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The Canadian Engineer

ESTABLISHED 1893.

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THE METRIC SYSTEM.

The metric system has been slow in making progress among English-speaking people, and its adoption and use in the regular work of life has been much slower than was anticipated by its friends a few years ago. The movement has received an impetus by the official announcement recently made that in the future all papers read before the American Electric-Chemical Society must contain measurements expressed in metric values. It is true these values may be inserted in parenthesis, but still, the compelling of their insertion is a distinguished gain to the metric system movement.

It is rumored that the American Institute of Electrical Engineers will shortly officially announce the adoption of a similar order.

The adoption of this plan will furnish a key to foreign engineers concerning matters that would otherwise probably remain as ciphers on paper, and in addition it will supply a numerical check upon the statement contained in the papers read.

The metric system of measurement is in use in a number of countries, and descriptions containing this nomenclature are becoming so frequent that it is necessary for the reader of scientific articles to be thoroughly familiar with the system, its principle and characters.

We may not see its universal adoption, but its uniformity, elasticity and simplicity guarantee for it wider acceptance each year.

EXCLUDING FOREIGN ARCHITECTS.

The Royal Architectural Institute of Canada, at their annual meeting recently held in Winnipeg, took up the question of foreign architects practising in Canada. It was maintained that these architects, employed by Canadian capital, had no interest in Canada other than their commission, and that eventually this condition would ultimately tell to the injury of both the profession and their Canadian clients.

Canadian architects are always pleased to welcome visiting professional men, but the purpose of the Royal Institute is to protect its members, and this movement to insist on heavy import duty on architectural plans is in conformity with this object of the Association.

The Canadian Manufacturers' Association is quite willing to work along with the architects to this end, provided they specify Canadian material only.

We wonder how many of the Canadian manufacturers who wish Canadian architects to specify Canadian material, use only Canadian machinery, Canadian insurance and Canadian trained men in their departments.

THE CRITIC.

The critic is one of the spurs that makes the publication of a good engineering journal possible. He provides interesting discussions, and the possibility of his criticism keeps the editorial department on the alert.

Recently, one of these kind friends deplored the supposed carelessness of "Engineering-Contracting" in allowing certain data to appear in their columns without the staff's personal verification of the statement contained. "Engineering-Contracting" very properly answers that to verify every statement submitted would make it impossible for them to produce a weekly journal.

Very recently a prominent consulting engineer took The Canadian Engineer to task for certain articles which, he claimed, did not outline good practice in a particular line. We discussed the matter very carefully with him, and found that his real reason for describing the methods referred to as not good practice were because they did not conform to his style of doing work. Too often we measure the correctness of the method by its conformity to our ideals.

An engineering journal records what has been done, and is being done, under various conditions and by different men. Very seldom will it appear that different men are employing the same method, and it cannot be expected that a journal contributed to by so many different workers shall show uniformity in method or design.

THE ELECTRAL TECHNICAL SOCIETY.

The unofficial conference of the Electral Technical Commission recently held at Brussels, Belgium, has served to remind us that the Commission was inaugurated in London in 1906, and that in its five years of existence very little real, practical results have been accomplished.

The unanimous conclusions arrived at, the clearness of the recommendations made and the decision to meet again within a year, lead us to expect results from the deliberations of this Commission. Although this conference was unofficial, yet it is expected, because of the unanimity of the Commissioners, that the reports will have the same value as if voted upon at the regular sitting of the Commission.

The following propositions were placed before the committees and adopted, and it is expected that next year they will be signed and sealed, and become part of the Commission findings:—

1. That small letters be reserved for instantaneous values.

2. That capital letters be reserved for effective or constant values.

3. That capital letters followed by the subscript "m" be reserved for maximum values of periodic electrical quantities.

4. That capital script letters be reserved for magnetic quantities.

5. That capital script letters with subscript "m" be reserved for maximum values of magnetic quantities.

6. That E, e, represent electromotive force; Q, q, electric quantity; L (script), inductance; H (script), magnetic force; B (script), magnetic flux density; and L, l, M, m, T, t, represent mass, length and time.

In the list of eight symbols recommended for adoption, u has been omitted. This must have been an oversight, as one cannot think of dropping u from permeability.

The delegate from France suggests that C be used instead of I for current, and it is hoped that this suggestion will lead to an early international agreement on the method of expressing Ohm's Law. Dr. Kennelly, one of the American delegates, introduced the question of Vector Notation in alternating current work, and, if this can be made uniform, the present difficulties in the way of reading the books of specialists in alternating current work will be largely eliminated, as much of the present difficulty is due to the fact that Vector directions are not uniform.

Altogether, the work of this Congress has been very important.

Last January the Canadian Society of Civil Engineers elected a committee to work with the international committee on this matter, and it is hoped that an active co-operation on the part of the various local committees will result in the Congress next year delivering specific findings.

THE FINANCIAL SITUATION.

(From The Monetary Times.)

Financial preparations for the coming crop movement are seen in the statement of the Canadian chartered banks for July. Call loans were reduced during the month by $28,500,000. Of that sum, $27,000,000 were withdrawn from the foreign call loan market. The decrease in that item from the June figures is 21.3 per cent., the domestic call loans having declined 2.4 per cent. Call loans out of Canada is the only account showing a decrease from the previous July figures, the amount then being $114,000,000, while this year that sum is reduced to $102,000,000, a loss of 10.6 per cent. Deposits on demand show a slight decrease of approximately $12,000,000, or 4.4 per cent.

The loan situation is, for more than one reason, the most important at the present time of year. While general business is suffering somewhat from summer slackness, the bank statement shows that our general managers have perfect confidence in the commercial future. Current loans in Canada increased during July by $4,000,000, or 0.5 per cent., this being an increase of 20.9 per cent. over the previous year.

. . . .

Credit has been liberally extended, the current loans in Canada having increased by 10 per cent. during the past year. Call loans in Canada made a gain in the same period of 20.9 per cent. Only once during the past thirteen months has a decrease occurred in domestic current loans.

The July bank statement shows that the interests of Canada are being well attended to by the Canadian banks. The call loans abroad have been reduced by $27,000,000 in order to finance the harvest, while at the same time the accommodation of the banks for business purposes was increased during the month by nearly $4,000,000. There is no sign of restriction of commercial activity. The maximum note circulation during July increased satisfactorily. The statement is altogether encouraging, and should prove an effective reply to the ever-busy pessimist.

SPECIAL COMMITTEES OF THE CANADIAN SOCIETY OF CIVIL ENGINEERS.

At the annual meeting of the society, held in Ottawa last January, the council of the society were requested to appoint an Electro-Technical Committee. The Council has named the following gentlemen as members of the committee:

Electro-Technical Committee.—Mr. L. A. Herdt (Chairman) and Messrs. H. T. Barnes, W. A. Duff, L. W. Gill, O. Higman, A. B. Lambe, J. Murphy, T. R. Rosebrugh, and J. J. Wright.

The Chairman of the Canadian Conservation requested the society to appoint a committee on conservation. The following committee was appointed, with Mr. C. R. Coutlee as chairman:

Representing Prince Edward Island—Mr. J. B. Hegan, Mr. H. F. Laurence.

Representing Nova Scotia—Mr. C. E. W. Dodwell, Mr. R. McColl.

Representing New Brunswick—Mr. E. T. P. Shewen, Mr. M. G. Henniger.

Representing Northern Quebec—Mr. A. E. Doucet, Mr. R. O. Sweezey.

Representing Southern Quebec—Mr. R. S. Lea, Mr. J. M. Shanly.

Representing Northern Ontario—Mr. C. R. Coutlee, Mr. Jas. White.

Representing Southern Ontario—Mr. W. H. Breithaupt, Mr. R. W. Leonard.

Representing Manitoba—Mr. G. A. Bayne, Mr. E. E. Brydone-Jack.

Representing Saskatchewan—Mr. A. J. McPherson, Mr. W. R. W. Parsons.

Representing Alberta—Mr. J. S. Dennis, Mr. J. Chalmers.

Representing British Columbia—Mr. H. J. Cambie, Mr. T. H. Tracy.

ROYAL COMMISSION ON TECHNICAL EDUCATION.*

From Nova Scotia and New Brunswick the Commission went to Charlottetown, P.E.I., on August 8.

The chief points brought out were that the industrial development was handicapped by transportation difficulties. Technical night schools were required. Agriculture was progressing, but there was room yet for improvement by way of advanced instruction. A short course in Truro Agricultural College was recommended. More school gardens were necessary. The advantages of manual training as a preparation for industrial training were strongly endorsed.

The witnesses included: Dr. Anderson, Chief Superintendent of Education; Hon. J. Richards, Commissioner of Agriculture; Dr. Robertson, Principal Prince of Wales College; Mr. W. E. Bentley, President of the Board of Trade; Mr. A. B. Warburton, M.P.; Mr. D. C. McLeod, Chairman of the Provincial Education Commission; Mr. Theodore Ross, Secretary of Agriculture; Mr. J. N. Clark, Superintendent Experimental Farm; Mr. A. McNair, Manager of Bruce Stewart & Company; Mr. W. P. Aitken, Mr. A. E. Dewar and other representative business men and farmers.

At the opening of the Commission's sittings at St. John, N.B., on August 17, the announcement was made as to the particular work of each Commissioner.

Jas. W. Robertson, C.M.G., LL.D., Montreal—Chairman of the Commission.

Gaspard de Serres, Montreal—The artistic element in industry and transportation problems.

Gilbert M. Murray, B.A., Toronto—Organization of industries and office management.

Rev. George Bryce, M.A., D.D., LL.D., F.R.S.C., Winnipeg—University and technological colleges and bibliography of industry.

David Forsyth, B.A., Berlin, Ont.—Collegiate and secondary technical schools, and relation of Public schools to manual training.

James Simpson, Toronto—Hours of labor, factory ventilation, light, etc., rates of wages, etc.

Hon. John Neville Armstrong, North Sydney, N.S.—Relation of industrial training to legislation.

Several witnesses were called who gave evidence in connection with agriculture. All made a plea for an agricultural college.

Mr. Lewis Simms was then called. Mr. Simms said that he was engaged in managing the broom and brush factory of T. S. Simms & Co., Limited. He had learned the practical side of the business. There was no regular system of apprenticeship, most of the employes simply learning to run one machine. Their greatest difficulty was in getting people to remain long enough to learn the work. They employed about 200 people. In the brush making skilled men were employed, but they learned their work by advancing from one department to another. Manual training might help in the wood working or machine department, but would be of little help to those taking up the brush making. His own knowledge of the business had been secured by practical experience and by visiting factories in the United States. He knew of no special system of instruction in any other brush factory. Evening classes would be of little use in helping to make better brush makers. His only suggestion would be some regulation that would prevent boys from shifting around to half a dozen factories in a year. There was a chance for the apprenticeship system in some of their departments. The work done by girls was not considered skilled labor. He did not think it would be an advantage to the management for the foremen to know more about the various materials used.

*See also Can. Eng., Vol. XIX., Pages 126, 159.

In reply to Mr. Simpson, Mr. Simms said that they adopted the most up-to-date labor-saving machinery, which they found did as good work as hand methods. Their employes entered their service at ages as much over fourteen as they could get them. They found the younger boys showed a tendency to play at their work.

Mr. Simms, continuing, said that the employes worked eight and nine hours a day, and earned from $2 a week to $1,000 a year.

Mr. John B. Cudlip, manager of the Cornwall and York Cotton Mills, was called next. He said they manufactured cotton cloths and employed 550 hands. It took about five years to make a thoroughly trained hand. Lack of training was due as much to lack of desire as lack of opportunity. From his observation at home and abroad, he did not think the average hand would take advantage of opportunities for training unless compelled to do so, as in Germany. In St. John they could secure training by correspondence, but the workers objected to the expense and time required. He knew of nothing to stimulate the workers along this line. The opportunities for promotion were little. At the Manchester Technical Schools there was a big attendance, but of a different class from what we have around St. John. We have no communities specializing on various trades as there are in England. Educational work would have to be general. The Public schools did wonders, but he found in children leaving the lower grades a lack of perception and observation. He thought the lower grades would be improved by greater concentration on fewer subjects. He believed in the study of classics for training the observation and memory, possibly even more than manual training and handling materials. He believed the foundation of education should be a training in observation and reflection. Some of their employes took the correspondence course, but he did not believe that correspondence could take the place of personal contact with the teacher. Mr. Cudlip referred to the apprenticeship system as used in England, referring to one machine shop where £300 premium was paid by parents for the admission of their boys. He believed in the apprenticeship system. His own boy was now serving his time as an apprentice. One of the chief difficulties of establishing technical schools was that it was such an immense proposition to establish a general school covering all trades. He believed that the specialized school was the best, but only a community which specialized could support one.

Mr. Charles McDonald, manager of the St. John Iron Works, followed. He said they made engines and other forms of machinery. They employed 100 people. They had a voluntary apprenticeship system covering three years. Some of the boys would leave, but the supply was greater than the demand. Some of the boys took night classes in drawing, etc., at the Y.M.C.A. He knew of none taking the correspondence courses. It would be better for them and their employers if they could read blue prints with facility. He believed in the value of the night schools. His foremen told him they could make better workmen out of boys who knew nothing of the work than those who thought they knew something about it. Theoretically, the foremen express belief in technical education, but he found difficulty in getting them to express practical opinions. Most of them were anxious to help the employes, and he believed they would be willing to give a couple of nights to teaching night classes. He mentioned the case of a boy who had entered lately who adapted himself more readily than usual to the work because of manual training he had received. He thought the boy who entered the works at fourteen was likely to make a better workman than a graduate of the High School. The latter usually forgot more than the elements of their education in a short time. He found the great difficulty was not lack of education, but lack of "gumption." The boy who wished to secure special education could do so by use of public libraries and correspondence courses.

Mr. James Pender was next called. He said he was the business manager of Jas. Pender & Co., Limited, manufacturers of nails, employing about 100 men. Few employes took correspondence courses, but he believed night classes would be of benefit to them. The company's product was distributed as far as freight rates allowed.

DIGGING TILE DITCHES BY GASOLINE MOTOR POWER.

The single wheel tile ditcher, noted in the accompanying illustration, Fig. 1, as well as the double wheel machine, are operated by gasoline engines, thereby eliminating the use of a caostan, horses or a team to haul fuel. The former illustration shows the tile spout and the canopy top over the traction outfit, while the latter shows the method of operating the double wheel ditcher providing for the laying of 24 inch to 30 inch tile.

Fig. 1.

The accompanying illustration, Fig. 2, shows a tile ditcher of this type operated by a gasoline motor in operation in Iowa, in remarkable surroundings, the slough grass 8 feet or 10 feet high, indicating the soil below. The tractor that propels or drags the ditcher along is of the caterpillar type. Practically all of the weight of the equipment is 25 to 35 feet away from the bottom of the ditch.

The accompanying drawing, Fig. 3, shows how the tile is laid by gravity, also the shield that prevents the side from falling in after the tile is laid. The bottom shoe of the shield is curved and adjusted up and down so as to be always on the same angle as the ditch and tile.

The gasoline engine used for traction for pulling the ditcher and furnishing power for digging the ditch is of the double cylinder type, having a capacity of 20 horse power. The weight of the tractor with the engine, water and gasoline tank is about 4,000 pounds, the weight of the ditcher being about the same. The conveyer consists of a steel plate apron fastened to a link chain running over four sprockets and has a cleaning device to scrape off any sticky mud that will not fall off of itself. This conveyer is adjustable so as to carry off the dirt excavated at different distances according to the width and depth of the ditch dug.

In laying small tile from 4 inches to 12 inches in diameter the gasoline motor driven ditcher works automatically, laying the tile by gravity so that if any dirt falls back it must fall

Fig. 2.

on the top of the tile and in case of "cave in" the same occurs after the tile is in place helping to fill the trench, rather than where the tile ought to be laid.

For large ditches a double wheel machine is provided with two wheels, chain and beam, that cut a ditch from 12 to 24 inches wide. It is stated, however, that on account of the great weight it is not practical to lay tile larger than 12 inches in diameter automatically, but for smaller tile it can be laid automatically by the machine, allowing ground to be ditched and tiled that would be practically impossible to tile by hand.

The grade or angle can be surveyed and proven before the tile is covered, and the grade stakes are left intact so that the work may be easily proven before the tile is covered.

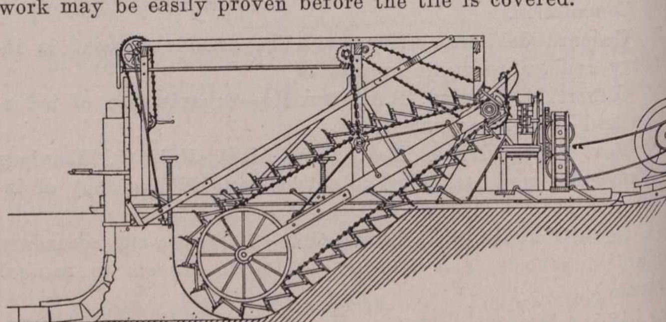


Fig. 3.

It is maintained that tiling by gasoline engines of this type may be done at one-third of the cost of tiling by hand. One may be required to raise and lower the wheel and steer the traction outfit, and another to keep the tiles filled. The speed of operation is said to be 150 feet per hour for a trench 4 feet deep, and 100 feet per hour for ditch 7 feet deep, while a depth of 10 feet can be dug and the tile laid, automatically, at the rate of 50 feet per hour.

It will readily be seen what a great convenience and wonderful labor-saving device a gasoline ditching and tiling machine of this type would prove in laying tile in wet, swampy and boggy farm lands.

THE

Sanitary Review

SEWERAGE, SEWAGE DISPOSAL, WATER SUPPLY AND WATER PURIFICATION

THE PROVINCE OF ALBERTA AND SEWAGE DISPOSAL.

In our issue of August 4th last we published a copy of a circular letter sent out by the Provincial Board of Health of Alberta to certain municipalities within that Province.

This circular practically said:—

The systems of sewage disposal now in use are condemned.

The Government are about to vote money to experiment with a new system, introduced by Mr. Owens, the Provincial Sanitary Engineer.

The new system is called "The Live Earth Bed System."

All municipalities are advised not to undertake any system of sewage disposal until a practical demonstration of Mr. Owens' system has been made.

We noted in connection with the above that we had seen the plans and specifications of Mr. Owens' system, and we had failed to perceive any new or extraordinary features connected with it, but that the so-called "Live Earth Bed System" was similar to what is known as "Dibden's Slate Bed System," and that the process had been fully experimented with at the Massachusetts State Board of Health Experiment Station.

In this issue we reproduce copies of the plans of the "Live Earth System," along with the promoter's specification.

As we have had several enquiries asking for further information on this matter, we have concluded to deal more thoroughly with the matter in this issue.

Claims Made for the "Live Earth System."

An examination of the specification points to certain definite claims being made as follows:—

(a) Live earth beds work on exactly the same principle as ordinary contact beds.

(b) The difference lies in the form of filtering material used; horizontal, thin slabs of concrete taking the place of the ordinary filter material. This constitutes the only difference.

(c) Above each layer of sewage is retained a layer of air sufficient to maintain a high degree of aeration during contact.

(d) The sludge or solids contained in the sewage is intercepted by, and retained on, the surface of the slabs, where it undergoes a change, rendering it non-putrescible.

(e) The action is aerobic, due to fermentation processes produced by bacteria and to digestive processes produced by worms, etc. The transformed sludge is called "humus."

(f) The effluent liquid is considerably purified, and can, with the addition of a germicide, be discharged into streams without creating a nuisance.

(g) The main claim is: "The sludge difficulty is **entirely eliminated.**"

The above claims crystalized simply mean: Here is a system which **gets rid of the sludge difficulty and produces a liquid purified to the extent of being incapable of producing any nuisance at the point of discharge.**

We do not know whether it is due to the Provincial Board of Health or to the promoter that this system has been termed the "Owens' Live Earth Bed System," but the only constructive difference which we can discover between it and the well-known "Dibden Slate Bed System" lies in the proposal to use thin concrete slabs instead of slates, presumably because slates are difficult to obtain in Western Canada.

The above also marks the only difference between contact bed filter No. 186, experimented with at the Lawrence Experimental Station, Massachusetts, regularly from January 18th, 1902, to June 30th, 1902, and which, evidently now after eight solid years have **passed over,** is to be the subject of experiment in Alberta in spite of its published failure at Lawrence under the most expert observation that the scientific sewage world has produced.

Dibden's Claims.

