specifications, reports on old or overloaded structures, investigation of failures and defective work and the artistic design of bridges.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

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

14712—September 6—Approving location of C.N.O. Ry. through unsurveyed territory, Dist. of Thunder Bay, mileage 140 to 160 from Port Arthur, Ont.

14713-14-15—September 7—Authorizing C.N.R. to cross three public roads with its Prince Albert-Battleford line, Province of Saskatchewan.

14716——September 7—Approving plans of proposed new station and platform to be erected at Shawinigan Junction, P.Q.

14717—September 6—Approving location of C.N.R. through unsurveyed territory, District of Thunder Bay, Ont., mileage 120 to 140 from Port Arthur, Ont.

14718-19-20-21—September 5—Approving bridge plans for bridges over Coldwater and Kettle Rivers, in the Province of British Columbia of the Kettle Valley Railway Company.

14722—September 6—Approving location of C.N.O. Ry. through unsurveyed territory, District of Thunder Bay, mileage 179 to 200 from Port Arthur, Ont.

14723—September 7—Disallowing joint tariffs on oysters from New Haven, Conn., Providence, R.I., and other shipping points of Adams Express Co., taking higher through rates than $1.50 per 100 lbs. to Toronto and $1.55 per 100 lbs. to Guelph. New joint tariffs to be issued.

14724- September 5—Authorizing C.P.R. to construct its double track and sidings across highways from mileage 57.64 to 130.49 on Brandon Subdivision.

14725—September 8—Authorizing Vancouver Power Co., Ltd., and New Westminster and Southern Rly. Co. to operate trains over crossing account interlocker completed at Cloverdale, B.C.

14726—September 9—Authorizing C.P.R. to construct bridge 133.28 over Thessalon River, Lake Superior Division.

14727—September 9—Authorizing C.P.R. to construct a branch line or spur into City of Lethbridge Material Yard, Lethbridge, Alta.

14728—September 9—Authorizing C.P.R. to construct industrial spur for Gordon, Ironsides & Fares Co., Moose Jaw, Sask.

14729—September 8—Authorizing G.T.P. Ry. to erect Standard No. 1 Station at Reford, in Province of Saskatchewan.

14730—September 9—Authorizing G.T.P. Ry. to reconstruct bridge across public road in 3rd Con., Twp of Tay, County of Simcoe, Ont.

14731—September 7—Authorizing G.T.R. to construct eight bridges on its Northern Division, Thirteenth District.

14732—September 8—14733—September 9—Authorizing C.N.R. to cross with its Prince-Albert Battleford line 6 highways in Saskatchewan, and with its Swift Current line 5 highways in Sask.

14734—September 6—Approving plans of substructure of subway under C.N.R. at 23rd Street, Saskatoon, Sask.

14735—September 7—Approving character and plans of specification of Ninth Concession Municipal Drain, the Berfeltz Municipal Drain and Brewer Municipal Drain under G.T.R. in Ct. Huron, Ont.

14736—September 12—Authorizing G.T.R. to construct siding into premises of the Tudhope-Anderson Co., Town of Orillia, Ont.

14737—September 9—Extending until October 31st, 1911, time for completion by G.T.R. of work of cutting down embankment in Twp. of Grahame, County of Northumberland Ont.

14738—September 9—Authorizing C.P.R. to construct subway across Scarlett Road in Twp. of York and to take possession of land of private owners.

14739—August 2—Authorizing C.P.R. to construct its third track across Papineau Avenue, Montreal, and Montreal Street Railway tracks. (Proposed third track between Angus and Mile End.)

14740—September 11—Authorizing C.P.R. to construct its Weston to Wolseley Branch across highways in Province of Saskatchewan.

14741—September 12—Authorizing City of Hamilton to maintain sewer under T. H. & B. Rly., south side of Main Street.

14742—September 12—Approving location of C.N.O. Ry. station grounds at St. Benoit, P.Q.

