# Canadian Engineer

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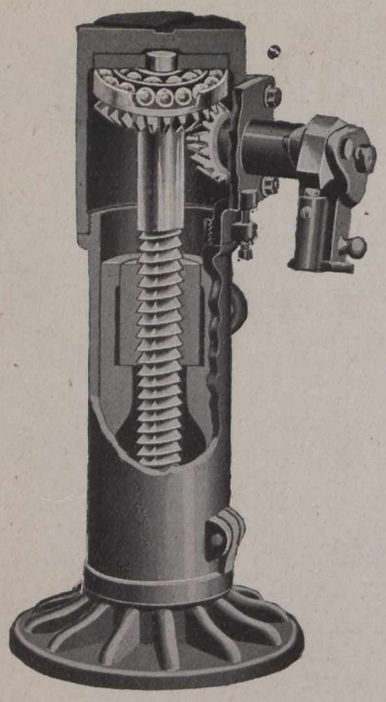

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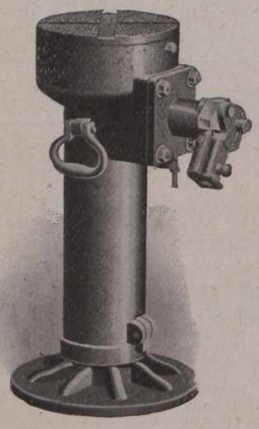

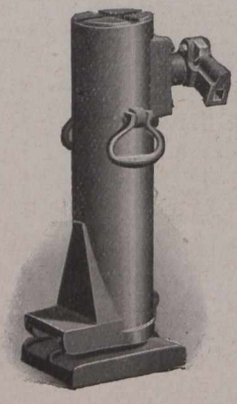

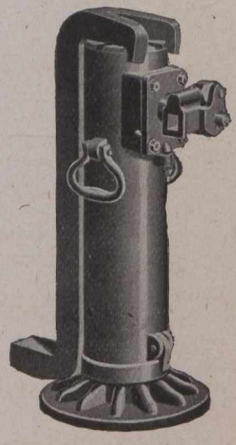

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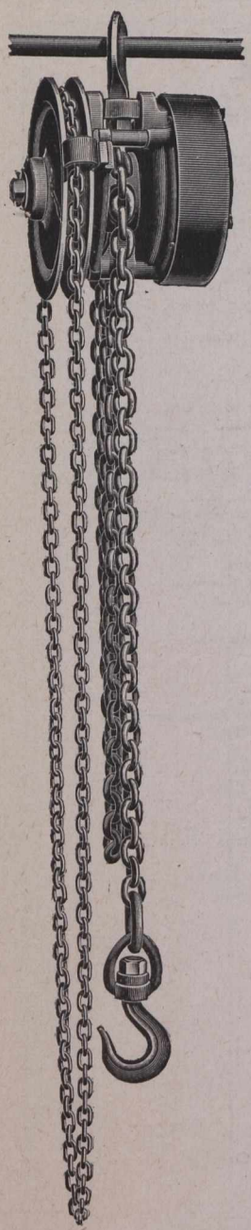

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# LONDON

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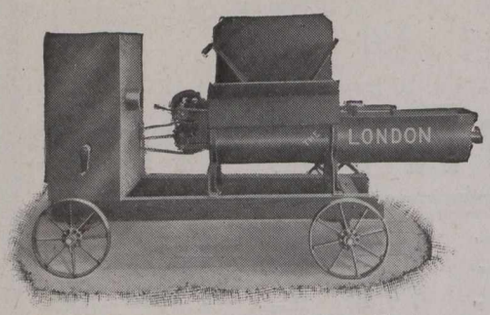


London Automatic Batch Mixer No. 1.

**THE LONDON AUTOMATIC BATCH MIXER No. 1,** with 2½ H.P. Gasoline Engine has a capacity of 50 yards per day, weighs only 1,600 lbs., is easily moved from place to place, can be set to give any desired capacity up to 50 yards, will measure any materials automatically, will give any consistency of moisture. This machine has the largest sale of any mixer manufactured or sold in Canada.