On page 6, "The Present Position of the Sewage Disposal Question," by W. J. Dibden, we read: "As is now well known, the 'slate bed' is an improved form of contact bed, which is filled with superposed layers of slate separated at convenient distances, about one inch to three inches, as may be necessary, apart, by means of slate blocks, the whole thus forming an indestructible series of shelves, on which the sewage suspended matters are deposited when the beds are filled with sewage. As in the case of the old clinker coarse contact bed, the sewage is allowed to remain quiescent for two hours, when the outlet valve is opened and the 'primary effluent' run off for further treatment on land, contact or sprinkler beds, etc., as the case may be, or for direct discharge into tidal estuaries, the sea, etc."

Again, on page 12 we read: "When the bed is first filled with sewage, and allowed to stand full in a quiescent state for a couple of hours, the solid matters settle on the slates until the 'living earth' is fully developed."

Here we have the term "living earth" first used, and Dibden himself has suggested the name for the re-christening of his child in Alberta.

Now, the particular feature in Dibden's claims which requires consideration at this moment is, that he does not claim sewage purification in the sense of producing a chemically stable sewage effluent. His claims are confined to the question of sludge treatment solely; and he admits all along the line that even after so much of the solids have been intercepted by the slabs that the liquid is still "liquid sewage," and as such requires treatment by oxidation or nitrification, unless it is to be discharged into tidal waters or into the open sea.

If the Alberta "specification" had been a little more modest in its claims, and had termed itself a "Description of how to Avoid the Sludge Difficulty" instead of "Description of Aerobic Biological Purification of Sewerage," we should have had less to say on the subject.

The Massachusetts Experiments.

On January 1st, 1902, a new filter (No. 186) was experimented with. Slates were placed horizontally in the body of the filter, about one-half inch space between each layer of slate. We quote from the State Board of Health report as follows:—

"The idea was to provide as much surface as possible for the accumulation of suspended matter under the most favorable conditions. This new filter, called No. 186, was filled with regular station sewage in three doses, one hour apart, and allowed to stand two hours before draining. The plan of providing favorable conditions for the deposition of suspended matter was entirely successful, but the filter lost open space rapidly. The effluent was never of good quality. During May and June the **anaerobic** conditions noted with filters Nos. 173 and 174 became strongly marked, and the filter was discontinued at the end of June."

Most assuredly the Provincial Board of Health cannot be aware of this experiment, or else they would hesitate in many of the statements made in their "Live Earth" specifications.

The anaerobic conditions referred to in filters Nos. 173 and 174 were simply as follows:—

"Neither filters were successful in producing good effluents; anaerobic action ensued when the filters were filled with sewage and no nitrification occurred."

General Remarks on Claims made for the "Live Earth System."

(a) The "System" is practically the same as the "Contact Bed System." Recent experimental work in connection with contact beds at Hamburg, Massachusetts and elsewhere, has clearly shown that a contact bed during the period of contact is practically a septic tank, from which air is excluded by the action of filling the bed with sewage. During this period the action is anaerobic and not aerobic, and not as claimed for the "Live Earth System." Nitrification only takes place when the tanks are empty and air is admitted. (See Massachusetts Report, 1908, page 445, with reference to conclusions on contact filtration: "Putrefactive reactives abound, inasmuch as the entrance of oxygen is partly excluded.")

In all modern methods of sewage purification putrefactive reactives are avoided as far as possible.

(b) The difference between the use of concrete slabs and slates is one of **expediency** and not of **efficiency**.

(c) **A high degree of aeration during contact is claimed.**—No aeration is possible during contact; air is excluded, just as in the case of the septic tank.

(d) **The sludge is retained and rendered non-putrescible.**—Any results obtained in this connection are practically the same as with the septic tank.

(e) **The action is aerobic, due to bacteria and worms.**—No aerobic action takes place during period of contact; aerobic action only takes place when the liquid is withdrawn. The period of contact is so much waste time, and deleteriously affects the liquid sewage, making it more difficult to treat in oxidizing filters. The presence of nitrates in contact beds, the product of nitrification, can only be due to the action which takes place in the presence of air during the period when the bed is empty.

(f) **The effluent liquid is considerably purified, and can be disinfected if necessary.**—(See Massachusetts experiments with slate contact beds, where no nitrification took place and the effluent liquid was not purified.) It requires about from three to four times the amount of chlorine to disinfect a denitrified effluent than an nitrified one. Effluents which contain the products of putrefaction and are robbed of their oxygen, such as septic effluents, require considerably more chlorine than even fresh, strained sewage in order to complete satisfactory disinfection. (See Bernard E. Phelps on "Disinfection of Sewage Effluents.")

(g) **The sludge difficulty is entirely eliminated.**—All sewage disposal experts are agreed that the sludge difficulty still remains a difficulty. (See Massachusetts experiments with slate bed filter, which lost open space rapidly.)

The Summing Up of the Question.

The whole question may be summed up thus:—

It is an undisputed fact that if the solids in sewage, forming what is termed sludge, are allowed to accumulate, either on concrete or slate shelves, will in time become organically exhausted and form a residual similar to soil or humus. This action is due to putrefactive processes, and may be aided by worms, etc. In the septic tank this action takes place, and the residual sludge is generally referred to as humus, similar to garden soil or loam.

That worms play an important part in contact beds is well known, is remarked upon by the Royal (British) Commission on Sewage Disposal, and was observed in many of the contact filters in connection with the Massachusetts experiments.

In connection with Filter No. 103 the State Board of Health reports:—

"An interesting feature in the life of this filter has been the presence of large numbers of worms of a form similar to the ordinary earthworms, which made their home in the filtering material, practically covering the surface when the filter was filled with sewage and returning below when it was drained." Thus again the period of contact is shown to be useless, even to the worms.

The question, however, for answer is simply this: Shall this putrefactive process in connection with sludge be allowed to take place in the presence of the fresh sewage liquid? It is the old question which has been recently asked and answered in connection with septic tank action. The answer is a most decided "**NO.**" All modern systems of any note are strenuously avoiding all septic sludge action in the presence of the fresh liquid sewage, looking, as they do, to a stable and non-putrescible liquid effluent, which is readily subject to disinfection by nascent oxygen obtained from hypochlorite or otherwise.

We cannot close this critique without reference to the uncalled-for slur upon the civil engineer which Mr. Owens considers necessary to his specification. The remark that the civil engineer's chief object is very often to dispose of sewage by the cheapest method possible without respect to its influence on the health of the public is uncalled for. This remark would have been more aptly applied to the municipal authorities who retain the services of the civil engineer.

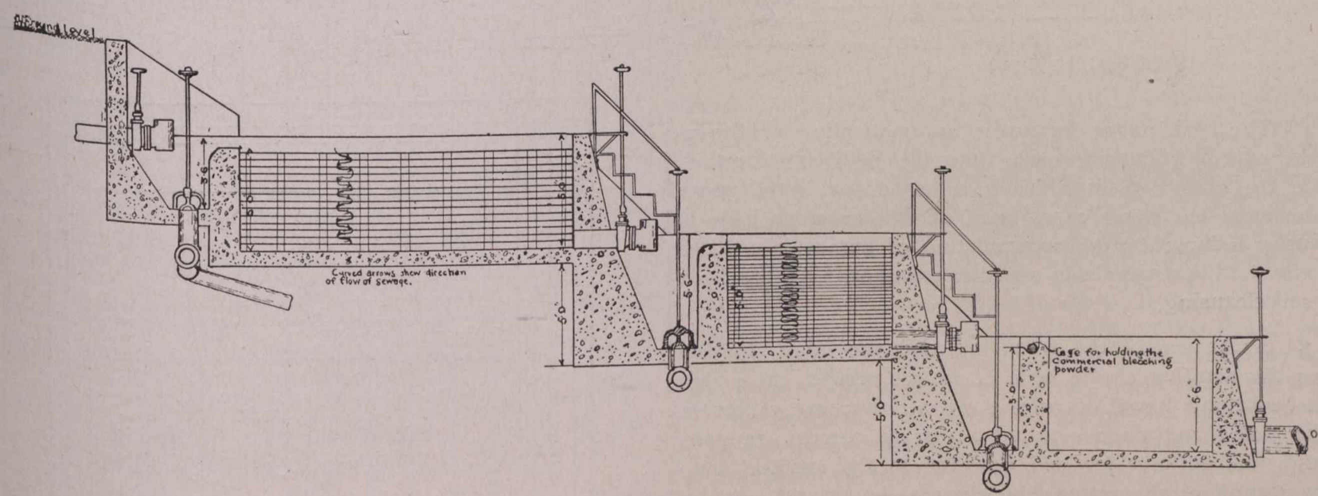
The man who cannot yet appreciate the great work done by the civil engineer in the development of modern methods of sewage disposal has a mind requiring greater "transition" than is likely to affect modern methods of sewage disposal in the near future.

DESCRIPTION OF AEROBIC BIOLOGICAL PURIFICATION OF SEWERAGE BY MEANS OF THE LIVE EARTH BED SYSTEM.

By R. B. Owens, B.A., M.R., San.I., Sanitary Engineer and Member Provincial Board of Health, Alberta.

Live earth beds work on exactly the same principle as ordinary contact beds. They treat the crude, unscreened sewage without any settling tank or septic tank except for grit; the solid matters are broken down by worms and other biological organisms which live on the surface of the concrete plates, in the presence of air, without forming sludge or creating any nuisance whatever.

The theory of their action is as follows: A layer of sewage is allowed to rest above a thin layer of "live earth" supported on the surface of a thin concrete plate; the construction of the beds allows a number of such surfaces to exist one above another. The suspended matters are deposited and rendered inoffensive by the digestive action of the organisms in the "live earth." Above each layer of sewage is retained a layer of air sufficient to maintain a high degree of aeration during contact. The layer of "live earth" is obtained from the first deposits of sewage which aerobically convert themselves into what may be described as a "culture" of aerobic organisms in which are retained fibres and earthy matters. Humus is formed and separated from the fresh sewage deposited on the plates by the action of thousands of worms which live in the layer of living earth formed on the plates, and which each time the effluent is discharged from the bed come to the surface for air, and throw up worm casts which are washed out of the bed the next time it is emptied. The worm casts are nothing more than mould containing a large number of bacteria. The humus is inodorous and readily settles in a shallow effluent channel, and if the floor of the channel is lower than the outlet the humus can be flushed every day into well drained land, or an ash draining bed, where the bacteria will die of starvation, the worms continuing the work until only waste matter remains.



Section A-A.

The proportion of humus to solid matters in the sewage varies with the strength of the sewage, but is with an exceptionally strong sewage less than one to twenty. The rate of increase in the depth of the deposit is very slow, a normal domestic sewage depositing only about one-hundredth of an inch layer at each filling. THE BIOLOGICAL DEGREDATION AND CONVERSION OF ANIMAL MATTER IN SUCH A THIN LAYER IS RAPID. After some months an appreciable film may be observed, which, under the microscope reveals a trace of recently deposited sewage matters the bulk being zoogloa masses of bacteria, which bind themselves together by the production of "colloids" in which remain the partially digested skeletons of fibres and particles of grit, with numerous worms, infusoria, etc. The older part of the film or humus breaks away or leaves the bed with the effluent, averaging about two grains per Imperial gallon. Collected from the effluent the colloidal humus remains inoffensive. The small quantity escaping is trapped and run on the land or onto a small ash bed where the jelly-like mass of organisms dries up as a jelly-fish will dry up when left on a rock and exposed to the air, leaving a minute quantity of "earth."

The system is an efficient, natural process based on well understood scientific facts. The beds are really large aquaria.

Interesting points in the working of the beds are the winter and spring changes. At the approach of winter the animal protozoa encyst and hibernate, while the vegetable bacteria continue to multiply on the added fresh material. As the decomposition sets free heat, the interior of the bed is never cold, and consequently the biological action is not slowed down. Toward spring, with the first warm weather the protozoa wake up and multiply, and the bacteria increase their growth and activity considerably. The jelly humus beomes less substantial and slips away with the effluent in larger quantities than in the winter, or even in the summer months. The escaping humus is quite inoffensive and in no way different from that escaping at other periods of the year, excepting in quantity.

The operation of live earth beds is INTERMITTENT, and exactly the same as that of ordinary contact beds. Two hours is the usual period of contact for sewage, the beds being allowed two or three hours aeration.

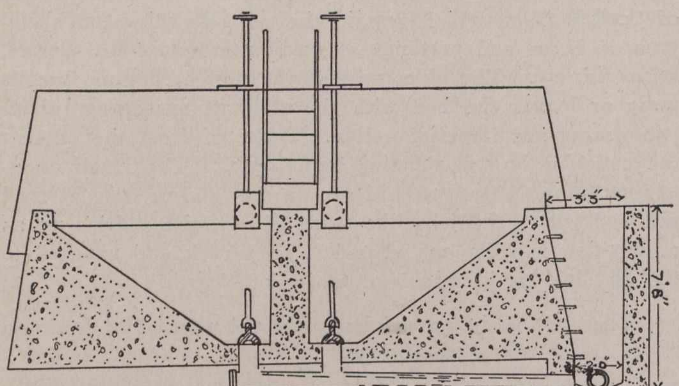
The live earth bed system has several very important advantages compared with other systems.

1. As the beds have a water capacity very considerably

more than that of ordinary contact beds formed with stone, clinker, etc., etc., they may be only half the size of ordinary contact beds and one-fifth the size of intermittent sand filters to treat the same quantity of sewage, thus besides the great saving in cost of construction, much less land for works is required.

2. It is impossible for the plates to settle down and pack tight as clinker does.

3. It is impossible for the material to break down and small particles to fill up the interstices between the material.



SECTION B-B

4. The residum or humus is automatically withdrawn by the outgoing effluent each time the beds are emptied, and at the same rate at which it is formed, with the result that whereas the water capacity of clinker or stone beds is gradually reduced by the accumulation of humus, the water capacity in live earth beds remains constant, i.e., the beds are **self-cleansing.**

5. By reason of the foregoing and the holes in the plates the aeration of the beds is almost perfect, the action of the outgoing liquid drawing down air over every portion of the plates and when emptied a reverse current inwards through the outlet valve and upwards to the surface over every portion of the plates, the current being set up by reason of the heat of decomposition which rising strongly upwards through the holes in the plates will draw inwards fresh air through the outlet during the two or three hours of aeration.

6. The whole of the decomposable organic matter in the sewage is digested by the worms (including the common river worm) and other living creatures and converted into humus; there is thus nothing left of the sewage but a material which dries up like garden mould and an effluent considerably purified and its composition so changed that, after the addition of a germicide, it can, without creating a menace to health or depositing organic matter on the banks, be discharged into any stream; five parts per million of available chlorine (2 oz. of commercial bleaching powder per 1,000 Imperial gals.) having been found to have removed 99.96 per cent. of the total bacteria and to have practically eliminated the intestinal organisms and B. coli and the typhoid organisms present in the effluent, the time of contact being two hours.

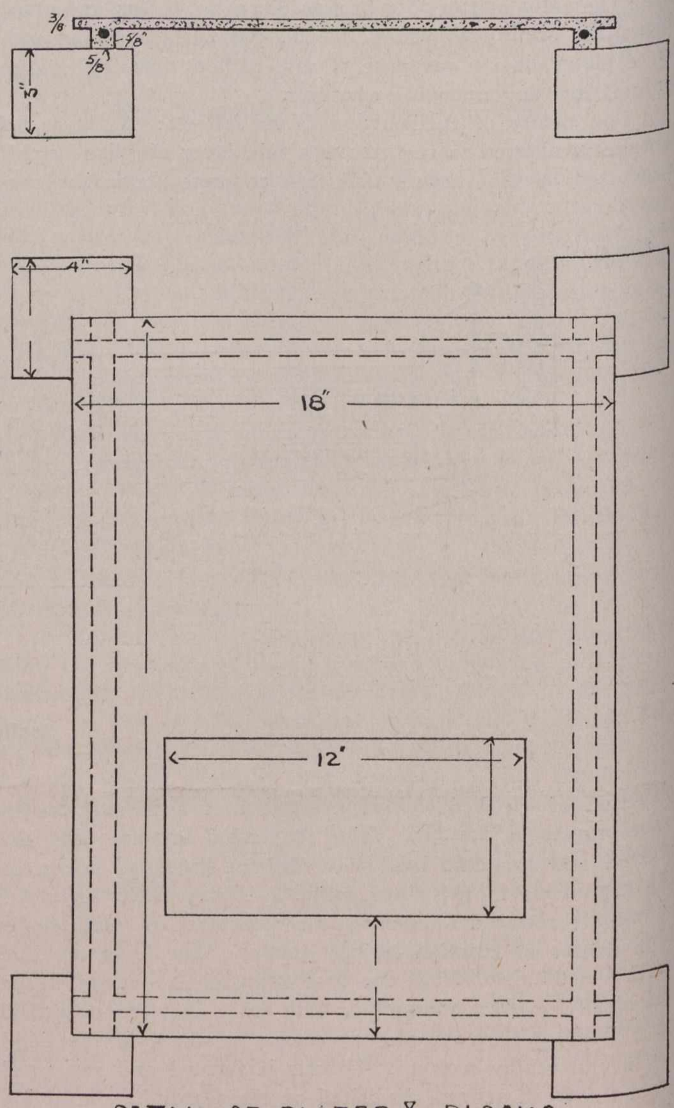
7. The sludge difficulty is entirely eliminated, the solid organic matters being resolved into an inoffensive condition without putrefaction or the accumulation of sludge.

8. The working-expenses are practically nil.

9. The beds are inodorous.

10. The system is particularly well adapted to Canadian climate conditions; the beds when full of sewage being about twelve parts liquid to one part solid. The whole of the heat of the inflowing sewage is retained and increased by decomposition, whereas in an ordinary contact bed or intermittent sand filter under similar conditions only one part is liquid to one part solid, hence the heat of the inflowing sewage is considerably lessened and the bacterial action materially reduced.

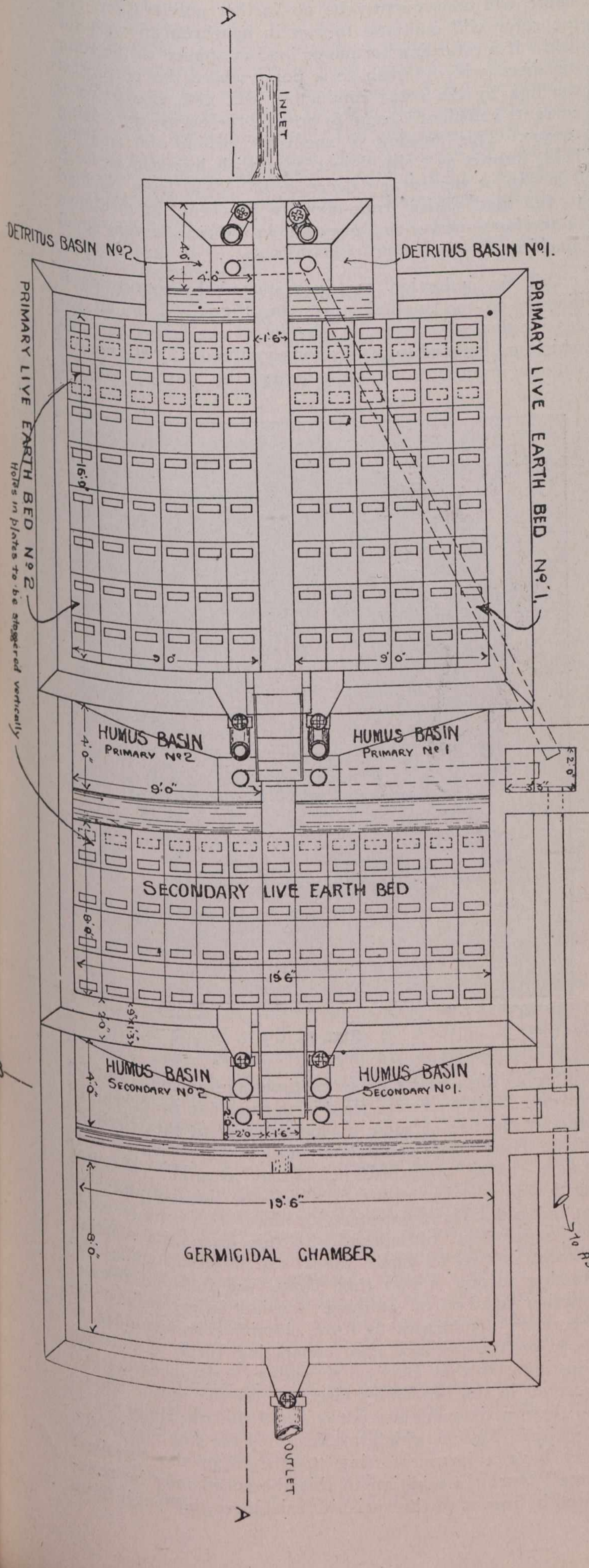
11. Their advantage in this country as compared to sprinkling filters is obvious; the liquid in sprinkling filters being so finely divided it freezes solid in winter, and owing to rapid evaporation in summer, it diffuses bacteria in the air, and has been found to encourage the fly nuisance to an alarming extent.