14743—September 12—Directing C.P.R. within 15 days of date of this order under penalty of $25 to erect and maintain between mile post 123 and 126, fences of minimum height of 4 ft. 6 ins., with swing gates at farm crossings. Complaint, H. Bergsteinsson, Alameda, Sask.

14744—September 12—Authorizing G.T.P., B.L. Co. to connect its Yorkton Branch with C.N.R. in S.W. quarter of Sec. 36, Twp. 30, R. 4, West 2nd at Canora, Sask.

14745—September 12—Authorizing G.T.R. to make change in deviation of branch line into premises of Canadian Light & Power Co. on its Lachine Canal Branch, Montreal, P.Q.

14746—September 11—Relieving C.P.R. from further protection of London and Chatham Road at mileage 62.2 East of Chatham, Ont.

14747—September 11—Directing G.T.R. to enlarge culvert under its railway on Lot 21, Con. 14, Twp. of Hullett, Ct. Huron, Ont.

14748-49—September 13—Authorizing Kettle Valley Railway Co. to cross roads at station 945 and 901 north-west of Midway, B.C.

14750-51—September 11—Authorizing C.P.R. to construct spur for Halliday Bros., Coal Merchants, Winnipeg, Man., and for Dryden Timber & Power Co., Ltd., Wabigoon River, Ont.

14752—September 11—Authorizing South Ontario Pacific Railway Co. to construct overhead crossing to carry track of its Guelph Junction to Hamilton Branch over Mill St., at mileage 12.02 (from Guelph Junction), Waterdown, Ont.

14753—September 11—Authorizing South Ontario Pacific Railway Co. to close portion of road allowance between Twp. of East and West Flamboro, in County of Wentworth, Ont.

14754—September 13—Relieving C.P.R. from further protection at crossing known as Pottery Corner Crossing, Lindsay Subdivision, in Twp. of Ops, Ont.

14755—September 13—Directing G.T.R. to provide suitable farm crossing for Joseph Lauzon in Twp. of Tilbury North, Ont.

14756—September 14—Authorizing Government of Province of Saskatchewan to construct highway crossing over C.P.R. along North of Section 15, Twp. 5, Range 11, West 2nd Meridian, Sask.

14757—September 14—Authorizing C.P.R. to construct its railway across highway crossing east of Lachevrotiere Station, Que.

14758—September 14—Authorizing C.P.R. to construct its Plenty Ballast Pit Spur on Moose Jaw Northwesterly Branch to a point in Section 3, Twp. 33, Range 19, West 3rd Meridian, Sask.

14759—September 14—Amending Orders issued re operating of semaphores at crossing of Hull Electric Ry. with C.P.R., Hull, P.Q.

14760—September 13—Directing C.N.R. to fence its right-of-way on Wawanesa Subdivision, under penalty of $25 per day after 1st July, 1912. Complaint, Oliver King, Wawanesa.

14761—September 13—Authorizing C.N.R. to connect with G.T.P. (Melville-Yorkton Branch) in S.W. quarter of Sec. 36, Twp. 30, Range 4, West 2nd M., Saskatchewan.

14762—September 14—Extending until October 15, 1911, time for completion by C.N.R. across Notre Dame Street and M.S. Ry., Montreal, P.Q.

14763—September 14—Authorizing C.N.R. to cross and divert public road between Secs. 21 and 20, Twp. 25, R. 31, West P.M. on its Rossburn line, Saskatchewan.

14764—September 18—Authorizing C.N.R. to cross with its Strathcona-Camrose line 8 highways in Province of Alberta.

14765—September 11—Directing C.P.R. to provide and construct crossing over its railway at extension of Henderson Street, Village of Grayson, Sask.

14766—September 18—Authorizing C.P.R. to construct bridge 93.5 over Stave River, Cascade Subdivision, B.C. Division.

14767—September 18—Authorizing C.P.R. to extend spur serving National Portland Cement Co., Ltd., Twp. of Brant, Ct. Bruce, Ont.