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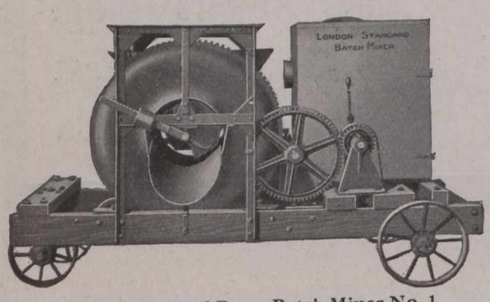
The London Automatic Machines will save you money— { In the First Cost of Mixer. Cost of Maintenance. Cost of Producing Concrete.


London Automatic Batch Mixer No. 2

## London Standard Batch Mixers




London Standard Drum Batch Mixer No. 1, equipped with Gasoline Engine.

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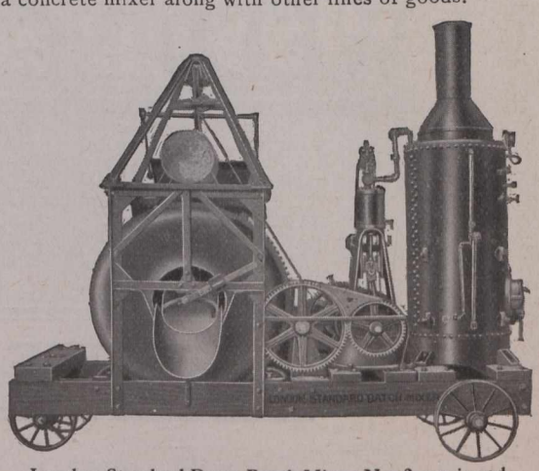

London Standard Drum Batch Mixer No. 2, equipped with Steam Engine and Loading Skip.

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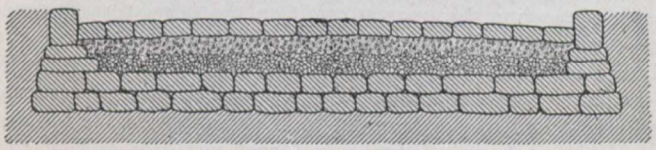
# THE CANADIAN ENGINEER

An Engineering Weekly.


## THE HIGHWAY, THE FARMER AND THE AUTOMOBILE.

There was a time when the farmer looked upon the automobile with considerable aversion. He saw in it only the pastime of the idle rich when confined to the city limits. When upon the country highway he saw in it something that would unnerve his horses, scatter dust in clouds, kill his chickens, and do anything else that might render it a public nuisance. In the larger cities, it is true that the automobilist can confine his trips to the city streets, but in the medium-sized towns and in the small village the country



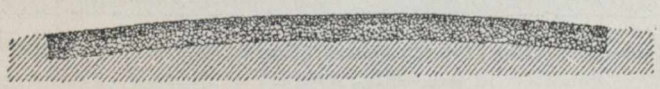
**Cross Section Roman Road.**

road must of necessity be used if any sort of a trip is to be enjoyed. Further than this, the far-seeing farmer sees in the automobile a vehicle that he can use to his own advantage and profit, and he is buying it readily, or in so far as his capital will allow.

With the rapid gowth of the automobile among the farmers there is bound to come a demand for better roads. The farmer has a good pathway from his house to his barn in order that he may travel between the two in all sorts of weather and with ease. Once the farmer begins to use the automobile and sees its advantages, he will of necessity demand a better road between his home and town, and the good roads question will receive a jolt that will send it upwards by leaps and bounds.

To the farmer the good road is the connecting link which binds him to the outside world. It is the side-track from his farm factory to the main line of the world's highway—the railway. It adds value to his realty, it increases his wealth and comfort, and brands his farm as an integral part of the whole community as a good place to live upon.