DETAIL OF PLATES & BLOCKS

12. IT IS NOT THE FUNCTION OF ANY SEWAGE TANK OR FILTER WHATSOEVER TO REMOVE GERMS OF DISEASE FROM SEWAGE. This can only be done by a germicidal treatment, and the live earth bed system is particularly well adapted to prepare sewage for such treatment.

13. The system has been designed by a duly qualified public health engineer for the purpose of disposing of sewage from a health official's point of view, rather than



from the point of view of a civil engineer, whose chief object very often is to dispose of sewage, (i.e. to get rid of it or to get it out of sight) by the cheapest possible way, irrespective of its influence on the health of the public in the surrounding country or neighbouring towns.

NOTE:—The enclosed blue print shows the live earth bed system with its attached germicidal chamber for the ultimate sterilization of the effluent.

PUBLIC OWNERSHIP OF FORESTS.

It is admitted by forestry experts that our knowledge of our actual forest resources is vague and uncertain at the best. Of one thing we may be pretty sure, and that is that private interests exploiting timber have tried to secure control of those forest areas that are most accessible and most easily worked, leaving the more distant timber and that more difficult of recovery to public ownership. Allowing for everything, however, there seems ground for congratulation in the comparisons given above, based on the figures (not official) of a government expert. This authority estimates as follows the timbered land making up the total.

	Total Acreage.	Publicly Owned.
British Columbia	50,000,000	49,200,000
Manitoba, Alberta, Saskatchewan and Territories	100,000,000	94,000,000
Ontario	7,000,000	52,400,000
Quebec	100,000,000	43,800,000
New Brunswick	12,800,000	2,400,000
Nova Scotia	4,000,000	None.

Recent reports by explorers show that of the great forests of the north, very large portions have been burned over, perhaps utterly destroyed. The fact that two-thirds of the timber area of the country is still owned by the public does not mean that Canada can count upon owning two-thirds of the timber wealth. But the giving away of timber has been practically stopped, and even where private exploitation is permitted the conditions imposed by the Government are such as to protect the forest as a whole from wanton destruction and to secure for the public a fair share of the wealth produced.

BIG YEAR IN METALS

Advance figures from the annual compilations of steel and iron statistics by Mr. James M. Swank of the American Iron and Steel Association, which are taken as authoritative in the trade, show an enormous increase in output during 1909, not only in iron and steel, but in some of the lines which are counted as auxiliaries of the iron and steel industry. The following table shows at a glance the production of the principal items in 1908, as contrasted with 1909:—

Gross Tons, Except Connellsville Coke, Which is in Net Tons.	1908.	1909.
Bessemer pig iron	7,216,976	10,557,370
Basic pig iron	4,010,144	8,250,225
Total pig iron	15,936,018	25,795,471
Bessemer steel	6,116,755	9,330,783
Open hearth steel	7,836,729	14,493,936
Crucible steel	63,631	107,355
All steel	14,023,247	23,955,021
Bessemer rails	1,349,153	1,767,171
Open hearth rails	571,791	1,256,674
All rails	1,921,015	3,023,845
Structural shapes	1,083,181	2,275,562
Shipments of Lake Superior ore	26,014,987	42,586,869
Shipments of Connellsville coke	10,700,022	17,785,832
Locomotives built	2,124	2,653
Cars built	69,594	89,600
Iron and steel vessels built	99	113

ELEMENTARY ELECTRICAL ENGINEERING.

L. W. Gill, M.Sc.

CHAPTER VI.

ALTERNATING CURRENT APPARATUS AND SYSTEMS.

This series of articles will be continued for some months. They will be of particular interest to the student of electrical work and the civil engineer anxious to secure some knowledge of the simpler electrical problems.

The Induction Motor.—The mechanical features and the operating characteristics of the induction motor differ radically from those of the synchronous motor. It has no projecting poles and does not require direct current for excitation. It has no commutator and in most cases no collector or slip rings. The circuits formed by the conductors on the rotating element or "rotor" are not connected in any way with the supplying system, the current in these circuits being set up by an e.m.f., which is generated or induced by the magnetic flux due to the currents flowing in the circuits on the stationary element or "stator." On account of the transformer action between the two elements, rotor and stator, the latter are sometimes referred to as "secondary" and "primary," corresponding to the two elements of the transformer.

Referring to Fig. 65, which represents the stator or primary element of an induction motor, it will be noted that the winding is placed in slots uniformly distributed around the inner surface. The conductors in these slots are connected up to form as many similar circuits as there are phases in the system to which the motor is to be connected. When these circuits are connected to a system of power supply, currents of different phases will flow therein and set up magnetic fluxes of different phases. At any particular instant the maximum flux will be linked with the circuit in which the maximum current is flowing. As the currents change in phase the maximum flux will shift from point to point around the inner surface of the stator. The primary currents thus set up a "rotating magnetic field." As this effect is produced by the combined action of the currents in the different circuits it follows that a rotating field cannot be produced by a single circuit.

Referring now to Fig. 66, which represents a "squirrel cage" rotor or secondary element, it will be noted that the winding consists of bars bolted at the ends to metal rings. With this arrangement the conductors are all in parallel, and thus form a large number of circuits of very low resistance. A very small e.m.f. generated in these conductors will consequently give rise to large currents. When the rotor is placed inside the stator and currents are passed through the stator circuits, the rotating field, being cut by the rotor conductors, will set up heavy currents in the latter. The reaction between these currents and the rotating field constitutes the driving torque, which tends to drag the rotor conductors in the direction of the field's rotation. If there is no retarding torque acting on the rotor it will accelerate until its speed is equal to that of the field. There will then be no cutting of lines of force by the rotor conductors, and no secondary current or torque. There will consequently be no further acceleration, and the rotor will continue to run in synchronism with the field. If a retarding torque or load is applied to the rotor its speed will diminish to a point where the cutting of the flux by the rotor conductors will give rise to rotor currents sufficiently large to provide the necessary driving torque. This lagging of the rotor behind the rotating field, known as "slip," increases with increase of load. The slip or percentage decrease of speed from no load to full load varies from about 2 per cent. in machines of 100 horse-power to 6 per cent. in the case of very small machines.

If an induction motor is started by connecting it directly to the supplying system, there will be an excessive flow of current on account of the heavy currents which are induced in the stationary circuits. With normal voltage impressed on the primary, the starting current will be as high as six or seven times the normal full-load current. This excessive rush of current can be prevented only by the use of some device external to the windings of the motor. The most common device is a transformer, known as a "compensator," when arranged for this particular use, by means of which the line voltage may be reduced. The compensator reduces the voltage to 60 or 70 per cent. of normal. In this case the starting current is two to three times the normal, while the starting torque is less than twice the full-load torque. Another method of starting consists in arranging the secondary conductors to form circuits corresponding to those on the primary and connecting these circuits to slip-rings, so that external secondary resistances may be inserted in the secondary circuits. As the motor speeds up these resistances are cut out and the slip-rings short-circuited. Motors which are designed for starting in this way have a large starting torque than the "squirrel cage" type. In addition to this the speed may be regulated by means of the variable resistances, although there

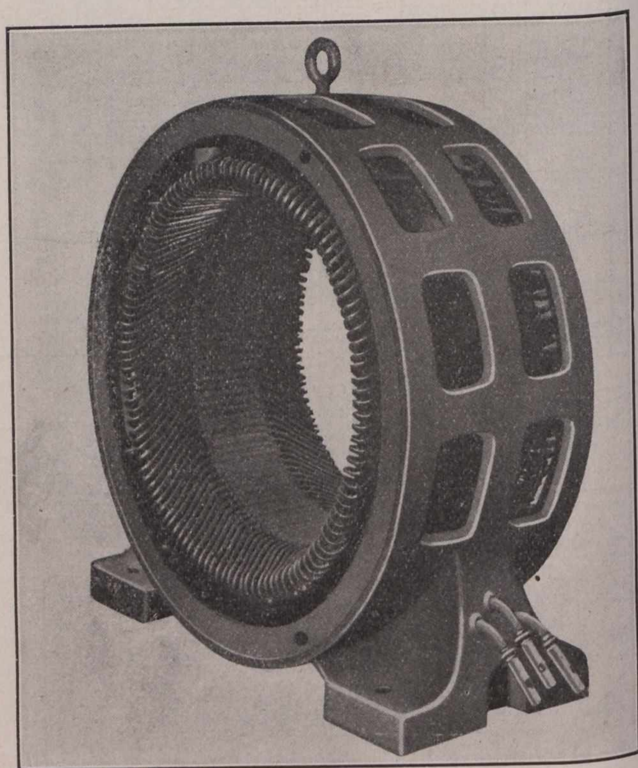


Fig. 65.

is a considerable loss in efficiency when working in this way on account of the heat loss in the resistances.

The power factor of standard induction motors of American manufacture at full load varies from .75 to .92, depending on the size of the motor and the frequency. At partial loads the power factor is less, diminishing to about .5 at one-eighth load. The efficiency varies from 80 to 90 per cent. at full load. In any particular case the efficiency is practically constant from full load to about one-third load. At lighter loads it diminishes rapidly.

Standard motors are constructed for frequencies ranging from 25 to 60, although frequencies of 35 or 40 are most desirable.

The direction of rotation of an induction motor depends on the direction of rotation of the magnetic field, as previously noted. The latter may be reversed by transposing the wires leading to **one phase.** This applies to either two or three-phase machines.

The simplicity and reliability of the induction motor,

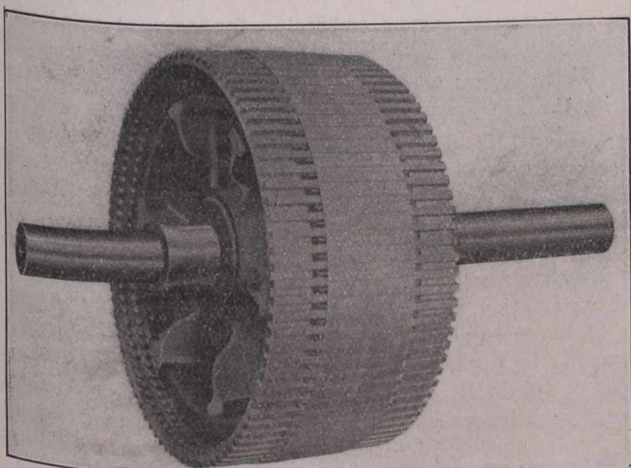


Fig. 66.

together with the absence of any commutator or sliding contacts, have made it a favorite motor for general use. In cases where the motor has to start under heavy load the motor with slip-rings and variable resistance is generally used, but for most commercial work the "squirrel cage" rotor gives sufficient starting torque.

Single-phase induction motors have the same mechanical features as polyphase motors, but a single circuit on the stator is not capable of starting a rotating magnetic field. Some additional arrangement is, therefore, necessary to obtain a starting torque. In some cases an auxiliary circuit is placed on the stator, and an external arrangement, known as a "phase-splitter," is used to split the current from the line into two currents differing in phase. These two currents, flowing in the main and auxiliary windings, produce an imperfect revolving field, and the motor may be started under a partial load.

In the Wagner motor, which is one of the most satisfactory single-phase motors on the market, the rotor is provided with a commutator. When a certain speed is reached a centrifugal device, placed in the central part of the rotor, raises the brushes and short-circuits the commutator segments. The rotor is thus converted into the equivalent of the polyphase "squirrel cage."

The combined effect of the stator and rotor currents in the single-phase motor when running produces a rotating field the same as exists in the polyphase. Their operating characteristics are, therefore, similar. The single-phase motor is larger per unit of output, and is consequently more expensive to build. In this connection it may be noted that if a polyphase motor is wound for use as single-phase its capacity will be only about 75 per cent. of its capacity if wound for polyphase operation. For this reason the single-phase motor is not built in very large sizes. On the other hand, it meets a growing demand for small motors in places where a single-phase circuit is the only source of power available.

The Alternating Current Series Motor.—This motor is essentially a single-phase machine. Its structural features are much the same as those of the induction machine. Its rotor is provided with a commutator the same as the Wagner single-phase induction machine. The essential difference between the two types of machines is that in the series motor the rotor circuit is connected directly in series with the stator circuit. Its operating characteristics are, therefore, similar to those of the direct current series motor described in the previous chapter. It is essentially a variable-speed machine, giving a large torque at low speed. It is, therefore,

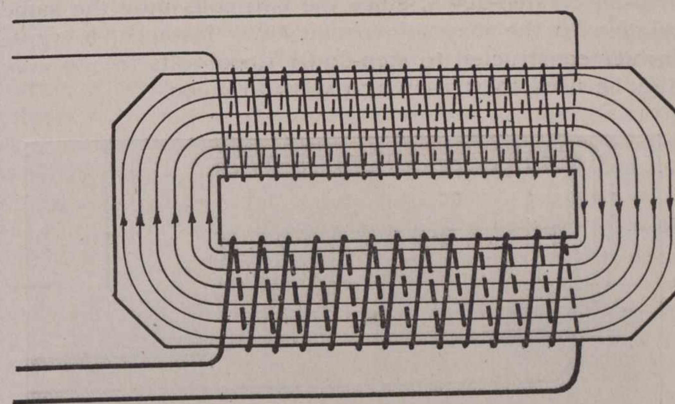


FIG. 67

suitable for railway work, for which purpose it was originally developed. A number of railways in the United States are now operating with this type of motor. It is adapted for operation only on low frequencies—15 to 25 cycles—but can be built in very large sizes.

The Transformer.—In the application of alternating current to the various apparatus adapted to its use it is often necessary to change the magnitude of the voltage at which the current is supplied. This is effected by means of the "transformer" (sometimes known as the "static transformer"), which may be constructed to change the voltage in any desired ratio. If the internal losses of the transformer are reduced to a negligible quantity the magnitude of the current will be changed inversely as the voltage, for, if there is no loss in the transformation, the power before must be equal to the power after transformation, and, since power is equal to the product of current and voltage, if the voltage is increased in any ratio, the current must be decreased in the same ratio, and vice-versa. The transformer may, therefore, be used to change the current as well as the voltage.

The transformer consists essentially of two coils of wire linked with one magnetic current, as shown in Fig. 67. When an alternating current is passed through one coil an alternating magnetic flux is set up in the magnetic circuit. This flux induces an alternating e.m.f. in the second coil, the frequency of which is the same as that of the alternating current. The magnitude of this e.m.f. will depend on the number of turns of wire on the coil, since the e.m.f. generated in each turn will be the same. From this it follows that a greater or smaller e.m.f. may be obtained by increasing or decreasing the number of turns on the second coil. As the alternating flux links with both coils it follows that an e.m.f. will be induced in the first coil, the magnitude of which will bear the same ratio to the e.m.f. induced in the second coil as the number of turns on the two coils. In commercial transformers the magnetic circuit is made large, so that the flux is sufficiently large to induce in the first coil an e.m.f. practically equal to the applied voltage. **It thus follows that the e.m.f. induced in the second coil is equal to the applied voltage multiplied by the ratio of the turns on the two coils.**

When the e.m.f. induced in the second coil is greater than the voltage applied to the first coil the arrangement is known as a "step-up" transformation, and when it is less, a "step-down" transformation. Any transformer, when once constructed, may be used either as step-up or step-down, since the two coils bear the same relation to the magnetic circuit. For instance, a transformer constructed to step-down 1,000 volts to 100 may also be used to step-up 100 volts to 1,000.

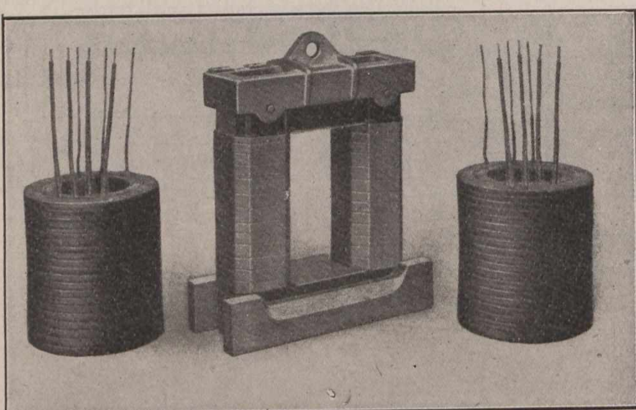


Fig. 68.

The coil to which the available voltage is applied is known as the "primary" coil, and the coil which gives the higher or lower voltage is known as the "secondary" coil. The primary coil takes power from the source of energy, and the secondary coil delivers power to be used as required. The coil in which the higher e.m.f. is induced; i.e., the coil with the larger number of turns, is sometimes referred to as the "high tension" coil, while the other coil is referred to as the "low tension" coil.

The iron which makes up the magnetic circuit of the transformer is usually known as the "core," and is built up of thin sheets (laminations), the surface of which is coated with an insulating varnish before the sheets are assembled, the object of this treatment being to prevent the flow of eddy currents from one sheet to another. The coils and magnetic circuit of a modern type of transformer ready for assembling are illustrated in Fig. 68.

The efficiency of the transformer as an energy-transforming device is very high, ranging from .98 for the larger sizes to .94 for the smaller sizes. The internal losses consist of heat losses (I^2R) in the coils and hysteresis and eddy current losses in the iron core. The former vary with the load, while the latter are constant. The heat thus generated in the interior of large transformers must be carried away either by forcing a blast of cool air through ducts arranged specially for this purpose, or by immersing the transformer in a special oil, which is circulated through ducts in the interior of the winding and core, provision being made for cooling the oil by any of the ordinary methods of cooling.

Transformers are built to give voltages as high as 250,000, but 110,000 is practically the limit in commercial work at the present time.

ELECTRIFICATION OF RAILWAYS.*

The author said that, believing unreservedly that the increased capacity of a railway and its stations, the economies of operation, and other advantages would bring about gradually the systematic electrification of steam railways, his wish was that the progress of the art might not be hampered, and such electrification of our main lines delayed or rendered unprofitable, by mistakes which experience, judgment, and foresight might enable us to avoid. It was his intention to direct attention to the necessity for the very early selection of a comprehensive electrical system embracing fundamental standards of construction which must be accepted by all railway companies in order to ensure a continuance of that interchange of traffic which, through force of circumstances, had become practically universal, to the great advantage of transportation companies and of the public. Having been identified with railway operations for over 40 years and with the development of the electrical industry for 25 years, he felt that the time was ripe for such a selection unless engineers were willing to regard with complacency the extension of the existing diversified systems and the creation of conditions which would prevent the general use of the most practical methods of operation. The tendency seemed to be toward diversity rather than unity, since different types of third-rail construction had been adopted, even for the several continuous-current systems in and about New York City, which rendered interchange of cars or locomotives difficult or impossible. The great difficulty in the electrification of standard railways was no longer the engineering problem of developing a locomotive and an electrical system which would operate trains, but it was a broad question of financial and general policy of far-reaching scope, considering the future electrification of railways in general as distinguished from isolated cases of limited extent, and requiring a combination of the highest engineering and commercial skill. To ensure interchange of traffic the fundamental requirements, so far as operation by steam was concerned, with full regard for safety, speed, and comfort, were: (a) A standard gauge of track; (b) a standard or interchangeable type of coupling for vehicles; (c) a uniform interchangeable type of brake apparatus; (d) interchangeable heating apparatus; and (e) a uniform system of train signals. The additional fundamental requirements for electrically operated railways were: (f) A supply of electricity of uniform quality as to voltage and periodicity; (g) conductors to convey this electricity so uniformly located with reference to the rails that, without change of any kind, an electrically fitted locomotive or car of any company could collect its supply of current when upon the lines of other companies; (h) uniform apparatus for control of electric supply whereby two or more electrically fitted locomotives or cars from different lines could be operated together from one locomotive or car. Apart from economy in capital expenditure and economy and convenience in operation by steam or electricity, it did not matter whether each locomotive and car and the apparatus upon them differed from every other locomotive and car in size or details of construction, so long as the constructions were operative and the materials employed were used within safe limits.

*Abbreviated from an address before the joint meeting of American and British Mechanical Engineers.