14768—Authorizing C.P.R. to maintain and operate certain sidings for the Lethbridge Collieries Co., Ltd., West of 4th Meridian, near Lenzie, Alta.

14769—September 16—Authorizing C.P.R. to construct two spur tracks to proposed freight shed at corner of Water and Sherbrooke Streets, City of Peterboro, Ont.

14770-71—September 18—14772—September 16—Approving details of masonry of abutments for subway to be constructed over Keele Street, and for bridges to be constructed at Jameson Avenue and Dowling Avenue. All in City of Toronto, Ont.

14773-74-75—September 18—Authorizing G.T.P. B.L. Co. to cross with its Biggar-Calgary Branch 5 highways in Saskatchewan. Three highways in Rural Mun. of Winslow, Sask., and two highways in Rural Mun. of Prairiedale, Sask.

14776—September 18—Authorizing G.T.P. Ry. to cross with its Lake Superior Branch the main line of C.N.R. at Empire Street, Fort William, Ont. Interlocker to be installed.

14777—September 18—Authorizing C.P.R. to join its main line tracks at mileage 88 from Victoria Harbor, with tracks of Ontario and Quebec Rly. (C.P.R.) at mileage 38.57 from Havelock, in Twp. of Hacan, County of Durham, Ont.

14778—September 18—Approving location of C.N.R. through Twps. 10-11, Ranges 1-3, West 3rd Meridian, Province of Saskatchewan.

14779—August 8—Appointing certain fire wardens in British Columbia (twelve) to investigate fire appliances with which locomotives of railway companies are equipped operating in British Columbia.

14780—September 2—Dismissing complaint of Fullerton Lumber & Shingle Co., of Vancouver, re credit allowed on shipments of lumber, C.P.R. undertaking to accept complainant company's surety bond.

14781—August 31—Dismissing complaint of Fullerton Lumber & Shingle Co. re rates on lumber.

14782—September 2—Dismissing application of New Westminster Board of Trade re cost of protecting crossing at New Westminster, B.C.

14783-84—September 2—14785—September 1—Dismissing two applications and refusing one application of Prudential Investment Co. and Prudential Builders, Ltd., re rebate on cost of spur track, rates on V.V. & E. Ry. and cost of constructing spur line at Burnaby Lake, B.C.

14785—August 31—Dismissing application of V.V. & E. Ry. to take certain lands at Burrard Inlet, Vancouver, B.C.

14787—September 7—Dismissing complaint of Canadian Rate Adjusting Agency, Lethbridge, Alta., re car of apples frozen in transit.

14788—Dismissing complaint of Elko, B.C. Board of Trade, re refusal of G.N. Ry. to install agent at that point.

14789—September 15—Authorizing C.N.R. to cross with its Prince Albert-Battleford line highway in R.M. Mayfield, Sask.

14790—September 14—Authorizing City of Toronto to cross with its wires track of C.P.R. and C.P.R. Tel. wires at Avenue Road, Toronto.

14791-92—September 15—Authorizing G.T.P. and G.T.P. B.L. Co. to erect stations at Mackay and Alix, Alta.

14793—September 15—Authorizing G.T.R. to construct spur into premises of William Laking, Haliburton, Ont.

14794—September 15—Approving plans of gates at Simplex Street, Village of St. Pierre, P.Q., to be installed by G.T.R.

14795—September 14—Authorizing C.N.R. to cross public road on its Prince Albert-Battleford line in R.M. Mayfield, Sask.

14796—September 13—Authorizing C.P.R. to cross with its Lauder Westerly Extension (Tilston to Griffin) 4 highways in Mun. of Albert.

14797—September 13—Authorizing C.P.R. to cross with its Bulyea South Branch 3 highways.

14798—September 15—Authorizing C.P.R. to construct an additional track across St. Hubert Street in St. Denis Ward, Montreal, P.Q.

14799—September 16—Authorizing C.P.R. to construct extra tracks under viaduct on Wellington Street, Ottawa, Ont.

14800—September 13—Authorizing C.P.R. to reconstruct 5 bridges on its Lake Superior, Eastern and Alberta Divisions.

14801—September 13—Approving details of subway to be constructed over Jane Street, City of West Toronto, Ont.

14802—September 18—Authorizing Canadian General Electric Co. to construct travelling crane over spur line of C.P.R. Peterboro, Ont.

14803—September 18—Approving location of Alberta Central Ry. Co. from mileage 64.5 to 71.3 west of Red Deer, Alta.

14804—September 19—Authorizing C.N. Alberta Ry. to cross with its St. Albert westerly line 7 highways in Alberta.

14805—September 19—Authorizing C.N.R. to cross with its Rossburn line 13 highways in Saskatchewan.

14806—September 19—Authorizing C.P.R. to construct siding across road allowance near Qu'Appelle Station, Sask.

14807—September 18—Approving locaton of G.T.P. B.L. Co. from east line of Sec. 9, Twp. 33, R. 21, to south line of Sec 11, Twp. 31, Range 25, west 3rd Meridian, Sask., mileage 50.23-77.13.

14808—September 19—Authorizing G.T.P. B.L. Co. to cross with its Calgary Branch highway at mileage 185, Province of Alberta.

14809—September 15—Approving station site of G.T.P. Ry. at Rosevear, Alta.

14810—September 18—Approving stress sheets of proposed new bridge of G.T.R. to be erected at Lost Channel, mile post 49.20 on 30th District near St. Louis Station.

14811—September 19—Further extending until 1st July, 1912, time for completion by G.T.R. of overhead bridge at Lachine Road, Montreal, P.Q.

14812—September 11—Directing C.N.R. to file plans within one month for undercrossing about 1 mile from Town of Camrose, Alta.

14813—August 31—Dismissing application of Matsqui Sumas Board of Trade for order directing C.P.R. and B.C. Electric Ry. to construct cross ing at Hazel Street, Town of Abbotsford, B.C.

14814—August 31—Dismissing application of C. J. Piper of Pipers Siding, B.C., re passenger rates charged by Vancouver, Fraser Valley and Southern Railway Company.

14815—September 1—Dismissing application of Transportation Committee of Surrey, B.C. Board of Trade, re refusal of G.N. Ry. to carry explosives on its mixed trains to Hazelmere, B.C.

14816—September 2—Authorizing C.P.R. to construct spur to premises of Nicola Valley Pine Lumber Company.

14817—September 20—Approving location of Alberta Central Rly. Co. from mileage 160 to 194.6 east from Red Deer, Alta.

14818—September 20—Authorizing C.P.R. to construct spur to premises of Louden Hardware Specialty Co. on Lot 49, Block 8, Parish Lot D.G.S. 46, St. John, in city of Winnipeg, Man.

COMING MEETINGS.

ROYAL ARCHITECTURAL INSTITUTE OF CANADA.—Oct. 3, 4, Montreal. F. S. Baker, President, Toronto; Alcide Chausse, Hon.-Secretary, 5 Beaver Hall Square, Montreal, Que.

AMERICAN ASSOCIATION FOR HIGHWAY IMPROVEMENT.—Nov. 20-24. First Annual Convention, Richmond, Va. Logan Waller Page, President, United States Office of Public Roads, Washington, D.C.

THE CANADIAN PUBLIC HEALTH ASSOCIATION.—Nov. 21-23. Montreal. F. C. Douglas, M.D., D.P.H., Secretary, 51 Park Avenue, Montreal.

ENGINEERING SOCIETIES.

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

QUEBEC BRANCH—
Chairman, P. E. Parent; Secretary, S. S. Oliver. Meetings held twice a month at Room 40, City Hall.

TORONTO BRANCH—
96 King Street West, Toronto. Chairman, H. E. T. Haultain; Secretary, A. C. D. Blanchard, City Hall, Toronto. Meets last Thursday of the month at Engineers' Club.