Three important electrical systems for the operation of railways had been put into practical operation, all using alternating current in whole or in part. These were: (a) The continuous or direct current system, usually spoken of as the "third-rail" system, which employed alternating current for transmitting power when the distance was considerable; (b) the three-phase alternating-current system with two overhead trolley wires; and (c) the single-phase, alternating-current, high-tension system with a single overhead trolley wire. The equipment of the power houses which generated the current was essentially similar in the three systems, but the systems differed in the kind of motors and the auxiliary apparatus for controlling them, and in the methods and apparatus for transmitting the current from the power house to the locomotive or car. Locomotives equipped with each of the three types of motors had been in successful operation and had demonstrated their usefulness, capacity, and reliability in practical railway service. The three-phase motor, having a definite constant-speed characteristic, was particularly adapted to certain conditions; but, on the other hand, it had a less general adaptability to the ordinary varying conditions of railway operation. The single-phase motor had a facility of voltage control which gave an efficient means of speed adjustment, and was in this particular superior to other systems. The controlling factor in the cost of electrification in nearly all cases was the system for transmitting power from the power house to the locomotive, and not the locomotive itself. The choice between the several systems must, therefore, be based upon a comparison of the complete systems. It was not his purpose, the author said, to urge the adoption of a particular system, but rather to point out some of the well-known characteristics of these systems which had a bearing upon their limitations and their general adaptability to railway conditions, and to urge the great gain which would result from a single universal system. In selecting a proper electrical system for railway operation it would probably be generally conceded that the following elements were of prime importance: (a) The electric locomotives should be capable of performing the same kinds of service which the steam locomotives now perform. This would be most readily secured by electric locomotives which could practically duplicate the steam locomotives in speed and power characteristics. This included a wide range of performance, embracing through passenger service at different schedule speeds; local passenger service; through freight service in heavy trains; the handling of local freight by short trains; and a variety of switching, terminal, and transfer movements. This naturally called for wide variation in tractive effort and in speed, both for the operation of different kinds of trains and also for the operation of the same train under the varying conditions usually incident to railway service. (b) The electric locomotive should be capable of exceeding the steam locomotive in its power capacity. It should be able to handle heavier trains and loads, to operate at higher speeds, and, in general, to exceed the ordinary limits of the steam locomotive in these regards. The readiness with which several electric locomotives could be operated as a single unit enabled any amount of power to be applied to a train. (c) The electric system should adapt itself to requirements beyond the ordinary limitations of the steam locomotive in small as well as large things. It should be adapted for use on branch lines, and for light passenger and freight service similar to that so profitably conducted by inter-urban electric roads, which in many cases ran parallel to steam roads, not only taking away the traffic of the steam roads, but building up a new and highly profitable traffic, both in passenger and in express service. (d) A universal electrical system required that power should be transmitted economically over long distances and supplied to the contact conductor. The system should utilize the most highly perfected apparatus for the electric transmission of energy and its transformation into suitable pressures for use. (e) The contact conductor in an ideal system should be economical to construct, both for the heaviest locomotives where the traffic was dense, and for light service on branch lines. It should impose minimum inconvenience to track maintenance, should give minimum probability of disarrangement in case of derailment or in case of snow and sleet, and should in general be so placed and constructed as to give a maximum assurance of continuity of service.

The use now made of electricity in steam railway service had been brought about, generally speaking, through compulsion. The steam locomotive had reached its limitations and had been found unsuitable and inadequate in tunnels or in terminal service. Even where other considerations might have been controlling, the problem had usually been a specific one of electrifying a relatively small area. The problem had been solved by considering those factors which were of immediate importance, without giving weight to uniformity with other systems or of extension. Now the natural course of development would be the extension of these limited zones, until after a time they met. Then there would arise great inconvenience and expense if the systems were unlike. For the present it might be a matter of little moment whether different systems had their contact conductors in the same position, or whether the character of the current used was the same or different. In the early days of railroading it was of little consequence whether the tracks of the different systems in various parts of the country were alike or unlike, but later it did make a vital difference, and the variation resulted in financial burdens which even yet lay heavily on some railways. It was this large view into the future of electrical service which should be taken by those responsible for electric railway development. The complete electrification of a railway would necessitate a rearrangement of ideas and practices in regard to operations. Coaling and watering places would not be needed; passenger trains would be differently composed, some classes being of less weight; and they would operate more frequently, thus promoting travel; other trains would be heavier than at present, or would operate at higher speeds; and branch lines, by the use of electrically fitted cars, could be given a through service not now enjoyed. The movement of freight would undergo great changes, due to the fact that electric locomotives could be constructed with great excess capacity, enabling them to move longer trains at schedule speed on rising gradients. The large percentage of shunting operations due entirely to the use of steam locomotives would no longer be required. The railway companies could combine upon some co-operative plan for the generation of electricity, thereby effecting large savings in capital expenditures, and could utilize their own rights of way for the transmission of the current, not only for the operation of trains, but for many other useful purposes. Notwithstanding the fact that great strides had already been made in cheapening the cost of generating electricity by steam engines, he foresaw from the progress made in the development of gas and oil engine power a still further reduction in cost which would accelerate the work of electrifying existing railways. One important aspect of this great question would engage the thoughtful consideration of every government—namely, the military necessity for uniform railway equipment in time of war. There would be serious difficulties to surmount in the selection of a general system. There naturally would be arguments in favor of one or another of the systems now in use, and the inclination of those who had adopted a particular system to advocate its general use. There would be enthusiastic inventors, and there would be many advocates of the common view—namely, that there was room for several systems and that each system would best meet the requirements of a particular case. There would be those who gave undue weight to some feature of minor importance, such as a particular type of motor or of locomotive, instead of giving a broad consideration to the whole system, and recognizing that in the general problem of railway electrification facility and economy in transmitting power from the power house to the locomotive were of controlling importance. Were there now only one system to be considered there would be a concentration of the energy of thousands on the perfecting and simplifying of the apparatus for that system, to the advantage of railway companies and of manufacturers. In conclusion he could only repeat, and earnestly recommend to the serious consideration of railway engineers and those in authority, the pressing need of determining the system which admitted of the largest extension of railway electrification and of a prompt selection of those standards of electrification which would render possible a complete interchange of traffic in order to save expense in the future and to avoid difficulties and delays certain to arise unless some common understanding was arrived at very shortly.

EXPLOSIVES.*

By F. H. Gunsolus, Manager, Technical Division. E. I. du Pont de Nemours Powder Co., Wilmington, Del.

This subject of Explosives is one in which we are all rightly and justly interested and one which the majority of consumers are to-day studying as hard and thoroughly as the manufacturer, both from a humanitarian and economic standpoint; or first, to produce the safest for use, at the same time protecting the lives of the users, and second, to supply the best at minimum cost. The consumer is making it a study with the idea of determining what kind of explosive and which explosive is better adapted for the work in hand. The manufacturer studies the subject with the idea of supplying that explosive which will fill the various conditions and demands not only for the present time but also future demands.

From the time of the invention of gunpowder, or approximately in 1250, the study of explosives has been the problem for generations. With the new kinds of High Explosives, "Permissible" Explosives, Sporting Powders and Detonating Agents, the problem is one of greater moment and continues to be studied with increased care, and by a larger number of expert chemists. Perhaps a short historical retrospect will be very useful in order to fully appreciate this fact.

Gunpowder was known in a crude form by the Chinese for many centuries, but the earliest date of which there is record and which can be considered authentic in any way is 1264, when Roger Bacon made known the results of his tests. I believe, however, that the Western World only used this gunpowder for throwing projectiles. Not until 1629 was gunpowder used as a blasting agent, at which time Casper Weindl invented the use of gunpowder for blasting purposes. A demonstration was made at Schemnitz in Hungary, where it was shown conclusively that its use would materially aid in mining and quarrying operations. Until the beginning of the nineteenth century, however, no other explosive was introduced into practice with success. In 1788 Bertholet and Lovoisier tried the effect of adding potassium chlorate, and in 1861 Designolle made a powder from potassium picrate and saltpetre but without much success. In 1846 Schoenbein invented gun-cotton and in 1847 Sobero discovered nitro-glycerin. The Austrian Government, which was the only one to try gun-cotton in guns, stopped the experiment abruptly in 1867, due to their having an explosion in the magazines at Hirtenberg. Not until 1863 was nitroglycerin available for general use owing to its extreme sensitiveness and to the inconvenience of handling it in its liquid state. Alfred Nobel, the great Swedish chemist, at this time found by using infusorial earth, known as Kieselguhr, as an absorbent for the nitroglycerin, it would overcome these objections to a large extent, and in 1867 he introduced this mixture under the name of dynamite. About this time the success of dynamite was assured by the discovery of the detonating effect of fulminate of mercury in the dynamite by Brown, a chemist in the English War Office. Gelatin dynamite was next produced when Alfred Nobel discovered that nitro-cotton was easily dissolved in nitroglycerin, forming an explosive gelatinous mass which he called blasting gelatin.

Such was practically the state of affairs as concerns explosives up to the year 1886. About this time it was recognized that most explosions in coal mines were due to the ignition of fire-damp by the firing of shots, and it was also recognized that it would be possible to produce explosives which could be used in coal mines and which would considerably reduce this danger.

From 1886 the strides made in the investigations, inventions and productions of different kinds of explosives have been very rapid. In fact, all explosive manufacturers produce two or three of the following kinds of explosives: Straight Nitroglycerin Dynamites, Gelatin Dynamites, Ammonia Dynamites, "Permissible" Expolsives, Low-freezing Dynamites, Non-freezing Dynamites and Detonators of different varieties. It is left, however, to the largest manufacturers of explosives to produce all of the different kinds just mentioned.

According to the Standard Dictionary, "an explosive is any substance that may cause an explosion by its sudden combustion or decomposition." A distinction, however, should be made between explosives in general and those which are applicable to blasting purposes: a mixture of oxygen and hydrogen gases, or of fire-damp and air, or coal dust, or flour dust and air, etc., may be termed explosive, as when mixed in the proper proportion they may be exploded by a spark, flame, or by having the temperature raised by any other means.

Another very good definition of an explosive is, "Such a substance as can in an extremely short time and in a small space develop a very large amount of heat and gas exerting enormous pressure on the surrounding bodies, and is able by the expansion of highly heated gases to perform considerable work."

Some of the important qualifications of an explosive for blasting purposes are the following:

1. Sufficient stability.
2. Difficulty of detonation by mechanical shock, that is, not too sensitive.
3. Handy form.
4. Absence of injurious effect on the health of those using it.
5. Sufficient strength of action.
6. Sufficient density.
7. Comparative "flamelessness" and low heat of detonation for coal mining.

Explosives may be divided into two general classes:

1. Low explosives or direct exploding materials, such as blasting powder.
2. High explosives or indirect exploding materials, such as dynamite, gun-cotton, gelatin dynamite, ammonium nitrate, picric acid, etc.

By direct exploding materials are meant those which can be made to develop their force by direct means, such as ignition; whereas the indirect exploding materials require an intermediate agent to develop their full force, such as a blasting cap or electric fuse.

In the case of a low explosive, such as blasting powder, the force is developed by first burning some of the powder, the fire being transmitted from grain to grain, a certain amount of pressure and heat are developed, when the whole amount of powder is brought into sudden decomposition. This fact is readily shown by burning a small quantity of blasting powder unconfined, and then burning it confined, the pressure being an important factor in bringing about the explosion of blasting powder. The finer the grain of the powder the greater proportionately is the amount of burning surface, and consequently, the quicker the complete transformation of the solid into the gases.

*From the Journal of the Franklin Institute.

To the high explosive class belong all those explosives commonly known as dynamite, and which or may not have nitroglycerin as the explosive basis of the substances, such as: ordinary nitroglycerin dynamite, the ammonium-nitroglycerin compounds, gelatin dynamite, low-freezing dynamite, and the Judson powders. To this class belong as of the "permissible" explosives.

Whereas a perfect explosion of a low explosive results from burning, a perfect explosion of a high explosive is the result of the detonation of the explosive. This may be considered the result of a certain kind of shock causing the instantaneous destruction of the very delicately balanced forces which preserve the chemical and physical equilibrium of the explosive compound.

Defective blasting caps and electric fuses are often causes of imperfect explosions of high explosives. Another cause, and one of frequent occurrence, is where dynamite is loaded in the same bore-hole with blasting powder without a detonator, the blasting powder being fired by the use of a squib or safety fuse. Another cause is where the fuse is laced through the cartridges of dynamite, which is very apt to set the dynamite on fire.

Before the sale of an explosive is undertaken those who manufacture and sell explosives should make such tests as will determine the characteristics of that particular explosive. Some of these points to be determined about any explosive are:

1. Sensitiveness.
2. Comparative strength.
3. Waterproof qualities.
4. Effects of temperature on the explosive.
5. Nature of gases resulting from detonation.
6. Velocity of detonation—that is quickness.
7. Height and duration of flame.
8. Temperature of detonation.
9. Heat of detonation.

There are many tests which have been devised and have been and are used to determine these various characteristics of explosives as far as is possible before the explosive is taken into actual work in a quarry or mine. Only those in the explosive business seem to fully realize the difficulties in the way of a proper comparison of the value of two or more explosives. All of the points which I have just mentioned have their material effect on the value of an explosive, and much can be. and is learned by study of an explosive at the laboratory, but the actual use of an explosive in practical work is necessary before a definite knowledge of the explosive can be obtained.

In this connection there is a point to which I wish to call your particular attention, and that is to the fact that the strength of a high explosive does not entirely depend upon the percentage of nitroglycerin in the explosive. Suppose you were making a test of two explosives, each containing the same percentage of nitroglycerin. One of these explosives may be found to be very much stronger than the other, depending entirely on the other components of the explosive. This method of grading explosives by the percentage of nitroglycerin contents is still in general use and is very unfortunate both for the consumer and the reliable manufacturer of explosives. The consumer desires an explosive having the proper strength and action to do the work he has to do, without regard of the percentage of nitroglycerin in the explosive.

In the manufacture of explosives very careful attention is given to the method of manufacture. The purity of the raw materials, the intimate mixing of the ingredients, cartridge-making and packing are all essential points to be thoroughly studied in order to produce the best explosives.

Since 1886, in England and on the continent of Europe a study has been and is being made to-day of explosives suitable for use in gaseous and dusty coal mines. As a result of these investigations many explosives are manufactured for this class of work more suitable and which can be used with more comparative safety than blasting powder or dynamite. In the United States this is a newer problem, and yet according to Explosive Circular No. 3, issued by the United States Geological Survey of the Department of the Interior, on May 16, 1910, there are manufactured forty-five "permissible" explosives suitable for use in gaseous or dusty coal mines.

Where large quantities of fire-damp are found, it is extremely dangerous to use either blasting powder or ordinary dynamite for this reason. Blasting powder produces a very long flame of considerable duration and ordinary dynamite produces a very hot flame when exploded. Because of this and the explosive character of a mixture of fire-damp and air, or coal dust and air, or of all three of these occurring in coal mines, demands are made for the development of explosives which are not liable in their use to cause an explosion of any of these mixtures.

From laboratory tests it has been determined that certain gaseous mixtures require certain temperatures to ignite them. It has been found with considerable accuracy that fire-damp mixtures ignite at a temperature in the neighborhood of 650 degrees C., 1202 degrees F. It is also necessary to heat the fire-damp mixtures up to the ignition point during a certain length of time. Consequently, the explosion of fire-damp depends on at least two factors, namely, time and temperature.

To determine the relative safety of explosives, the United States, as well as other countries, have established experimental stations. The apparatus used consists of an artificially constructed tunnel or gallery which can be filled with fire-damp and air, or other explosive gas or coal-dust mixture, and into which various sized charges of explosives can be fired from a mortar with or without tamping. The first fact established was that no explosive is absolutely safe, as all will ignite fire-damp when the charge per bore hole is sufficiently large, which is true even where the explosion temperature of an explosive is below 2000 degrees C., or 3632 degrees F.

Thus far we have dwelt only on the temperature of detonation of explosives, but after careful study of this subject it has been found that other factors in connection with the charge must be considered. These are the rate or velocity of detonation, the length and duration of the flame, the heat of detonation or the quantity of heat produced, the "after flame" ratio, or the relation between the rate of detonation and the duration of the flame, etc. All of these qualities have their effect on the safety of explosives in fire-damp, it having been shown that the lower they are, the safer the explosives. However, no limit can be placed on any of them, as excess in any other may counter-balance it. This point has been proven in the case of blasting powder, which possesses all the necessary qualities for a safe explosive except the duration of the flame, which alone makes it very unsafe.

In looking over the field for the uses of explosives to-day, we find this list to be of much greater length than only a few years back. At one time we believed that explosives could be used only in quarries, mines of all kinds and railroad construction work. To-day we find that explosives are used in blasting stumps, boulders, tearing down buildings, breaking up hard pan and hard-sub-soil, breaking up boilers and scrap iron, digging drainage ditches, breaking up log jams and ice jams, planting orchards and many other classes of work.

The E. I. du Pont de Nemours Powder Company, of Wilmington, Delaware, are considered the largest manufacturers of explosives in the United States. They manufacture all the different kinds of explosives for use in different kinds of work and have the largest force of expert chemists to carefully and thoroughly study the manufacture of explosives. They also maintain a technical division, having a large field force to assist, wherever requested, in the better use of explosives in actual work.

All of the dynamites mentioned in this article are packed in cartridge form, the standard size of cartridges ranging from ⅞ inch x 8 inch to 2 inch x 18 inch, depending, of course, upon the kinds of explosives packed. As a general rule, they are packed in two sized cases, viz., 25-lb. cases and 50-lb. cases. The cases are made of one-half inch lumber, lined with paper and a small amount of sawdust sprinkled in the bottom of each case according to regulations established by the bureau for the safe transportation of explosives.

Nearly all kinds of dynamite freeze at temperatures between 45 degrees F. and 50 degrees F. and they should be thoroughly thawed before using in order to obtain the full explosive effect. The low-freezing explosives, however, do not freeze much above the freezing temperature of water, yet these explosives should be thoroughly thawed when the temperature reaches the freezing point. The non-freezing explosives are, as their name suggests, truly non-freezing. As a general rule the "permissible" explosives used in the United States should be thawed before using if the temperature is below 50 degrees F.

The thawing of dynamite is the cause of much loss of life, generally due to the fact that it is not given proper attention, as many of the methods used are very crude. Too great care cannot be taken in the thawing of explosives, and it would be well for consumers of explosives to consult very freely with manufacturers on this important question.

In detonating dynamite, two methods are generally used; one by means of electricity and the other by use of safety fuse and blasting caps. Of these two methods the one most strongly recommended by explosive manufacturers for nearly all kinds of blasting is that by electricity, as it is the most effective, economical and safe system that can be used. This is especially true in coal mines, as when using safety fuse and blasting caps, the gas is apt to be ignited while lighting the fuse or by the spitting out of the fuse, while there is no danger in this respect when electricity is used.

Another very vital point to be considered in the use of explosives is the tamping material and the method of tamping the charge in the bore-holes. The best material to use is damp clay, for the reasons that it contains no gritty matter which will damage the fuse or electric fuse wires in tamping, and also it will pack well in the bore-hole and thus leave no air spaces. No inflammable material should ever be used. In tamping the explosive should be well confined to obtain its maximum efficiency, and to insure the maximum resistance against the pressure of the gases of explosion.

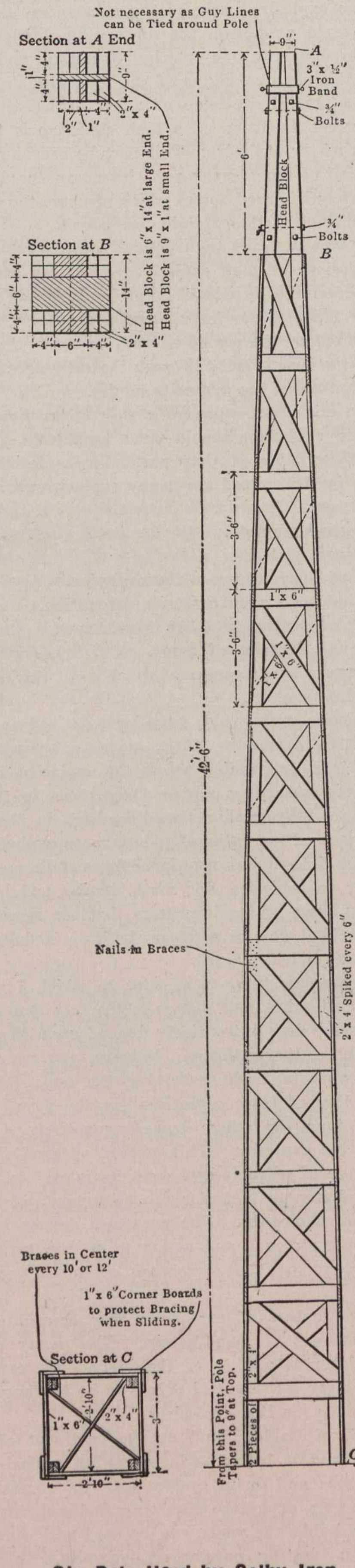
Since 1886 as important results have been obtained in the manufacture, handling, storage and use of explosives as in the whole of the previous years. This is no doubt due to the enormous amount of scientific research and experiment devoted by manufacturers to the study of such questions and also demands made on manufacturers for different kinds of explosives. To-day every up-to-date manufacturer recognizes that only by the best scientific knowledge can he effect improvement to keep in line with modern developments of the industry.