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

VANCOUVER BRANCH—
Chairman, Geo. H. Webster; Secretary, H. K. Dutcher, 319 Pender Street West, Vancouver. Meets in Engineering Department, University.

OTTAWA BRANCH—
Chairman, A. A. Dion, Ottawa; Secretary, H. Victor Brayley, N. T. Ry., Cory Bldg.

MUNICIPAL ASSOCIATIONS.

ONTARIO MUNICIPAL ASSOCIATION.—President, Chas. Hopewell, Mayor, Ottawa; Secretary-Treasurer, Mr. K. W. McKay, County Clerk, St. Thomas, Ontario.

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

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

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

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

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

CANADIAN TECHNICAL SOCIETIES.

ALBERTA ASSOCIATION OF ARCHITECTS.—President, G. M. Lang; Secretary, L. M. Gotch, Calgary, Alta.

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

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

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

BUILDERS, CANADIAN NATIONAL ASSOCIATION.—President, E. T. Nesbitt; Secretary Treasurer, J. H. Lauer, Montreal, Que.

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

CANADIAN CEMENT AND CONCRETE ASSOCIATION.—President, Peter Gillespie, Toronto, Ont.; Secretary-Treasurer, Wm. Snaith, 57 Adelaide Street, Toronto, Ont.

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

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

CANADIAN FORESTRY ASSOCIATION.—President, Thomas Southworth, Toronto; Secretary, James Lawler, Canadian Building, Ottawa.

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

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

CANADIAN MINING INSTITUTE.—Windsor Hotel, Montreal. President, W. Doan, M.D., Harrietsville, Ont.; Secretary-Treasurer, Francis Mortimer-Lamb, Windsor Hotel, Montreal.

CANADIAN PEAT SOCIETY.—President, J. McWilliam, M.D., London, Ont.; Secretary-Treasurer, Arthur J. Forward, B.A., Castle Building, Ottawa, Ont.

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

CANADIAN STREET RAILWAY ASSOCIATION.—President, D. McDonald, Manager, Montreal Street Railway; Secretary, Acton Burrows, 70 Bond Street, Toronto.

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

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

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

EDMONTON ENGINEERING SOCIETY.—President, J. Chalmers; Secretary, B. F. Mitchell, City Engineer's Office, Edmonton, Alberta.

ENGINEERING SOCIETY, TORONTO UNIVERSITY.—President, W. B. McPherson; Corresponding Secretary, A. McQueen.

ENGINEERS' CLUB OF MONTREAL.—Secretary, C. M. Strange, 9 Beaver Hall Square, Montreal.

ENGINEERS' CLUB OF TORONTO.—96 King Street West. President, Killaly Gamble; Secretary, R. B. Wolsey. Meeting every Thursday evening during the fall and winter months.

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

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

INTERNATIONAL ASSOCIATION FOR THE PREVENTION OF SMOKE.—Secretary, R. C. Harris, City Hall, Toronto.

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

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

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

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

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

THE PEAT ASSOCIATION OF CANADA.—Secretary, Wm. J. W. Booth, New Drawer, 2263, Main P.O., Montreal.

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

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

SOCIETY OF CHEMICAL INDUSTRY.—Dr. A. McGill, Ottawa, President; Alfred Burton, Toronto, Secretary.

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

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

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

ENGLISH ENGINEER FINDING CANADIAN SCHEMES.

The Canadian Engineer had an interview with Mr. J. Edward Waller, M. Inst. C.E. of Messrs. Kincaid, Waller, Manville & Dawson, consulting engineers, of London, England, following on a tour of investigation made by Mr. Waller of the Dominion.

Mr. Waller's visit to Canada was at the instance of several financial groups, which evinces a growing interest in the Old Country in the opportunities which Canada offers for legitimate and sound investments. Some of the financial firms by whom Mr. Waller has been retained are, it is understood, for the first time turning their attention to this country; but in one case Mr. Waller is acting in connection with a firm in England, Messrs. Matthews, Wrightson & Company, Limited, who have already shown their belief in Canadian prospects by the establishment of offices in Montreal and Winnipeg.

Our enquiries elicited from Mr. Waller that he was particularly impressed with the growth of Winnipeg, Calgary, and Vancouver. Mr. Waller has submitted to Messrs. Matthews, Wrightson & Company, his report on a proposed radial line from Calgary to Chestermere Lake, a distance of about ten miles in an easterly direction. The Chestermere Lake is the storage reservoir of the Canadian Pacific Railway for the irrigation belt. It is about four miles in length and a mile wide. Mr. Waller believes that this will become a favorite summer resort for the inhabitants of Calgary when proper traffic facilities are provided. The numerous purchases of land sites round the lake for residential purposes; the reservation of a township site by the Canadian Pacific Railway Company, and the presentation of a park site by the same company, give color to these anticipations.

Mr. Waller's journey included a visit to Nanaimo, in British Columbia, at the instance of Messrs. Heaton's Agency, of Toronto, who have interested themselves on behalf of a British syndicate in connection with a franchise for a street car system proposed by the city. While the population of the city is only about 5,000, Mr. Waller informs us that the city limits are very restricted, and that for the purpose of a commercial enterprise of this character, it is probably to be reckoned more in the neighborhood of 12,000. Mr. Waller thinks it more than probable that his friends will be prepared to take up the Nanaimo concession, provided the city authorities are prepared to accept reasonable conditions.

Amongst the other propositions Mr. Waller is taking home to his friends is the construction of an inter-urban electric line between London, Ontario, St. Mary's and Stratford, a length of about forty miles, with a branch to Lucan, about six miles in length. The charter is in the hands of the North Midland Railway Company, and it is proposed to be financed by an English group whom Mr. Waller represents.

In connection with hydro-electric undertakings, a water power at Waddington, on the St. Lawrence, has been investigated. Waddington is in the United States, almost directly opposite Morrisburg, and there are many towns in Canada urgently requiring a supply of electrical energy situated within easy reach of Waddington, while at considerable distance from the Niagara Falls installation, and, as a consequence, the Hydro-Electric Commission have, we understand, entered into a contract with the Waddington Company for the supply of electricity over transmission lines to be erected by the Commission, to such towns as Kingston, Brockville, Lynn, Morrisburg, Cardinal, and Prescott. The charter under which the company holds the property emanates from the United States, but it is understood that a Canadian or English company will probably hold the entire stock, and make a fresh bond issue in order to facilitate English finance.

Mr. Waller's firm are well known as consulting engineers in England. Amongst the numerous undertakings for which they are responsible, probably a work which they are at present carrying out in the electrification of the London, Brighton & South Coast Railway in England, and the large system of electric tramways in Buenos Ayres, in respect of which they are consulting engineers, will be most likely to be known; but their sphere of action embraces many countries.

ALUMINUM.

For several years France was the only country producing aluminum. The number of French aluminum factories has increased in the region of the Alps, especially in the Department of Savoie, where there are six establishments. With the two other French factories it is estimated that the total output is considerably above 25,000 tons annually.

The reduction plant established in 1889 at Nelhausen, in Switzerland, has had a most successful existence. Starting with an annual production of forty tons of aluminum, it turned out no less than 2,621 tons in the first nine months of 1910, valued at more than $840,000. The company has several branches, all of which are operating successfully. Its stock has never yet paid less than 12 per cent.; in 1906 it paid 26 per cent. on a par value of 1,000 francs ($193).

The Swiss control of the aluminum market, which had existed for several years, passed away with the opening of the American factories at Niagara. Neither Switzerland nor France possesses such rich mines of oxide of aluminum and such sources of electrical energy as the United States. Negotiations were begun a year ago with the view of limiting the production of aluminum and keeping up the prices, but owing to the attitude of the American producers the movement has not been successful up to this time.