A BUILT-UP GIN POLE.

By W. B. Rosenberger.*

The accompanying illustration shows a light, strong and easily constructed gin pole. The pole is 42 ft. 6 in. long, and has been used by the Colby Iron Mining Company over two years. Its principal use is in raising smokestacks, the largest on which this pole was used being 60 in. in diameter and 85 ft. high. The pole being a framed structure is easy to climb in case it is necessary for a man to go to the top to adjust pulleys.

* Mining engineer, in the Engineering and Mining Journal, Colby Iron Mining Company, Bessemer, Mich.



Gin Pole Used by Colby Iron Company.

ELECTRIC POWER IN THE CONSTRUCTION OF THE LOS ANGELES AQUEDUCT.*

By E. F. Scattergood.

The Los Angeles aqueduct extends from the intake in Owens Valley, about twelve miles north of the town of Independence, to the storage reservoirs at the head of the San Fernando Valley, about 24 miles distant from the city of Los Angeles, from which point the city water department will take care of the distribution of the water. The length of the aqueduct proper is, therefore, 240 miles.

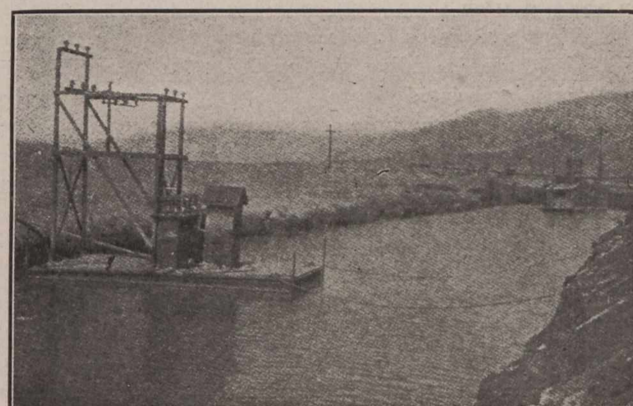
From the southern end north to the north portal of the Elizabeth Lake Tunnel, a distance of thirty-five miles, the work is heavy, being to a considerable extent composed of tunnels, including the Elizabeth Lake Tunnel, some 27,000 feet in length, through granite rock. Preliminary estimates showed that in such sections the considerable amount of power required could be furnished much more cheaply from a central generating plant and distributed by high tension transmission than by small power generating units, either by steam or distillate engines at various points as required. This section is supplied with power purchased from the Southern California Edison Company, and delivered at one of its substations about four miles west of the aqueduct line and near the centre of this section. From the Elizabeth Lake Tunnel to a point fifty-five miles further north the aqueduct follows along the desert in the open, and estimates indicated that the conduit excavation and concrete work of lining and cover could be done more cheaply with the use of steam shovels and gas engines than by the erection of a temporary electrical generating and distributing system. From the Pinto Hills north to the intake, a distance of 150 miles, there are alternate sections of the heavy tunnel work and of the lighter conduit work. In the Owens Valley there are numerous creeks flowing down the eastern slope of the Sierra Nevada Mountains offering excellent opportunities for power in sufficient quantities for construction work on the aqueduct; and estimates showed clearly that power could be developed at these creeks and transmitted along this 150 miles, and delivered to all points requiring power, in large or small amounts, at a very much lower cost than that for which it could be furnished in any other way.

It should be stated for the benefit of those who are not so familiar with the city's project, and who may read this paper, that the power referred to here is for construction purposes only, and should not be confused in any way with the large amount of electric power which may be developed along the line of the aqueduct when it is in operation, and which will total a peak load capacity of 120,000 horse-power delivered at step-down voltage in the city.

Power System.

For the purpose of supplying power along the section of the aqueduct from the intake to the Pinto Hills, hydro-electric plants were installed on Division and Cottonwood Creeks. The Division Creek plant is about three miles south from the aqueduct intake, and has a rated capacity of 600 kw. The works at the point of diversion at the creek cost $1,214. The penstock starting from this point, and extending down the slope 10,500 feet, consists of 6,291 feet of 18-inch riveted pipe and 4,209 feet of 15-inch lap-welded pipe, and cost, in place, $28,102. The effective head obtained is approximately 1,200 feet. The power-house equipment consists of one tangential wheel direct connected to a 2,200-volt, three-phase, 600-revolutions per minute generator, and a bank of transformers, stepping the voltage up to 33,000, each of which has a continuous overload capacity of 25 per cent. above the 600-kw. rating. The power-house is built of concrete in a substantial manner. This is also true of the second one to be described, as these plants are intended to become a part of the permanent aqueduct power system. The cost of the power-house and equipment, including three cottages, etc., is $21,100, making a total cost of approximately $84.50 per kw., or $63 per h.p. rated capacity at the switchboard.

The Cottonwood power-house is approximately 40 miles south from the Division Creek plant. Its equipment consists of two tangential wheels, operated under 1,200 feet effective head, each direct connected to a 750-kw. three-phase, 2,200-volt, 600-revolutions per minute, generator, each of which in turn is connected to the 33,000-volt line through a separate bank of transformers. The works at the diversion point cost $3,964. The canyon for a distance of 3,750 feet is so precipitous as to make a conduit or tunnel impracticable within reasonable cost, therefore, a 24-inch, No. 12 gauge, riveted pipe was buried along the side of the canyon, at a cost of $9,352. From this point to the forebay, a distance of 7,042 feet, covered concrete conduit, 30-inch by 20-inch, inside section, was constructed on the mountain side at a cost of $11,228. The penstock, with 523 feet of 24-inch pipe and 4,009 feet of 22-inch pipe, or a total of 4,532 feet, cost $29,820. The power-house and camp complete cost $49,638, making a total of $69.40 per kw., or $51.75 per h.p. of rated capacity at the switchboard, the plant having 25 per cent. overload capacity.



Floating transformer station used in connection with suction dredge; Owens Valley.

The transmission line is 151 miles long, and is made up of three No. 4 bare copper wires; two-part seven-inch porcelain insulators with iron thimbles, pins and bases; one wire on a 15-inch crossarm at the top of a 30-foot pole, and two on a 6-foot crossarm below, and poles spaced 180 feet apart. The average cost of this line is $862.50 per mile. About one-fifth of this line is through rough mountainous country, and the wagon haul for the entire line an average of 12 to 15 miles. This line has since been extended from its southern end to the aqueduct cement plant, a distance of 17 miles, with No. 2 copper, at a cost of $1,050 per mile. The object of this extension is to deliver surplus power to the cement plant, with the advantage of supplementing the steam plant, thus saving fuel oil and making the entire system more flexible and reliable by running in parallel with two

*A paper presented before the Los Angeles Section of the American Institute of Electrical Engineers, March 22nd, 1910.

750-kw. steam turbines at that point. Had the cement plant been contemplated originally, more copper might have been used along the whole line, and more generating capacity installed to advantage. As an interesting illustration of the value of synchronous condensers in connection with transmission of electric power, it may be stated that while delivering a distributed load of 1,000-kw. between the intake and the Pinto hills, 400 to 420-kw. could be delivered at the cement plant, 125 miles from Cottonwood at 30,000 volts with 35,000 volts at Cottonwood when not in parallel with the steam turbines; and that 800-kw. can be delivered at the cement plant when running in parallel, by strengthening the field of the turbo-generators, with the same voltage drop and the same distributed load along the line.

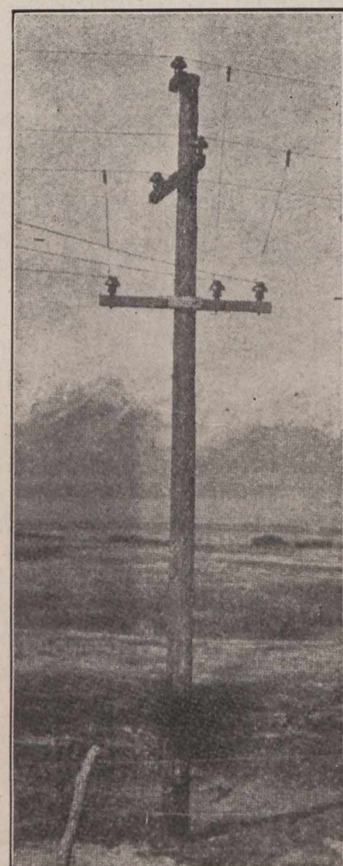
There are about 74 step-down transformers connected to this line in banks of two or three; most of these transformers are of 40-kw. capacity, the remainder are either 20-kw. or 80-kw. The greater number are of the out-door type, which have given excellent satisfaction, and are very much liked by the men in charge of work, because of the decreased expense and time of setting them up. Most of them have been shipped from the factory with the oil in them, as they are in boiler iron cases, made suitable for moving with the oil in place, thus avoiding the necessity for drying out of transformers at isolated places. The protection of this high-tension line against lightning and surge voltages is a combination of low-equivalent arresters at the Cottonwood power-house, and three sets of horn-gap arresters at other important places. The transformer stations are protected by air-insulated choke coils and fused horn-gap switches. The comparatively small insulators for the voltage used, while they have given no trouble whatever, do undoubtedly serve to give additional protection to apparatus along the line by affording relief from any excessive potential. No apparatus has been lost from lightning or surges during the eighteen months of its operation.

By including interest, placing a proper depreciation on the permanent power plant, and assuming a low value of return from the copper on the temporary line, and on the transformers constituting the substations, (the system to be in use but four years), it was estimated that the cost per kilowatt hour delivered at a step-down voltage, in large and small quantities as desired, would be approximately 1.15 cents. The indications are that this estimate will prove to have been conservative.

Uses of Electric Power.

Stating as briefly as possible the uses to which this power is put; there are in Owens valley about 20 miles of the aqueduct which can conveniently be built with dredges. Four electric shovels are in use for conduit excavation in the open country. One mill for regrinding tufa with the cement is located at Haiwee, 22 miles south of Cottonwood. Electric power is used at Haiwee, also for sluicing and other work connected with the building of the earthen dam. There are approximately 18 miles of rock tunnels and three miles of earth tunnels provided for by this power system. The typical tunnel equipment consists of one air compressor, driven by a 100-h.p., 440-volt, three-phase induction motor; one 80-kw. motor-generator set, providing 250-volt direct current for electric locomotives; lighting and other work inside the tunnels; other power for blowers, machine shop, hoists, pumping, etc., as the case may be, and for lighting camp. In case electric locomotives are not used, as in shorter tunnels, alternating current at 110 volts is used for lighting in the tunnels also.

Dredges.—There are two suction dredges in operation in Owens valley, each equipped with a 12-inch centrifugal pump, driven by a 100-h.p., 440-volt induction motor; one 40-h.p. motor to run the cutter, one 40-h.p. motor to run the jetting pump for breaking down the bank over the cutter, and one 20-h.p. motor for operating various hoists. There is also one dipper dredge of one and one-half yards' capacity of the friction type, driven by one 100-h.p. induction motor. The step-down transformers in each case are mounted on a float, with the rack overhead supporting the choke coils and switch on which the taps from the transmission line land. The line being close by requires but one short span, and a crossarm is placed on the round cedar pole by clamping it with two bolts and a short piece on the back, as shown in the illustration, then pushing up at a safe distance from the lower arm. Connection is made with the line through long spiral springs of tempered brass and a brass clip at the end. These are put in place by means of a long pole from an insulating

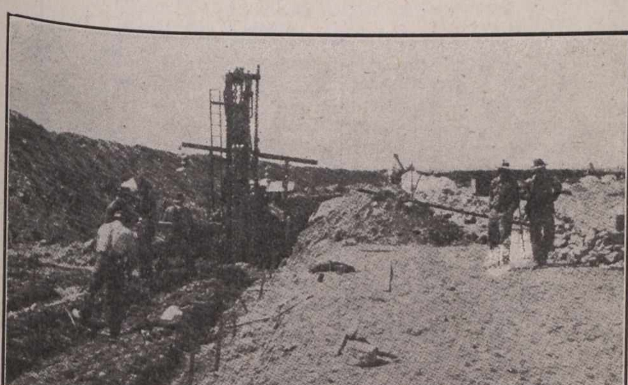


Method of connecting portable substation to 33,000-volt transmission line.

stand, or by climbing a short distance up the power poles, with the line switches at the transformer open, and the transmission line hot, which necessity requires, and which cannot result in personal harm when done by an experienced lineman, as is the case. The connection from the transformer float to the dredge is made by means of a three-conductor submarine armored cable. The cable is stored on a reel on a second float attached behind the dredge, with flexible connections to the dredge, so that the cable is automatically paid out, and when all out the flexible connections are detached and the cable wound up, then the reel float and the transformer float are towed up to the dredge together. This method has proved very satisfactory in avoiding abuse to the cable and in saving time and expense in moving.

Electric Shovels.—Electric shovels with three-quarter yard buckets, and 25-ft. booms, used for conduit excavation, are of the friction type, driven by one 75-h.p., 2,200-volt induction motor. The step-down transformers are mounted permanently on sleds or trucks, with the racks supporting the choke coils and switches permanently fixed overhead, and with two 10-kw., 2,200- to 440-volt transformers attached, supplying power for concrete mixers operated in connection with each shovel. The cable used is three conductor No. 10 with rubber insulation, rounded out with jute, taped with weather-proof braid and half round steel armor over all. This connects between the transformers and the shovel, and between the temporary 440-volt-line on the power poles (about 1,000 feet back from the transformers), and the mixers, and is giving excellent satisfaction. The considerable advantage experienced with the use of out-door type transformers in connection with dredges and shovels is very evident.

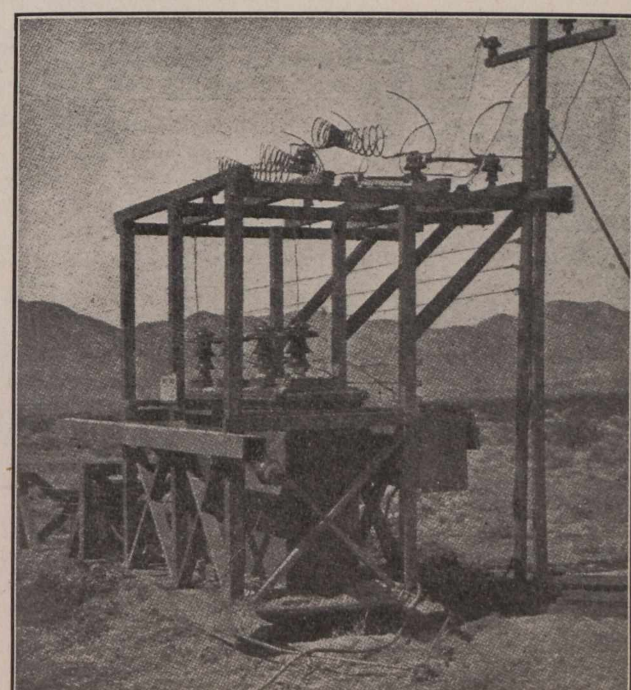
Electric Locomotives.—Twelve three-ton electric locomotives rated at 1,200 lbs. draw-bar pull at six miles per hour, are in use in this section of the aqueduct. At each end of the Elizabeth tunnel, which is not supplied from this power system, there is one locomotive of this size and one six-ton locomotive. In that tunnel, which is approximately 90 square feet in section when lined, the larger locomotive is



Electric shovel on open conduit; Mojave Valley.

preferred, making it possible to pull out 14 to 16 cars of muck at one time. The three-ton locomotives are of good size for the tunnels in the section under consideration, which are approximately 70 square feet in finished section, and range from 2,000 to 10,000 feet in length where locomotives are used. The use of electric locomotives in these tunnels results in a reduction in cost of excavation and placing the concrete lining, which is a considerable percentage of their total cost. The actual cost of removing muck and delivering concrete is considerably less than it would be if done in other ways, especially by mules; but the greater reduction in cost is due to the practical condition of being able to get the muck away for the convenience and economic working of the miners in excavation, and allowing the placing of rock crushers and concrete mixers at a convenient point outside of the tunnel for concrete work. Concreting is being done successfully and with perfect satisfaction to the engineers at a distance of 10,000 feet in one instance. This use of these machines makes it possible not only to reduce the cost where speed is not a consideration, but to very materially increase the speed, if desired.

Small Isolated Power.—Experience with distillate engines in connection with concrete mixers and other small power has led the men in the field to plead for electric power; for example, several steam shovels are in use in this section for conduit excavation, and it was thought at first that the expense of stepping down the voltage, moving transformers, etc., for supplying two or three motors of 7½ to 10-h.p. each would not be justifiable but the division engineers now insist that the cost of maintaining and operating distillate engines under the conditions experienced along such work is in itself greater than the cost of supplying the electric power, including the charge made against them for the energy, as well as the equipment, beyond the transformers; and they further state that the interruptions which they have experienced in concrete work with distillate engines behind a single steam shovel, as compared with what they have experienced in concrete work with electric power behind an electric shovel, has cost them anywhere from $20 to $40 a day after the engines had been in use a few months and began to develop troubles under those conditions of operation; in other words, the saving is due to the consideration of reliability aside from actual



33,000-volt portable substation—outdoor type transformers.

cost of supplying power to the mixers. The cost for tunnel work is considerably reduced and the speed increased by electric lighting. The illustration herewith shows a type of home-made cluster, which is giving excellent results at the headings.

Protection Against Gases.

One of the long tunnels in another section runs through an oil district, and at times has developed considerable explosive gases. In order to protect the men against this danger, electric sparking devices have been installed, designed as shown in the illustration. They may be operated either by alternating or direct current. They are operated by direct current in this case by means of a switch outside of the tunnel, and as may be seen, are absolutely positive in their action and cannot fail if properly trimmed when the miners leave the tunnel. They have exploded gases several times, and in the form shown are usually found intact after the explosion; several of them being in use gives opportunity for further trials before entering the tunnel.

Amount of Power Required.

A good idea of the amount of power necessary to operate the equipment may be obtained by studying the following tabulation, which gives the total rated motor capacity, approximately 3,470-h.p., of the various equipment attached to this system, and the total electrical horse-power, approximately 2,000-h.p., required at the switch-board of the two power plants combined for supplying this system independent of the cement plant. The energy necessary for lighting machine shops and other small requirements is not tabulated, but is included in the power at the switchboard. In many instances power is used 24 hours each day, but in other cases during 16 or 8 hours per day; on an average about 16 hours per day. The amount stated as being required at the switchboard is taken from the heavy load periods during the day; in other words, the average peak load for that work. The average load during the 24 hours would be about 60 per per cent. of this.

Motor Installation Intake to Pinto Hills.

2 suction dredges	400-h.p.
1 dipper dredge, 1½-yard dipper	100 "
4 electric shovels, ¾-yard dippers	300 "
Tufa regrinding mill	200 "
Haiwee dam, hydraulic work	100 "
8 air compressors, 500 cubic feet each	800 "
8 motor generators, 80-kw. each	1,000 "
7 rock crushers, 10 and 20 tons per hour each	140 "
28 concrete mixers, 6 and 10 cubic feet per batch	280 "
7 blowers, 1,350 cubic feet per minute each	70 "
3 hoists	20 "
3 hoists	60 "
Total rated capacity of motors	3,470-h.p.

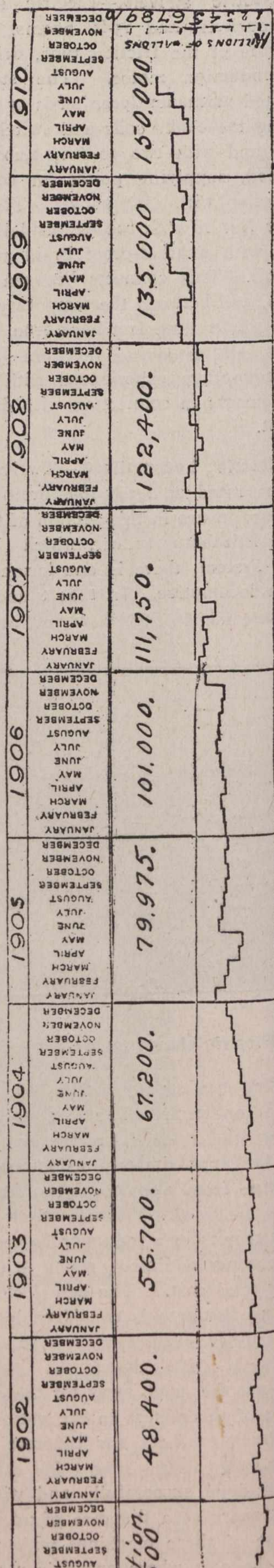
The average power used at each end of the Elizabeth tunnel already described, is 88-kw. during the 24 hours, divided, as follows: 5½-kw. for lighting outside the tunnel; 35½-kw. for operating the motor-generator which supplies power for ventilation, electric locomotives, lighting the tunnel and a small amount of pumping from the tunnel; and 47-kw. for compressed air for drilling, machine shop, camp water supply, etc. The average peak is about double the average load.