Aluminum has become indispensable in the construction of automobiles, dirigible balloons and aeroplanes. It is employed also in paper decorations and for wrapping purposes. It has been found of enormous advantage also in the textile industry.

RUSSIA PLANS TO CONNECT BLACK SEA TO BALTIC.

From time to time projects have been mooted in Russia for the construction of a canal to connect the Black Sea and the Baltic, but owing to a variety of reasons chiefly financial, the government has been disinclined to take the matter in hand. Reports are now, however, widely current to the effect that a syndicate of French and Russian capitalists is prepared to carry the scheme through, and that application has been made with a view to the grant of a concession. Beginning at Riga and ending at Kherson, the waterway will have a total length of 1,600 miles, but the engineering difficulties are not considered serious, as every advantage will be taken of the Rivers Dwina and Dnieper, which, of course, will have to be dredged and widened, while waterfalls will be constructed between the two rivers in the vicinity of Vitebsk. The total cost is estimated at about $250,000,000. One of the results of the enterprise, if completed, will be the opening up of the north of Europe to Russian grain supplies on a much larger scale than is possible at present, and the coal from the Donetz district will also be made available for the Baltic provinces and the Black Sea ports.

CONSTRUCTION NEWS SECTION

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

TENDERS PENDING.

In Addition to Those in this Issue.

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

Place of Work.	Tenders Close.	Issue of.	Page
New Glasgow, N.S., church	Oct. 14.	Sept. 28.	57
North Bay, Ont., waterworks extensions	Oct. 9.	Sept. 28.	66
Ottawa, Ont., Baddeck branch line	Oct. 12.	Sept. 14.	64
Ottawa, Ont., Hudson Bay Railway	Oct. 16.	Sept. 14.	64
Ottawa, Ont., breakwater, Jamesville, N.S.	Oct. 4.	Sept. 21.	57
Ottawa, Ont., armory, Sarnia	Oct. 11.	Sept. 21.	57
Ottawa, Ont., coal docks, Three Rivers, Que.	Oct. 11.	Sept. 21.	57
Ottawa, Ont., public building, Athens, Ont.	Oct. 9.	Sept. 21.	58
Ottawa, Ont., store building, Winnipeg	Oct. 7.	Sept. 21.	58
Ottawa, Ont., breakwater, Port Hood, N.S.	Oct. 9.	Sept. 28.	58
Ottawa, Ont., breakwater, Little Bras D'Or, N.S.	Oct. 11.	Sept. 28.	57
Ottawa, Ont., wharf, Louisdale, N.S.	Oct. 11.	Sept. 28.	57
Ottawa, Ont., breakwater, Charles Forest's Cove, N.S.	Oct. 10.	Sept. 28.	57
Ottawa, Ont., public building, Wallaceburg, Ont.	Oct. 10.	Sept. 28.	57
Ottawa, Ont., wharf, Rous Brook, N.S.	Oct. 19.	Sept. 28.	57
Ottawa, Ont., breakwater, Cheticamp Point, N.S.	Oct. 10.	Sept. 28.	57
Ottawa, Ont., wharf, Finlay Point, N.S.	Oct. 17.	Sept. 28.	57
Ottawa, Ont., protection pier, Gimli, Man.	Oct. 10.	Sept. 28.	58
Ottawa, Ont., wharf, Windsor, Ont.	Oct. 4.	Sept. 28.	58
Ottawa, Ont., breakwater, Port Richmond, N.S.	Oct. 18.	Sept. 28.	58
Ottawa, Ont., breakwater, New Harbor, N.S.	Oct. 17.	Sept. 28.	58
Point Grey, B.C., steel pipes	Oct. 9.	Sept. 28.	58
Toronto, Ont., overhead and pole line material	Oct. 18.	Sept. 28.	64
Vermilion, Alta., electric light plant	Oct. 16.	Sept. 28.	64
Victoria, B.C., school building	Oct. 16.	Sept. 28.	58
Windsor, Ont., intake pipe and screen well	Oct. 12.	Sept. 21.	66

TENDERS.