Telephone System.

The telephone system is considered not only one of the most profitable adjuncts to the aqueduct construction, but one which is essential to its economic construction at reasonable speed. It consists of approximately 260 miles of main line from the Los Angeles offices to the intake, built of two No. 10 copper wires strung on redwood poles, at a cost of $188 per mile. This line is divided in three sections by two exchanges, which more than doubles its efficiency. In addition to this there are local telephone systems in each of the various divisions along the work; some of these have as high as 26 telephones. Each local system may be temporarily connected with the main line by a switch in the division engineer's office, there being but one main line telephone on each division. As the telephone system is to be used by all classes of men, very few of them familiar with electrical work, it was thought undesirable, if not wholly impossible, to operate it successfully with the line on the power poles. Estimates showed that by making the poles on the transmission line five ft. shorter, the telephone line could be placed on separate redwood poles at an equal or slightly less cost, and this has been done. The telephone lines are in every case placed underground at crossings with high-tension electric lines.

CONSUMPTION OF WATER IN WINNIPEG.

The accompanying diagram indicates graphically the water consumption, by months, for the last nine years, in the city of Winnipeg. The population for each year is given, from which, together with the curve, the per capita consumption can be calculated. The diagram indicates that the water waste in Winnipeg is large, as the winter months show as large a consumption as the summer, with the exception of the last three years. This improvement in the last two or three years is due to the large number of meters that have been placed upon services. The citizens now, if they wish to be extravagant, must be so at their own expense.



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

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

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

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

COMING MEETINGS.

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

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

NEW ENGLAND WATER WORKS ASSOCIATION.—September 21-23. Annual meeting, Rochester, N.Y. Willard Kent, Secretary, Narragansett Pier, R.I.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.—October 11-16. Seventeenth annual convention, Erie, Pa. Prescott Folwell, Secretary, 239 W. 39th Street, New York, N.Y.

NATIONAL MUNICIPAL LEAGUE.—November 14-18. Annual meeting, Buffalo, N.Y. Clinton Rogers Woodruff, Secretary, North American Building, Philadelphia, Pa.

INTERNATIONAL MUNICIPAL CONGRESS AND EXPOSITION.—September 18-30, 1911, at Chicago, Ill. Curt. M. Treat, Secretary, 1107-8 Great Northern Building, Chicago.

NATIONAL IRRIGATION CONGRESS.—Eighteenth Annual, September 26-30, 1910, Pueblo, Colorado. Secretary, Arthur Hooker, Spokane, Wash.

TORONTO, CANADA, SEPT. 1, 1910.

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REVISED SPECIFICATIONS FOR STEEL RAILS.

At the twelfth annual meeting of the American Society for Testing Materials, held at the Hotel Traymore, Atlantic City, N.J., Committee A on Standard Specifications for Iron and Steel submitted a report, the proposed specifications of which will be referred to the members of the Society for adoption by letter ballot. The proposed specifications for Bessemer and open-hearth rails are as follows:

Bessemer Steel Rails.

1. (a) The entire process of manufacture and testing shall be in accordance with the best current practice, and special care shall be taken to conform to the following instructions:

(b) Ingots shall be kept in a vertical position in the pit heating furnaces until ready to be rolled or until the metal in the interior has time to solidify.

(c) No bled ingots shall be used.

(d) There shall be sheared from the end of the blooms formed from the top of the ingots less than x per cent, * and if, from any cause, the steel does not appear to be solid, the shearing shall continue until it does.

2. Rails of the various weights per yard speciefid below shall conform to the following limits in chemical composition:

	50 to 60 lbs.	61 to 70 lbs.	71 to 80 lbs.	81 to 90 lbs.	91 to 100 lbs.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Carbon	0.35-0.45	0.35-0.45	0.40-0.50	0.43-0.53	0.45-0.55
Phosphorus, not over	0.10	0.10	0.10	0.10	0.10
Silicon, not over	0.20	0.20	0.20	0.20	0.20
Manganese	0.70-1.00	0.70-1.00	0.75-1.05	0.80-1.10	0.84-1.14

3. The number of passes and speed of train shall be so regulated that on leaving the rolls at the final pass, the temperature of rails of sections 75 lbs. per yard and heavier will not exceed that which requires a shrinkage allowance at the hot saws of 6 7-16 ins. for a 33-ft. 75-lb. rail, with an increase of 1-16 in. for each increase of 5 lbs. in the weight of the section.

No artificial means of cooling the steel shall be used after the rails leave the rolls, nor shall they be held before sawing for the purpose of reducing their temperature.

4. One drop test may be made on a piece of rail not less than 4 ft. and not more than 6 ft. long, selected from each blow of steel.

The rails shall be placed head upward on the supports and the various sections shall be subjected to the following impact tests under a free falling weight:

Weights of rail per yard.	Height of drop in feet.
50 to 60 lbs.	15
61 to 70 lbs.	16
71 to 80 lbs.	16
81 to 90 lbs.	17
91 to 100 lbs.	18

If any rail breaks when subjected to the drop test, two additional tests will be made of other rails from the same blow of steel, and if either of these latter tests fail, all the rails of the blow which they represent will be rejected; but if both of these additional test pieces meet the requirements all the rails of the blow which they represent will be accepted.

*The percentage of minimum discard in any case to be subject to agreement, and it should be recognized that the higher this percentage the greater will be the cost.

The drop-testing machine shall have a tup of 2,000 lbs. weight, the striking face of which shall have a radius of not more than 5 ins., and the test rail shall be placed head upward on solid supports 3 ft. apart. The anvil block shall weigh at least 20,000 lbs., and the supports shall be part of, or firmly secured to the anvil. The report of the drop test shall state the atmospheric temperature at the time the test was made. The temperature of the test pieces, when tested, shall be not less than 60 degrees Fahr. or greater than 120 degrees Fahr. The testing shall proceed concurrently with the operation of the mill.

5. Unless otherwise specified, the section of rail shall be the American standard, recommended by the American Society of Civil Engineers, and shall conform, as accurately as possible, to the templet furnished by the railroad company, consistent with paragraph 6, relative to specified weight. A variation in height of 1-64 in. less, or 1-32 in. greater than the specified height, and 1-16 in. in width will be permitted.

6. The weight of the rails will be maintained as nearly as possible, after complying with paragraph 5, to that specified in the contract. A variation of one-half of 1 per cent. for an entire order will be allowed. Rails shall be accepted and paid for according to actual weights.

7. The standard length of rails shall be 30 or 33 ft. Ten per cent. of the entire order will be accepted in shorter lengths, varying by even feet down to 24 ft. A variation of ¼-in. in length from that specified will be allowed.

Both ends of all short-length No. 1 rails shall be painted green.

8. Circular holes for splice bolts shall be drilled in accordance with the specifications of the purchaser. The holes shall accurately conform to the drawing and dimensions furnished, and must be free from burrs.

9. Care must be taken in hot-straightening the rails, and it must result in their being left in such a condition that they shall not vary throughout their entire length more than 5 ins. from a straight line in any direction when delivered to the cold-straightening presses. Those which vary beyond that amount, or have short kinks, shall be classed as second quality rails and be so stamped. The distance between supports of rails in the gagging press shall not be less than 42 ins. Rails shall be straight in line and surface when finished—the straightening being done while cold—smooth on head, sawed square at ends, variations to be not more than 1-32 in., and, prior to shipment, shall have the burr occasioned by the saw cutting removed and the ends made clean. No. 1 rails shall be free from injurious defects and flaws of all kinds.

10. The name of the maker, the weight of the rail, and the month and year of manufacture shall be rolled in raised letters on the side of the web, and the number of the heat shall be so stamped on each rail as not to be covered by the splice bars. For rails weighing 70 lbs. per yard or over, a letter shall be stamped on the side of the web to indicate the portion of the ingot from which the rail was rolled.

11. No. 2 rails will be accepted to at least 5 per cent. of the whole order. Rails that possess any injurious defects, or which for any other cause are not suitable for first quality, or No. 1 rails, shall be considered as No. 2 rails; provided, however, that rails which contain any physical defects which

Continued on page 281.

CONSTRUCTION NEWS SECTION

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

TENDERS PENDING.

In addition to those in this issue.

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

Place of Work.	Tenders Close.	Issue of.	Page.
Athabasca, Que., public buildings	Sept. 7.	Aug. 25.	243
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Spanish Ship Bay, N.S., wharf	Sept. 6.	Aug. 18.	211
Toronto, Ont., steel viaduct	Sept. 6.	July 28.	53
Toronto, Ont., track construction	Sept. 6.	Aug. 11.	53
Wiarton, Ont., breakwater	Sept. 12.	Aug. 18.	211
Winnipeg, Man., piping and wiring	Sept. 14.	Aug. 25.	243

TENDERS.

Fredericton, N.B.—Tenders are being invited by Chief Commissioner Morrissy for building Porter Millstream Mouth Bridge, in Charlotte County.

Edmundston, N.B.—Tenders will be received until Sept. 8th for the installation of a water works system. V. H. Dupont, engineer, 62 St. James St., Montreal, Que.

Montreal, Que.—Tenders will be received until Sept. 12th for electric lighting and power. L. N. Senecal, Secretary, Board of Commissioners.

Valleyfield, Que.—Tenders will be received until Sept. 7th for the construction of a reinforced concrete conduit across the Beauharnois Canal. L. Jos. Bayer, City Clerk.

Belleville, Ont.—Tenders will be received until Sept. 2nd for the construction of sewers. Jas. G. Lindsay, city engineer.

Galt, Ont.—Tenders will be received until September 10th, for the erection of a vault in the town hall. Edw. O. Fuce, town engineer.

Hamilton, Ont.—Tenders will be received until Sept. 28th for the construction of a wharf and two retaining walls. R. C. Desrochers, Secretary, Department of Public Works, Ottawa.

Haileybury, Ont.—Tenders will be received until Sept. 1st for the erection of a stone church. Moran, McPhail & Thomson, Architects.

Kingston, Ont.—Tenders will shortly be called for street paving. H. H. Craig, City Engineer.

Ottawa, Ont.—Tenders will be received until Oct. 31st for the construction of a twin screw steel lighthouse and buoy steamer for the Pacific coast. Alex Johnston, Deputy Minister of Marine and Fisheries.

Port Arthur, Ont.—Tenders will be received until Sept. 3rd for the excavating and refilling of trench for sewer and water mains. J. McTeigue, City Clerk, Corporation Offices.

Toronto, Ont.—Tenders will be received until Sept. 6th for the construction of asphalt, bitulithic, vitrified block and concrete pavements, also concrete curbs, concrete walks, and sewers. G. R. Geary, (Mayor), Chairman, Board of Control.

Waterloo, Ont.—Tenders will be received until Sept. 14th for the construction of a public building. R. C. Desrochers, Secretary, Dept. of Public Works, Ottawa.

Medicine Hat, Alta.—Time for receiving tenders for two d.c. gas engine driven, 125 K.W. alternating current units has been extended to Sept. 12th. M. A. Maxwell, Consulting Engineer.

Victoria, B.C.—Tenders have been invited by the public works department for the erection of a new school building at Erickson, to be received by or before the 7th of September; also for a charter to operate a ferry across the Skeena at Kitselas, receivable up to the 15th proximo; tenders for building a new school at Westbank, in the Okanagan, are to be received up to the 31st inst., and bids for the alterations, additions and repairs to the Rossland court house, until the 30th of September.

Winnipeg, Man.—Tenders will shortly be invited for a $20,000 open air home.

Winnipeg, Man.—Tenders will be received until Sept. 14th for rails and fastenings. P. E. Ryan, secretary. The Commissioners of the Transcontinental Railway. (Adv. in The Canadian Engineer).

Winnipeg, Man.—Tenders will be received until September 6th for all trades except heating, required in connection with the erection of the North Branch Y.M.C.A. building. J. H. G. Russell, architect, McArthur Building.

Winnipeg, Man.—Tenders will be received until September 8th, for a heating and ventilating plant, to be installed in each of the two technical schools. R. J. Smith, Secretary-Treasurer, W.P.S.B.

Winnipeg, Man.—Tenders will be received until September 7th, for supply of labor and material required in the erection of a tubercular hospital building. M. Peterson, Secretary, Board of Control.

Vancouver, B.C.—Tenders will be received until Sept. 5th for the following work:

Construction of reinforced concrete sluiceway under C. P. R. embankment.

Excavation of outlet canal, raising of Dewdney Trunk road to form secondary dyke, filling of Dewdney Road bridge across Hatzic slough, etc. C. E. Cartright, engineer, 503 Cotton building.

CONTRACTS AWARDED.

Quebec, Que.—Mr. James Ballantyne, Montreal, was awarded a contract for heating, ventilating and plumbing the Ecole Technique de Quebec, at $53,000.

Brockville, Ont.—E. R. Blackwell, C.E., for the counties of Leeds and Grenville, awarded to the Jenks-Dresser Company of Sarnia a contract for the superstructures of three highway bridges and to the Dominion Concrete Company of Kemptville, for the substructure.

Ottawa, Ont.—The civic commission has awarded the following contracts for the new conduit from the power station in Hull to the distributing station on Laurier avenue: For transformers, Canadian General Electric Company, $12,000; cable, British Insulated Cable Company, Montreal, $16,246; conduit pipe, Eadie-Douglas Company, limited, $2,704; manhole covers, J. B. Maclaren, Ottawa, 2¼ cents per pound for cast iron, and $35 per ton for rails.

Smith's Falls, Ont.—The contract for the construction of the C. P. R. subway which is to be built in the northern section of Smith's Falls, has been awarded to M. McCormack, of Sudbury, and J. H. Morin, of Montreal. Work has commenced.

Toronto, Ont.—Messrs. Barber & Young, York County, engineers, have awarded to E. C. Lewis, 16 Close avenue, a contract for filling and grading the approaches to a concrete bridge over the Humber river at 70 cents a cubic yard for filling and $1.50 a cubic yard for gravel surface.

Toronto, Ont.—John Maguire, 196 Spadina Road, has been given a contract for sewer construction in York township. The following bids were received:

	Spadina Rd.	Walmer Rd.
John Maguire	$3,172	$831
F. B. Goodman, 464 Markham St.	3,390	940
E. J. Elliott, 279 Main St.	3,229	850

Toronto, Ont.—The Board of Education approved of the awarding of the following contracts for the new Humberside Collegiate Institute:—Masonry, W. T. Joy, $21,536; carpentry, M. Hutcheson, $11,025; plastering, G. White, $2,593; roofing and tinsmithing, G. Duthie and Son, $1,294; painting, Fred J. Cox, $1,244; plumbing, Fred Armstrong Company, $1,440; heating and ventilating, Fred Armstrong Company, $8,057; heat regulators, Johnston Temperature Regulator Company, $680; total, $47,869.

Lethbridge, Alta.—Smith Bros. & Wilson received the contract for erecting the Fleetwood school. The tenders were as follows:

	Stone	Concrete blocks
Smith Bros. & Wilson	$55,050	$54,250
W. Rex Virtue	56,553	53,128
D. E. Wilson	59,000	56,000
Doyle & Thomas	61,624	58,124

Stone was the material decided upon.

The following bids were for plumbing and heating, and the contract went to the Standard Plumbing Company:

Standard Plumbing Company	$12,637
Wm. Head and Company	12,699
Western Plumbing Company	13,295
Hick-Sehl Hardware Company	13,387

Lethbridge, Alta.—W. H. Holt has secured the contract for the erection of a business block for the Bentley Company.

Saskatoon, Sask.—Harry Welch, a local contractor, was given the contract for laying water mains and sewer pipe at $1,045, or $2.90 per lineal foot.

New Westminster, B.C.—The Canadian Boving Company of Vancouver, got the contract for 1,000 feet of 13-inch and 1,200 feet of 12-inch lap welded steel pipe and 13-inch flexible joints at $7,501. McDonald & Company, New Westminster bid at $9,145.

Prince Rupert, B.C.—Contract for plank roadway was given to La Trace at $782.45, and the grading to Swanson at $3,822. The City Engineer's tender was $4,000.

Vancouver, B.C.—The following tenders are being considered: Sidewalk work, M. P. Cotton, 15 cents per foot; Tenth avenue pavement, Granville to Laurel, Warren Construction Company, $35,547; Second avenue, Pine to Trafalgar, Hassam Paving Company, $61,500; Fourth avenue, Cedar to Maple, Palmer Bros. & Henning, $21,800, M. P. Cotton, $22,255. Tenders for a definite supply of sewer pipe to be delivered within four months were received from the Dominion Glazed Cement Pipe Company and Evan, Coleman & Evans. Their respective figures were: Ten inch, 29½ and 39 cents; 12-inch, 37 and 50 cents; 14-inch, 55 and 75 cents; 16-inch, 68 and 95 cents; 18-inch, 80½ and $1.20; 20-inch, $1.14½ and $1.40; 24-inch, $1.99½ and $2.25.

Victoria, B.C.—Contract for the erection of an apartment house on the south-east corner of Vancouver and Couttes streets for the Mount Edwards' Apartment House Syndicate was awarded to D. C. Fulton. The building will cost between $60,000 and $70,000.

Albany, N.Y.—The contract for the largest piece of lock work on the barge canal system was awarded by Supt. Stevens, of the State Department of Public Works to Larkin & Sangster, of St. Catharines, Ont. Their bid was $1,149,401. Other bidders were: Smith, McCormick Co., Easton, Pa.; S. Pearson & Son, Inc., New York; MacArthur Bros'. Co., New York, and Dredging Co., Buffalo. The contract consists of replacing the five locks at Lockport with two mammoth locks. Engineers believe this contract is going to prove one of the most difficult feats of engineering along the entire canal. The largest items in the contract are as follows: 265,000 cubic yards of excavation, of which 191,000 cubic yards are rock; 61,000 cubic yards concrete and 1,714 tons of structural steel. The engineer's estimate of the cost of the work is $1,290,000. The contract is to be completed May 1, 1913.

RAILWAYS—STEAM AND ELECTRIC.

Montreal, Que.—The construction of the Canadian Northern Railway line from L'Epiphanie, Que., to Rawdon has just been completed.

Belleville, Ont.—The Sidney Township Council has been officially notified that the Railway Commission has approved of the route of the Canadian Northern Ontario Railway through that township. The line is located north of the highway from Trenton to a point east of Belleville cemetery, thence south of the highway to the city. This work will be commenced about September 1.

Toronto, Ont.—In regard to the report that the company would build a new line from Smith's Falls to Toronto, Mr. David McNicoll, first vice-president of the C.P.R., in a recent interview, said it will rest entirely on the engineers' report. It was a question of grades rather than of route, though the route may have something to do with it. But it was most important to get a level line first, and then double track it. The C.P.R. were already double tracking a portion of the line west of Smith's Falls.

Duncan, B.C.—Survey parties have been at work along the foreshore at Cowichan Bay for the Canadian Northern Railway. A proposed route is marked along the foreshore from a point not far from the present wharf for some miles.

Victoria, B.C.—Notice has been given by Barnard and Robertson that application will be made to the legislature at its next sitting for a charter for a company with authority to build and operate a railway of standard gauge from Port Simpson or Work Channel to the eastern boundary of the province—via the south-west side of Work Channel to the Skeena River; thence up the north side of the Skeena to Hazelton; thence to the junction of the Bulkley River; up the right bank of the Bulkley eight miles to the Suskewa and up that river by a low divide to the head of Babine Lake; thence to the north end of Stuart Lake; north of McLeod Lake to the Misnichinca River and up that river to Summit Lake to Pine River Pass; thence north-westerly to the head of Pine River and down the Pine to Moberly Lake; thence by the Peace River to the eastern boundary of British Columbia.

Buffalo, N.Y.—The telephone has been substituted for the telegraph in transmitting all train orders over the Cleveland division of the Nickle Plate from Bellevue to Conneaut, 132 miles, the busiest division between Buffalo and Chicago. From October to April 60 to 70 trains a day are operated, and, with the exception of the twenty-five miles between Cleveland and South Lorrain, and a short distance in New York State, it is a single track.

LIGHT, HEAT AND POWER.

Montreal, Que.—Following a decision of the Board of Control public tenders are being asked for the lighting of the city for the ensuing ten years. In order that no one company will have a monopoly tenderers may light certain parts of the city and not necessarily the whole of it. By this arrangement it is expected that a number of offers will be received. Tenders must reach the Board of Control not later than September 12th, of the present year. All parts of the city are to be lighted except those districts formerly St. Henri, St. Cunegonde, Villeray, St. Louis du Mile End, Delorimier, La Ville de Notre Dame des Neiges, (Mount Royal ward), La Ville de St. Paul, Emardville, La Ville de Notre Dame de Grace, Bordeaux, Ahuntsic, Le Village Tetroultville (now part of Longue Pointe ward), and Rosemount, which are now under contracts with a certain company for lighting.