Brandon, Man.—Tenders will be received until October 12th, 1911, for 100 lamp standards for electric street lighting and equipments. R. E. Speakman, City Engineer. (Adv. in the Can. Eng.)

London, Ont.—Tenders will be received until October 12th, 1911, at the office of the city clerk, for the construction of tile sewers on (1) York Street, (2) Harvard and Yale Streets, (3) Eva Street. Plans and specifications may be seen at the office of the City Engineer. Neil Cooper, Chairman No. 2 Committee; George Wright, City Engineer.

Ottawa, Ont.—Tenders will be received until October 18th, 1911, for the construction of a pile wharf at Krout Point, La Have River, Lunenburg County, N.S. Plans, specifications to be seen at the office of H. A. Russell, Dist. Engineer, Halifax, N.S.; E. G. Millidge, Dist. Engineer, Antigonish, N.S.; on application to the Postmaster at Krout Point, N.S., and at the office of R. C. Desrochers, Secretary, Dept. of Public Works, Ottawa.

Peterboro, Ont.—Tenders will be received until October 6th, 1911, for the addition of two storeys to the premises of J. J. Turner & Sons, George St., Peterboro. Plans and specifications may be seen at the office of J. E. Belcher, architect, or at the office of Turner & Sons.

Port Arthur, Ont.—Tenders will be received until October 7th, 1911, for the installation of sewer and water mains on Wolseley Street and Egan Street. Full particulars may be obtained from the City Engineer. J. McTeigue, City Clerk, Corporation Offices, Port Arthur.

Saskatoon, Sask.—Tenders will be received until October 10th, 1911, for the erection of a telephone building on lots 10 and 11, in block 149, Saskatoon, Sask. Plans, specifications and forms of tender may be obtained on application to Messrs. Storey & Van Egmond, architects, Regina, and S. P. Porter, Deputy-Minister, Department of Railways, Telegraphs and Telephones.

St. Norbert, Man.—Tenders will be received until October 16th, 1911, for the construction of bridges in the municipality of Ritchot. Plans and specifications may be seen at Public Works Dept., Winnipeg, at Mr. Baribault Engineer's Office, Builders Exchange No. 607, Winnipeg; at the municipal office at St. Norbert, and at Mr. Arthur Lemorine's residence at St. Agathe. G. V. Landry, secretary-treasurer, St. Norbert, Man.

Toronto, Ont.—Tenders for the construction of the tube railway will be received until November 1st, 1911, the specifications of which were submitted to the Board of Control by E. L. Cousins, railway engineer in the Works Department, and formally adopted.

Toronto, Ont.—Tenders will be received until November 1st, 1911, for the construction of three miles of reinforced concrete subway and subway stations. G. R. Geary (Mayor), Chairman Board of Control, City Hall, Toronto. (Adv. in the Can. Eng.)

Victoria, B.C.—Tenders will be received until October 11th, 1911, for the erection and completion of a large one-room schoolhouse at South Wellington, in the Newcastle Electoral District, B.C. Plans, specifications, etc., may be obtained at the offices of Jas. Bateman, secretary of the School Board, South Wellington, B.C., the government agent, Nanaimo, B.C., and at the office of J. E. Griffith, Public Works Engineer, Dept. of Public Works, Victoria.

Winnipeg, Man.—Tenders will be received until October 13th, 1911, for the manufacture and delivery f.o.b., Winnipeg, of the following materials, namely: Section "A"—75-2 wire, 500 volt, 500 ampere, D.C. Fuse Boxes; section "B"—75-2 wire, 230 volt, 200 ampere, A.C. Fuse Boxes. Forms of tender, etc., may be obtained at the office of the manager of the Light and Power Department, 449 Main Street. M. Peterson, Secretary Board of Control Office, Winnipeg.