The number of arc lamps used for public lighting purposes in all parts of the city, except the districts above specified, is at present time approximately 1,650 lamps, and

the number of incandescent lamps of various candle power, approximately 500 lamps.

Tenderers must state the source of power at their disposal, and must also give guarantee cheques that they are in a position to fulfil their contracts. If poles are to be erected they must not be unsightly, while the city reserves the right, after the expiration of five years, to supply municipal lighting. In such an event the city shall purchase the pole, lamps, etc., of companies supplying Montreal with light. What is known as the Standard Arc and Incandescent Lamps must be supplied. The lamps shall be 40 and 80 candle power respectively.

Belleville, Ont.—The Seymour Electric & Power Company are undertaking the construction of two power lines to Belleville, one from Campbellford and the other from another point on the Trent River.

Port Arthur, Ont.—No decision has been reached in connection with the gas franchise, and it is believed that the plant will not be installed this year.

Regina, Sask.—City Electrician Bull is preparing a report dealing with the question of extensions to the light and power plant. Much new equipment is needed.

Nelson, B.C.—The application of the Pacific Exploration Company for permission to erect a large electric power plant on the Pend d'Oreille River, near Waneta, has been granted and plans of the proposed huge plant with a daily capacity of 25,000 horse-power. The president of the new company is H. C. Hall of Nelson; J. W. Falls is manager. and A. Y. Lorch secretary. A considerable amount of Nelson capital is involved. The promoters of the new enterprise expect to furnish electric power to the Pend d'Oreille valley, the Sheep Creek and Ymir districts, and to the Orient, Chewela, and Metaline districts. On the other side of the international boundary the Northport smelter is expected to be another consumer of power. It is expected that the unlimited supply of power will immensely stimulate industrial and mining developments.

BY-LAWS AND FINANCE.

Berlin, Ont.—Bylaws of $8,300 to extend the sewer system and to loan $15,000 to the Baetz Bros. Furniture Company were voted on, the sewer by-law being passed.

Fort William, Ont.—A number of by-laws received their first and second readings and will go to the ratepayers at once. Most of them are to raise money for civic improvements as follows: $16,000 to improve and enlarge the central and ward four fire halls; $7,000 for cemetery purposes; $65,000 for a court house and police station, (building and site); $14,000 for extensions to the water works; $22,000 for improvements to certain streets; $12,000 for improvements to the City Hall.

New Liskeard, Ont.—The water works extension by-law was passed by the ratepayers, but the by-law to guarantee the bonds of C. B. Matthews, who proposed the erection of a flour mill, was defeated.

Owen Sound, Ont.—The by-law to raise $100,000—$50,000 for a bonus and $50,000 to be invested in the stock of a million-dollar shipbuilding establishment at this port was passed, while a $20,000 loan by-law for the erection of a furniture factory was also sanctioned.

Regina, Sask.—The ratepayers will shortly vote on a $100,000 by-law for the construction of a municipal-owned street railway.

SEWAGE AND WATER

Berlin, Ont.—The $8,300 by-law for sewer extensions was passed.

Raymond, Alta.—W. I. Gray & Co., of Minneapolis, have commenced work on the installation of the Raymond water works.

Nanaimo, B.C.—The Western Fuel Company has commenced work on the construction of a water works system from which they propose drawing the entire supply of water needed in the operation of their local mines. The supply of water is to be obtained from Chase River, men already being engaged on the construction of a dam at a point in the river known as the "Canyons," about a mile below the city dams, and distant about two and a half miles from No. 1 shaft.

Penticton, B.C.—Ratepayers sanctioned a $100,000 debenture issue to cover the purchase of the Penticton Water Supply Company's irrigation system, which will supply water for both irrigation and domestic use.

MISCELLANEOUS.

New Glasgow, N.S.—The fire committee favored purchasing a new wagon to cost $2,100 and 500 feet of new hose at $1.15

Montreal, Que.—The Board of Works will spend $500,000 on the construction of permanent sidewalks.

Ottawa, Ont.—Arrangements are being made by the Conservation Commission, under the supervision of Hon. Clifford Sifton, for a complete report on Canadian water-powers and causes of variation of flow in streams during the past twenty-five years.

Fort William, Ont.—Intimation was received by the City Council that the Canadian Pacific intends to start at once the erection of a modern stock yard here, to cost not less than $35,000.

London, Ont.—Mayor Beattie wants the city to buy an asphalt plant to cost about $14,000.

Welland, Ont.—The Chemical Works, composed of the Chemical Laboratories, Ltd., of Toronto, and an American Company, will establish a $100,000 plant here, according to a recent report.

Ottawa, Ont.—The British shipbuilding firms seeking permission to tender for the construction of the new Canadian navy are Harland & Wolff, Swan & Hunter, and Vickers' Sons & Maxim. The Canadian firms which have asked for the privilege of looking over the British Admiralty plans are the Polson Iron Works, Toronto; the British Columbia Marine Works, Victoria, and the Collingwood Shipbuilding Company. When the Admiralty plans are in readiness, it is announced that the agents of the companies interested or desiring to tender will be allowed to examine the plans as proposed before putting in their tenders.

Vancouver, B.C.—On September 1st operations will be commenced at the southwest corner of Seymour and Hastings streets for the new eight storey building of the Bank of Ottawa. The plans for this structure, which is to cost in the neighborhood of a quarter of a million dollars, have just been completed by Architect W. Marbury Somerville, 43 Exchange Building. The work will be finished by the end of May, 1911.

CURRENT NEWS.

Toronto, Ont.—The total production of all kinds of pig iron in Canada in the first half of 1910 amounted to 376,271 gross tons, compared with 327,449 tons in the last half of 1909 and 349,641 tons in the first half. This is an increase of 48,822 tons compared with the last half of 1909, and of 26,630 tons compared with the first half. The production in the first half of 1910 was the greatest in any half year.

Gross tons—	1910.	1909.	1908.
First half	376,271	349,641	307,074
Second half	....	327,449	256,598
Total		677,090	563,672

The production of bessemer pig iron in the first half of 1910 amounted to 129,208 tons, against 69,906 tons in the last half of 1909, and 99,639 tons in the first half of that year. The production of basic pig iron in the first half of 1910 amounted to 165,984 tons, against 192,853 tons in the last half of 1909, and 165,112 tons in the first half. On June 30, 1909, Canada had 16 completed blast furnaces, of which 12 were in blast and four were idle.

Ottawa, Ont.—It is announced that the survey of the Saskatchewan River to report on its use as a grain-carrying waterway cannot be completed this fall. It will be continued during the winter and completed in the spring.

Ottawa, Ont.—It is expected that construction will commence next spring on the Levis and St. John drydocks. Plans have been completed at the offices here of the Dominion Dry Dock Company, and it is stated that they will be filed shortly at the Department of Public Works. when formal application will be made for a subsidy under the con-

ditions of the Act passed at the last session of Parliament. Both docks are to be of the first-class and will cost four million dollars each. The Dominion Dry Dock Company has Canadian incorporation, and connected in it are the Harland and Wolff, the Canadian Pacific, White Star-Dominion, and Allan line interests, Sir Robert Perks, and other concerns. A staff has been engaged since early in the spring in getting out the designs under the direction of engineers who have built several such structures for the British Admiralty. The plans as now completed provide for docks 1,000 feet long, 100 feet wide at the bottom and 135 at the top. The entrances will have a width of 100 feet and at high water there will be a depth of 36 feet. The capacity will be such as to accommodate ships of 80,000 tons, which is larger than any yet built, including the Olympic and Titanic, and the new Dreadnought, the Lion. The location of the Levis dock will be at Point St. Joseph, while the one at St. John will probably be in Courtenay Bay, although a couple of other sites have been looked into. It is very likely that at St. John a shipbuilding plant will also be constructed, but upon this no subsidy can be claimed from the Federal Government. The Harland and Wolff firm intends to bid on the construction of ships for the Canadian navy, and if successful will most likely construct them at St. John.

Winnipeg, Man.—The entire set of plans for the new Bank of Montreal building, which came to Winnipeg last March from New York, via Montreal, from the offices of McKim, Mead & White, New York, were seized yesterday by Customs officials, who charge that the duty has never been paid on them. Mr. J. N. Semmens, Winnipeg representative of the architects, declares that the duty and fees were paid at Montreal, but the department makes answer that they will have to prove payment. A peculiar feature of the seizure is its happening so long after the plans arrived and also while the Royal Institute of Architects are in annual session here.

PERSONAL.

Mr. C. T. Bowring has recently severed his connection with the New York office of the Westinghouse Electric Company, and has opened an office in the Temple Building, Toronto. Mr. Bowring will act as Canadian representative for well-known European electrical and hydraulic manufacturing firms.

SOCIETY NOTES.

Royal Architectural Institute Elects Officers—Next Meeting in Montreal—Two Municipal Unions Hold Conventions.

The Royal Architectural Institute of Canada wound up their annual convention held at Winnipeg last week, by electing the following officers:—President, F. S. Baker, Toronto; first vice-president, J. G. Resther, Montreal; second vice-president, Edmund Burke, Toronto; third vice-president, S. Frank Peters, Winnipeg; honorary-secretary, Alcide Chausse, Montreal; honorary treasurer, J. W. H. Watts, Ottawa; council, W. H. Archer, Vancouver; C. B. Chappelle, P.E.I.; A. F. Dunlop, Montreal; D. Ewart, Ottawa; C. E. Fairweather, St. Johns; H. E. Gates, Halifax; H. B. Gordon, Toronto; E. L. Horwood, Ottawa; J. P. Hynes, Toronto; R. P. Lemay, Quebec; C. P. Meredith, Ottawa; G. A. Monette, Montreal; Jas. A. Wise, Edmonton; Sam Hopper, Winnipeg.

The next annual meeting will be held in Montreal.

The recent seizure by the customs officials of the plans of the new Bank of Montreal was discussed briefly, but it led to a discussion on the present duty on plans. It was felt that the duty imposed at present was too low, and a motion of S. Frank Peter's, seconded by Edmund Burke, was carried unanimously, resolving that the council of the Royal Architectural Institute of Canada do all in its power to bring about further protection for Canadian architects by urging the Government to materially increase the duties on plans, blueprints, and specifications.

The entire evening was given over to the annual dinner. An excellent repast was done full justice to, after which songs, recitations, and clever speeches took up the rest of the evening. The toast list was as follows:—"The King," F. S. Baker, Montreal; "The City," H. B. Gordon, Toronto, H. E. Rogers, Winnipeg; "Sister Societies," E. L. Horwood, Ottawa, Edmund Burke, Toronto, Alcide Chausse, Montreal; "Our Guests," J. W. H. Watts, Ottawa, F. W. Drewry, W. H. Carter; "The Press," S. Frank Peters. Songs were rendered during the evening by Fred. G. Pucey, H. E. Matthews, and S. F. Chalmers.

The fifth annual convention of the Union of Saskatchewan Municipalities will be held at Saskatoon on the 21st and 22nd of September.

At the Union of Nova Scotia Municipalities, which concluded at Kentville on August 26th, the following officers were elected for 1910-11 on the recommendation of the nominating committee, the report being unanimously adopted:—President, J. A. Chisholm, Halifax; vice-president, D. A. Cameron, Sydney; secretary, Arthur Roberts, Bridgewater; treasurer, F. W. W. Doane, Halifax; executive, Finlay McDonald, Sydney; W. K. Dimock, Windsor; Mayor Hoyt, Bridgetown; W. M. Kelley, Yarmouth; A. S. McMillan, Antigonish; Angus Stewart, Sydney Mines; A. J. McDonald, Baddeck; D. J. McLeod, Amherst; A. E. McMahon, Aylesford. Auditor, W. W. Foster, Halifax.

RAILWAY EARNINGS; STOCK QUOTATIONS.

CANADIAN PACIFIC RAILWAY EARNINGS.

C.P.R. traffic returns for July, 1910: Gross earnings, $8,869,215; working expenses, $5,384,595; net profits, $3,484,620. In July, 1909, net profits were $2,479,871. The increase in net profits over the same period last year is, therefore, $1,004,749.

CANADIAN NORTHERN EARNINGS.

The report of the Canadian Northern Railway Company for the month of July compares as follows:

	1910.	1909.	1908.	1907.
Average miles	3,297	3,094	2,874	2,509
July gross	$1,225,100	$843,500	$728,500	$1,024,200
Expenses	876,900	613,900	525,600	662,300
July net	348,200	229,600	202,900	361,900

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

Road	Wk ended	1910	Previous week	1909
C. P. R.	Aug. 21	$1,897,000	$1,999,000	$1,555,000
G. T. R.	Aug. 21	872,795	868,402	857,003
C. N. R.	Aug. 21	256,500	233,600	175,100
T. & N. O.....	Aug. 21	24,756	29,418	33,839
Hal. Elec.	Aug. 21	5,160	5,419	4,760

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

Road.	Mileage.	July 1st to	1910.	1909.
C. P. R.	10,326	Aug. 21	$14,621,000	$11,772,000
G. T. R.	3,536	Aug. 21	5,647,562	6,039,449
C. N. R.	3,180	Aug. 21	1,963,400	1,397,000
T. & N. O.....	264.74	Aug. 21	176,754	206,919
Hal. Elec.	13.3	Aug. 21	57,824	34,941

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

Co.	Capital. 000's Omitted.	Price Aug. 26 1909.		Price Aug. 18 1910.		Price Aug. 25 1910.		Sales last week.
C.P.R. .	$150,000	.....	184¼	.....	.....	.....	188¼	58
Mont. St.	18,000	213½	212½	241½	241	247½	247¼	2,248
H. Elec..	1,400	.....	116	125	124¾	126	123	27
Tor. St. .	8,000	124½	123	.....	.....	.....	.....	1,338
G.T.R. ...	226,000	1st pfd., 109; 3rd pfd., 55¾; com., 26¼						

REVISED SPECIFICATIONS FOR STEEL RAILS.

(Continued from Page 274.)

impair their strength shall be rejected. The ends of all No. 2 rails shall be painted white in order to distinguish them. Rails rejected under the drop test will not be accepted as No. 2 rails.

12. The manufacturer shall furnish the inspector daily, with carbon determinations of each blow, and a complete chemical analysis every 24 hours, representing the average of the other elements contained in the steel for each day and night turn. Analyses shall be made on drillings taken from small test ingots, the drillings being taken at a distance of not less than ¼-in. beneath the surface of said test ingots. On request of the inspector the manufacturer shall furnish drillings for check analysis.

The inspector representing the purchaser shall have free entry to the works of the manufacturer at all times while his contract is being executed, and shall have all reasonable facilities afforded him by the manufacturer to satisfy him that the rails are being made in accordance with the terms of the contract. All tests and ispection shall be made at the place of manufacture prior to shipment, and shall be so conducted as not to unnecessarily interfere with the operation of the mill.

Open-hearth Steel Rails.

The specifications covering open-hearth steel rails are identical with the preceding with the following exceptions:

2. Rails of the various weights per yard specified below shall conform to the following limits in chemical composition:

	50 to 60 lbs. Per cent.
Carbon	0.46-0.59
Phosphorus, not over	0.04
Silicon, not over	0.20
Manganese	0.60-0.90

For each decrease of 0.003 per cent. in phosphorus down to 0.03 per cent. phosphorus, an increase of 0.01 per cent. carbon will be accepted.

In paragraph 10, it is provided in addition to the specifications mentioned in the Bessemer section, that "the number of the heat and the letters O. H. (to designate the grade of steel), shall be so stamped," etc.

Paragraph 12 opens with this sentence, "The manufacturer shall furnish the inspector a chemical analysis of each heat of steel covering the elements specified. Analyses shall be made," etc.

MARKET CONDITIONS.

Montreal, August 31st, 1910.

While there is more activity in the Pittsburg iron trade than was the case a week or ten days ago, an increased volume of business nearly always comes out in the fall. The railroads are no longer heavy buyers of steel, and this fact not only reacts upon the business of the steel companies, but will soon affect the reported earnings of the roads themselves. A year ago the lines were doing a big business in hauling their own freight, at good rates, and charging the cost of the transportation to the cost of the improvements under way.

An inquiry for 10,000 tons of basic pig-iron was made for last quarter delivery. It is said that the Pittsburg pig-iron market will be called upon to deliver large tonnage within the next six weeks, so that the material required in the contracts can be made at the local mills. At present the price asked for pig-iron varies from $13.75 to $14.50, but it is said the former figure can be done on acceptable business.

The bi-monthly examination of the sales sheets of the Republic Iron & Steel Company will be held in Pittsburg, September 10th, for the purpose of determining the rate to be paid puddlers and bar mill workers under the new scale during the months of September and October. Because of the dull condition of the market no increase over the prevailing rates is expected. The puddlers are now being paid $6.12 a ton on a $1.45 card.

United States interests report the pig-iron situation unchanged, with the market almost at a standstill. Eastern iron is quoted on the basis of $15.50 to $15.75 furnace. Other irons are quoted on No. 2 basis as follows:—Virginia, $13.50 to $13.75 furnace, Buffalo, $14.25 to $14.50 furnace, water shipment, and $14.50 rail shipment, and Southern $11.50 Birmingham. It is probable, however, that on inquiries of any importance, concessions of from 50c. to 25c. from these figures would be made. At the same time the opinion is expressed that the volume of iron to be had at these concessions is considerably smaller than it was early in the month, and that the time is not far distant when none will be available below the figures quoted above. A good percentage of current deliveries are on high-price contracts, the average price for all deliveries representing a fair profit. But practically all of these high-priced contracts will expire on September 1st, and any concession after that date from the quoted figures, which represent the average cost of production, will be at a loss.

Advices from Great Britain during the past week have not been voluminous, and the news conveyed has not been very exciting. Prices range at about the same level as formerly, and the demand all the way round is light. Export demand gives little promise of improvement, and producers are simply awaiting developments.

In the local market, there is a certain amount of anticipation concerning fall shipments, and no doubt, arrivals will begin to be heavy during the month of October, inasmuch as the bulk of the iron will have to be landed here by the end of November. Importers and producers continue to quote the same prices on iron and steel. Finished products and semi-finished products are quoted at the same range as previously, this range having now held for several months, with practically no changes whatever.

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

Bar Iron and Steel.—The market holds dull and steady. Bar iron, $1.90 per 100 pounds; best refined horseshoe, $2.15; forged iron, $2.05; mild steel, $1.95; sleigh shoe steel, $1.90 for 1 x ⅜ base; tire steel, $2.00 for 1 x ⅜-base; toe calk steel, $2.40; machine steel, iron finish, $2.00; imported, $2.05.

Building Paper.—Tar paper, 7, 10, or 16 ounces, $1.80 per 100 pounds; felt paper, $2.75 per 100 pounds; tar sheathing, 40c. per roll of 400 square feet; dry sheathing, No. 1, 30 to 40c. per roll of 400 square feet; tarred year will be the largest in the history of the country. Prices on foreign fibre, 55c. per roll; dry fibre, 45c. (See Roofing; also Tar and Pitch). (164).

Cement.—Canadian cement is quotable, as follows, in car lots, f.o.b., Montreal:—$1.35 to $1.40 per 350-lb bbl., in 4 cotton bags, adding 10c. for each bag. Good bags re-purchased at 10c. each. Paper bags cost 2½ cents extra, or 10c. per bbl. weight.

Chain.—The market is unchanged, being now per 100 lbs., as follows:—¼-in., $5.30; 5-16-in., $4.70; ⅜-in., $3.90; 7-16-in., $3.65; ½-in., $3.55; 9-16-in., $3.45; ⅝-in., $3.40; ¾-in., $3.35; ⅞-in., $3.35; 1-in., $3.35.

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

Copper.—Prices are strong at 13¾ to 14c.

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

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

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

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

Laths.—See Lumber, etc.

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

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

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

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

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

Pipe.Cast Iron.—The market shows a steady tone although demand is on the dull side. Prices are firm, and approximately as follows:—$32 for 6 and 8-inch pipe and larger; $33 for 3-inch and 4-inch at the foundry. Pipe, specials, $3 per 100 pounds. Gas pipe is quoted at about $1 more than the above.

Pipe.—Wrought and Galvanized.—Demand is about the same, and the tone is firm, though prices are steady, moderate-sized lots being: ¼-inch, $5.50, with 63 per cent off for black, and 48 per cent. off for galvanized; ⅜-inch, $5.50, with 50 per cent. off for black, and 44 per cent. off for galvanized; ½-inch, $8.50, with 60 per cent. off for black, and 50 per cent. off for galvanized. The discount on the following is 71½ per cent. off for black, and 61½ per cent. off for galvanized; ¾-inch, $11.50; 1-inch, $16.50; 1¼-inch, $22.50; 1½-inch, $27; 2-inch, $36; 2½-inch, $57.50; 3-inch, $75.50; 3½-inch, $95; 4-inch, $1.08.

Plates and Sheets.—Steel.—The market is steady. Quotations are: $2.20 for 3-16; $2.30 for ⅛; and $2.10 for ¼ and thicker; 12-gauge being $2.30; 14-gauge, $2.15; and 16-gauge, $2.10.

Rails.—Quotations on steel rails are necessarily only approximate and depend upon specification, quantity and delivery required. A range of rails, per gross ton of 2,240 lbs., f.o.b. mill. Re-laying rails are quoted at $27 to $29 per ton, according to condition of rail and location.

Railway Ties.—See lumber, etc.

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

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

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

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

Telegraph Poles.—See lumber, etc.

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

Tin.—Prices are firm, at $34 to $34.50.

Zinc.—The tone is easy, at 5¾ to 6c.

CAMP SUPPLIES.

Beans.—Prime pea beans, $2 to $2.25 per bushel.

Butter.—Fresh made creamery, 22¾ to 23½c.

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

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

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

Dried Fruits.—Currants, Filiatras, 5¾ to 6½c.; choice, 8 to 9c.; dates, 4 to 5c.; raisins, Valentias, 5 to 6¼c.; California, seeded, 7½ to 9c.; Evaporated apples, prime, 8 to 8½c.

Eggs.—No. 1 eggs are 19 to 20c.; selects, 22 to 25c.

Flour.—Manitoba, 1st patents, $6.30 per barrel; and patents, $5.80; strong bakers', $5.60.

Molasses and Syrup.—Molasses, New Orleans, 27 to 28c.; Barbadoes, 40 to 45c.; Porto Rico, 40 to 43c.; syrup, barrels, 3½c.; 2-lb. tins, 2 dozen to case, $2.50 per case

Potatoes.—Per 90 lbs., good quality, 65 to 75c.

Rice and Tapioca.—Rice, grade B., in 100-lb. bags, $2.75 to $2.80; C.C., $2.65. Tapioca, medium pearl, 5½ to 6c.

Rolled Oats.—Oatmeal, $2.20 per bag; rolled oats, $2, bags.

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

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

Fish.—Salted.—Medium cod, $7 per bbl.; herring, $5.25 per bbl.; salmon, $7 per half barrel. Smoked fish.—Bloaters, $1.10 per large box; haddies, 8c. per lb.; kippered herring, per box, $1.20; new smoked herring, 13c. per box.

Provisions.—Salt Pork.—$24 to $31 per bbl.; beef, $18 per bbl.; smoked hams, 17 to 21c. per lb.; lard, 15½ to 17c. for pure, and 12½ to 14c. per lb. for compound.

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Toronto, September 1st, 1910.

As is usual during exhibition week, prices are high, both for produce and the regular supplies. The number of out-of-town buyers make the demand brisk, and consequently prices are firmer in most lines.

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

Antimony.—Trade is quiet, price unchanged at $8.50.

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

Bar Iron.—$2.05 to $2.15, base, per 100 lbs., from stock to wholesale dealer. Free movement

Bar Mild Steel.—Per 100 lbs., $2.15 to $2.25. Sleigh shoe and other take same relative advance.

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

Boiler Tubes.—Orders continue active. Lap-welded, steel, 1¼-inch, 10c.; 1½-inch, 9c. per 10 foot; 2-inch, $8.50; 2¼-inch, $10; 2½-inch, $10.60; 3-inch, $12.10; 3½-inch, $15.30; 4-inch, $19.45.

Building Paper.—Plain, 27c. per roll; tarred, 35c. per roll. Demand is moderate.

Bricks.—In active movement, with very firm tone. Price at some yards $9.50, at others, $10.00 to $11.00 for common. Don Valley pressed brick are in request. Red and buff pressed are worth $18 delivered and $17 at works per 1,000.

Broken Stone.—Lime stone, good hard, for roadways or concrete, f.o.b., Schaw station, C.P.R., 70c., until further notice, per ton of 2,000 lbs., 1-inch, 2-inch, or larger, price all the same. Rubble stone, 55c. per ton, Schaw station, and a good deal moving. Broken granite is selling at $3 per ton for good Oshawa.

Cement.—The G.T.R. strike being broken, shipments are resumed. Car lots, $1.75 per barrel, without bags. In 1,000 barrel lots $1.60. In smaller parcels $1.90 is asked by city dealers. Bags, 40c. extra. Demand constant.

Coal.—Anthracite, egg, and chestnut sizes, $6.75 per ton, net, and pea coal to $5.75 per ton. In the United States there is an open market for bituminous coal and a great number of qualities exist. We quote: Youghiogheny lump coal on cars here, $3.75 to $3.80; mine run, $3.65 to $3.70; slack, $2.75 to $2.85; lump coal from other districts, $3.55 to $3.70; mine run 10c. less; slack, $2.60 to $2.70; cannel coal plentiful at $7.50 per ton; cook, Solvey foundry, which is largely used here, quotes at from $5.75 to $6.00; Reynoldsville, $4.90 to $5.10; Connellsville, 72-hour coke, $5.25.

Copper Ingot.—A very large volume of business is being done, but the market is weaker at $15.25 to $13.50. Production goes on at a rapid rate

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

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

Felt Roofing.—A very good volume of trade is going on at $1.80 per 100 lbs. as before.

Fire Bricks.—English and Scotch, $30 to $35; American, $25 to $35 per 1,000. Fire clay, $8 to $12 per ton.

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

Iron Chain.—¼-inch, $5.75; 5-16-inch, $5.15; ⅜-inch, $4.15; 7-16-inch, $3.95; ½-inch, $3.75; 9-16-inch, $3.70; ⅝-inch, $3.55; ¾-inch, $3.45; ⅞-inch, $3.40; 1-inch, $3.40, per 100 lbs.

Iron Pipe.—A steady request at former prices:—Black, ¼-inch, $2.03; ⅜-inch, $2.25; ½-inch, $2.63; ¾-inch, $3.28; 1-inch, $4.70; 1¼-inch, $6.41; 1½-inch, $7.70; 2-inch, $10.26; 2½-inch, $16.39; 3-inch, $21.52; 3½-inch, 27.08; 4-inch, $30.78; 4½-inch, $35.75; 5-inch, $39.85; 6-inch, $51.70. Galvanized, ¼-inch, $2.86; ⅜-inch, $3.08; ½-inch, $3.48; ¾-inch, $4.43; 1-inch, $6.35; 1¼-inch, $8.66; 1½-inch, $10.40; 2-inch, $13.86, per 100 feet.

Pig Iron.—We quote Clarence at $20.50, for No. 3; Cleveland, $20.50; Summerlee, $22; Hamilton quotes a little irregular, between $19 and $20. The market unchanged and quiet.

Lead.—A very fair demand exists, at an unchanged price of $3.75 to $3.85. A better feeling exists, however.

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

Lumber.—A brisk demand continues for all descriptions, and prices are fully maintained. Pine is good value at $32 to $40 per M. for dressing, according to width required; common stock boards, $28 to $33; cull stocks, $20; cull sidings, $17.50. Southern pine dimension timber from $30 to $45, according to size and grade; finished Southern pine, according to thickness and width, $30 to $40; hemlock is in demand and held quite firmly, we quote $17.50 to $18; spruce flooring in car lots, $22 to $24; shingles, British Columbia, are steady, we quote $3.10; lath, No. 1, $4.60; white pine, 48-inch, No. 2, $3.75; for 32-inch, $1.85 is asked.

Nails.—Wire, $2.35 base· cut, $2 60; spikes, $2.85 per keg of 100 lbs.

Pitch and Tar.—Pitch, unchanged at 70c. per 100 lbs. Coal tar, $3.50 per barrel. Demand moderate.

Plaster of Paris.—Calcined, New Brunswick, hammer brand, car lots, $1.95; retail, $2.15 per barrel of 300 lbs.

Putty.—In bladders, strictly pure, per 100 lbs., $2.25; in barrel lots, $2.10. Plasterer's, $2.15 per barrel of three bushels.

Ready Roofing.—An active demand; prices are as per catalogue

Roofing Slate.—Most of the slate used in Canada comes now from Pennsylvania or Maine, the Canadian supply being slender and mostly from the Rockland quarries of the Eastern Townships in Quebec. There is a great variety of sizes and qualities, so that it is difficult to indicate prices But No. 1 Bangor slate 10 x 16 may be quoted at $7 per square of 100 square feet, f.o.b., cars, Toronto; seconds, 50c. less. Mottled, $7.25; green, $7, with a prospect of advance. Dealers are fairly busy.

Rope.—Sisal, 9¼c. per lb.; pure Manila, 10½c. per lb., Base.

Sand.—Sharp, for cement or brick work, $1.05 per ton f.o.b., cars, Toronto siding.

Sewer Pipe.—

	4-in.	6-in.	9-in.	10-in.	12-in.	24-in
Straight pipe per foot	$0.20	$0.30	$0.65	$0.75	$1.00	$3.2[illegible]
Single junction, 1 or 2 ft. long	.90	1.35	2.70	3.40	4.50	14.6[illegible]
Double junctions	1.50	2.50	5.00	....	8.50	.....
Increasers and reducers	....	1.50	2.50	....	4.00	.....
P. traps	2.00	3.50	7.50	....	15.00	.....
H. H. traps	2.50	4.00	8.00	....	15.00	.....

Business very active; price, 73 per cent. off list at factory for car-load lots; 60 per cent. off list retail.

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

Sheet Steel.—American Bessemer, 10-gauge, $2.50; 12-gauge, $2.55; 14-gauge, $2.35; 17, 18, and 20-gauge, $2.45; 22 and 24-gauge, $2.55; 26-gauge, $2.65; 28-gauge, $2.80. A very active movement is reported at unchanged prices.

Sheets Galvanized.—Apollo Brand.—Sheets 6 or 8 feet long, 30 or 36 inches wide; 10-gauge, $3.00; 12-14-gauge, $3.00; 16, 18, 20, $3.20; 22-24, $3.35; 26, $3.50; 28, $3.95; 29, $4.25; 10¾, $4.25 per 100 lbs. Fleur de Lis—28-gauge, $4.10; 26, $3.80 per 100 lbs.

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

Tool Steel.—Jowett's special pink label, 10¼c. Cammel-Laird, 16c. "H.R.D." high speed tool steel, 65c.

Tin.—Market irregular, with considerable business passing. We quote 34½ to 35c.

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

Zinc Spelter.—The market can no longer be described as lively; a steady but limited movement goes on at $5.50 to $5.75 per 100 lbs.

CAMP SUPPLIES.

Beef.—By carcases, $9.50 to $10.50.

Butter.—Dairy prints, 19 to 20c.; creamery prints, 23 to 24c.; the creamery output is now considerable.

Canned Goods.—Peas, $1.15 to $1.75; tomatoes, 3s, 90 to 95c.; pumpkins, 3s, 95c.; corn, 85c.; peaches, 2s, white, $1.50 to $1.60; yellow, $1.80 to $1.85; strawberries, 2s, heavy syrup, $1.50 to $1.85; raspberries, 2s, $1.75 to $1.95.

Cheese.—Moderately firm; old cheese, large, 11½c.; twins, 11¾c.; new, 12¼c.

Coffee.—Rio, green, 10 to 10¼c.; Mocha, 21 to 23c.; Java, 20 to 31c.; Santos, 11 to 15c.

Dried Fruits.—Raisins, generally higher, Valencia, 7c.; seeded, 1-lb. packets, fancy, 8c.; 16-oz. packets, choice, 7½c.; Sultanas, good, 7c.; fine, 8c.; choice, 8½c.; fancy, 9c.; Filiatras currants, cleaned, 6½ to 7c.; Vostizzas, 8½ to 9c.; uncleaned currants, 6¼ to 6¾c.

Eggs.—Easy, at 19 to 20c. per dozen, in case lots.

Flour.—Keeps higher; quotations at Toronto are: Manitoba flour, first patents, $6.20; second patents, $5.70; strong bakers', $5.50; Ontario flour, winter wheat patents, $3.75 to $3.85 per barrel.

Lard.—Tierces, 14½c.; tubs, 14½c.; pails, 14¾c.; stock steady.

Molasses.—Barbadoes, barrels, 37 to 45c.; West Indian, 27 to 30c.; New Orleans, 30 to 33c. for medium.

Pork.—Not much doing, short cut, $30 to $30.50 per barrel; mess, heavy, $27.50 to $28.

Rice.—B grade, 3½c. per lb.; Patna, 5 to 5¼c.; Japan, 5 to 6c.

Salmon.—Fraser River, talls, $2; flats, $2; River Inlet, $1.85; cohoes, $1.60.

Smoked and Dry Salt Meats.—Long clear bacon, 15 to 15½c. per lb., tons and cases; hams, large, 17 to 17½c.; small, 18½ to 19c.; rolls, 15 to 15¼c.; breakfast bacon, 19 to 20c.; backs (plain), 21 to 21½c.; backs (peameal), 21 to 22c.; shoulder hams, 14c.; green meats out of pickle, 1c. less than smoked.

Spices.—Allspice, 18 to 19c.; nutmegs, 30 to 75c.; cream tartar, 22 to 25c.; compound, 15 to 20c.; pepper, black, pure Singapore, 14 to 17c.; pepper, white, 20 to 30c.

Sugar.—Granulated, $5.20 per 100 lbs., in barrels; Acadia, $5.10; yellow, $4.80; bags.

Syrup.—Corn syrup, special bright, 3⅜c. per lb.

Teas.—Japans, 20 to 35c. per lb.; Young Hysons, 16 to 35c.; Ceylons.

Vegetables.—Potatoes—Ontario, new, 70 to 90c. per bag; onions by the crate, Spanish, $3.

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Winnipeg, August 30th, 1910.

The local situation in regard to bricklayers' and masons' lockout which took place ten days ago, is considerably relieved, and over a hundred International union men signed up on a new agreement and started to work this week, and the others it is expected will follow, and within a few days all building should be in full swing again.

The demand for all kinds of supplies is well kept up, and it is confidently expected that by the end of the year Winnipeg's building permits will go over the $15,000,000 mark.

A great deal of water supplies, such as iron pipe and sewer pipe are being used in the West this year, and the demand in all these lines is good, the lumber and cement situation is steady and prices remain about as usual, and in all prices quoted below there is no change to record:—

Quotations on this market are as follows:—

Anvils.—Per pound, to 12½c.; Buckworth anvils, 80 lbs., and up. 10¼c.; anvil and vice combined, each, $5.50

Axes.—Chopping axes, per dozen, $6 to $9; double bits $12.10 per dozen.

Barbed Wire.—4 point and 2 point, common, $3.15 per cwt.; Baker, $3.20; Waukegan, $3.30.

Bar Iron.—$2.50 to $2.60.

Bars.—Crow $4 per 100 pounds

Beams and Channels.—$3 to $3.10 per 100 up to 15-inch. (4, 30, 41, 50, 118, 119, 127, 132, 145, 176.)

Boards.—No. 1 Common Pine, 8 in. to 12 in., $38 to $45; siding, No. 1 White Pine, 6 in., $55; cull red or white pine or spruce, $24.50; No. 1 Clear Cedar, 6 in., 8 to 16 ft., $60; Nos. 1 and 2 British Columbia spruce, 4 to 6 in., $55; No. 3, $45.

Bricks.—$11, $12, $13 per M, three grades.

Building Paper.—4½ to 7c. per pound. No. 1 tarred, 84c. per roll; plain 60c.; No. 2 tarred, 62½c.; plain, 56c.

Coal and Coke.—Anthracite, egg, stove or chestnut coal, $9.75 large lots to $10.50 ton lots, net; Alleghany soft coal; carload lots, basis, Winnipeg, f.o.b., cars, $6 per ton; cannel coal, $10.50 per ton; Galt coal, $1 f.o.b., carload lots, $9 single ton; coke, single ton, $7 at yard; large lots special rates. American coke, $11 to $11.50 a ton; Crow's Nest, $10 a ton

Copper Wire.—Coopered market wire, No. 7, $4 per 100 lbs.; No. 6, $4; No. 10, $4.06; No. 12, $4.20; No. 14, $4.40; No. 16, $4.70.

Cement.—$2.40 to $2.75 per barrel in cotton bags.

Chain.—Coil, proof, ¼-inch, $7; 5-16-inch, $5.50; ⅜-inch, $4.90; 7-16-inch $4.75; ½-inch, $4.40; ⅝-inch, $4.20; ¾-inch, $4.05; logging chain, 5-16-inch. $6.50; ⅜-inch, $6; ½-inch, $8.50; jack iron, single, per dozen yards, 15c. to 75c.; double, 25c. to $1; trace-chains, per dozen, $5.25 to $6.

Copper.—Tinned, boiler, 26½c.; planished, 29½c.; boiler and T. K. pits plain, tinned, 45 per cent. discount.

Dynamite.—$11 to $13 per case.

Hair.—Plasterers', 90c. to $1.15 per bale.

Hinges.—Heavy T and strap, per 100 lbs., $6 to $7.50; light, do., 65 per cent.; screw hook and hinge, 6 to 10 inches, 5¾c. per lb.; 12 inches up, per lb., 4¼c.

Galvanized Iron.—Apollo, 10¾, $4.90; 28, $4.70; 26, $4.30; 22, $4.10; 24, $4.10; 20, $4; 18, $3.95; 16, $3.90; Queen's Head, 28, $4.90; 26, $4.70; 24, $4.30; 22, $4.30; 20, $4.10 per cwt.

Iron.—Swedish iron, 100 lbs., $4.75 base; sheet, black, 14 to 22 gauge, $3.75; 24-gauge, $3.90; 26-gauge, $4; 28-gauge, $4.10. Galvanized—American, 18 to 20-gauge, $4.40; 22 to 24-gauge, $4.65; 26-gauge, $4.65; 28-gauge, $4.90; 30-gauge, $5.15 per 100 lbs. Queen's Head, 22 to 24-gauge, $4.65; 26-gauge English, or 30-gauge American, $4.90; 30-gauge American, $5.15; Fleur de Lis, 22 to 24-gauge, $4.50; 28-gauge American, $4.75; 30-gauge American, $5.

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

Lumber.—No. 1 pine, spruce, tamarac, 2 x 4, 2 x 6, 2 x 8, 8 to 16 feet, except 10 feet, $29; British Columbia fir and cedar, 2 x 4, 2 x 6, and 2 x 8, 12 to 16 feet, $32; 2 x 20, 4 x 20, up to 32 feet, $42.

Nails.—$4 to $4.25 per 100. Wire base, $2.85; cut base, $2.90.

Picks.—Clay, $5 per dozen; pick mattocks, $6 per dozen; clevishes, 7c. per lb. (132.)

Pipe.—Iron, black, per 100 feet, ¼-inch, $2.50; ⅜-inch, $2.80; ½-inch, $3.40; ¾-inch, $4.60; 1-inch, $6.60; 1¼-inch, $9; 1½-inch, $10.75; 2-inch, $14.40; galvanized, ½-inch, $4.25; ¾-inch, $5.75; 1-inch, $8.35; 1¼-inch, $11.35; 1½-inch, $13.60; 2-inch, $18.10. Lead, 6½c. per lb.

Pitch.—Pine, $6.50 per barrel; in less than barrel lots, 4c. per lb.; roofing pitch, $1 per cwt.

Plaster.—Per barrel, $3.25.

Roofing Paper.—60 to 67½c. per roll.

Rope.—Cotton, ¼ to ½-in., and larger, 23c. lb.; deep sea, 16½c.; lath yarn, 9½ to 9¾c.; pure Manila, per lb., 13¾c.; British Manila, 11¾c.; sisal, 10½c.

Shingles.—No. 1 British Columbia cedar, $4; No. 2, $3.50; No. 1 dimension, $5; No. 1 band sawn, $6.

Spikes.—Basis as follows.—1¼ 5 and 6, $4.75; 5-16 x 5 and 6, $4.40; ⅜-x 6, 7 and 8, $4.25; ½ x 8, 9, 10, and 12, $4.05; 25c. extra on other sizes.

Steel Plates, Rolled.—3-16-in., $3.35 base; machinery, $3 base; share, $4.50 base; share crucible, $5.50; cast share steel, $7.50; toe calk, $4.50 base; tire steel, $3 abse; cast tool steel, lb., 9 to 12½c.

Staples.—Fence, $3.40 per 190 lbs.

Timber.—Rough, 8 x 2 to 14 x 16 up to 32 feet, $38; 6 x 20, 8 x 20, up to 32 feet, $42.

Tool Steel.—8½ to 15c. per pound.