In the case of highways, the farmer is both a manufacturer and a consumer. He builds up, uses and tears down, and as he builds so is the usefulness of that which he manu-



**Cross Section of Modern Macadam Road.**

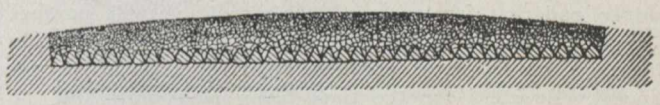
factures to him. It should always be his aim in making roads to establish the easiest, shortest and most economical line of travel. It is, therefore, desirable that the roads be firm, smooth, comparatively level, and fit for use at all seasons of the year; that they should be properly located, so that their grades shall be such that loaded vehicles may be drawn over them without great loss of energy; that they should be properly constructed, the road-bed graded, shaped and rolled; and that they should be surfaced with the best material suited to their needs.

This matter of grade is one of prime importance. They do not affect matters so much in a country like Western Canada, but should nevertheless be watched carefully. "A chain is no stronger than its weakest link," and the load must always be governed by the steepest grade.

No one has yet taken the trouble of working out the influences of grade uuon the efficiency of the automobile or any other vehicle; but some very careful data has been worked out as regards the horse, and, as the horse is simply a means of motive power, this data will apply in the main to the traction engine or automobile when used for hauling purposes.

The "Canadian Thresherman and Farmer" states that if a horse can pull on a level 1,000 pounds on a rise of one foot in—

| | | Pounds. |
|---|---|---|
| 100 | he draws | 900 |
| 50 | " | 810 |
| 44 | " | 750 |
| 40 | " | 720 |
| 30 | " | 640 |
| 25 | " | 540 |
| 24 | " | 500 |
| 20 | " | 400 |
| 10 | " | 250 |



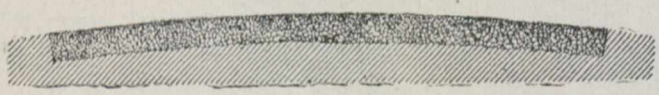
**Cross Section Telford Road, 1820.**

It is, therefore, seen that when grades are 1 foot in 44, or 120 feet to the mile, a horse can draw only three-quarters as much as he can on the level; where the grade is 1 foot in 24 feet, or 220 feet to the mile, he can draw only half as much; and on a 10 per cent. grade, or 520 feet to the mile, he is able to draw only one-quarter as much as on a level road. The cost of haulage is, therefore, necessarily increased in proportion to the roughness of the surface or steepness of the grade. It costs one and one-half times as much to haul over a road having a 5 per cent. grade, and three times as much over one having a 10 per cent. grade, as on a level road. As a perfectly level road can seldom be had, it is well to know the steepest allowable grade. If the hill be one of great length, it is sometimes best to have the lowest part steepest, upon which the horse is capable of exerting his full strength, and to make the slope more gentle toward the summit, to correspond with the continually decreasing strength of the fatigued animal

So far as descent is concerned, a road should not be so steep that the wagons and carriages cannot be drawn down it with perfect ease and safety. Sir Henry Parnell considered that when the grade was no greater than 1 foot in 35 feet, vehicles could be drawn down it at a speed of 12 miles an hour with perfect safety. Gillespie says:—

"It has been ascertained that a horse can for a short time double his usual exertions; also, that on the best roads he exerts a pressure against his collar of about one thirty-fifth of the load. If he can double his exertion for a time, he can pull one thirty-fifth more, and the slope which would force him to lift that proportion would be, as seen from the above table, one of 1 in 35, or about a 3 per cent. grade. On this slope, however, he would be compelled to double his ordinary exertion to draw a full load, and it would, therefore, be the maximum grade.

Every farmer knows the import and truth of the above. When loading his wheat for the elevator or in arranging for the hauling of any other product to market, the first consideration is the steepest grade, and in bad weather this consideration becomes so serious that he must needs oftentimes stop marketing entirely. Apart from this the extra draw upon horse flesh is no small item. Every bushel of oats that is required extra is just so much money taken from the farmer's pocket, to say nothing about the decrease in the value of his horses due to the extra work done. There is also an unwarranted amount of wear upon harness,



**Cross Section of Original Macadam Road, 1816.**

wagons, buggies, etc., that add to the farmer's depreciation and expense bill.

The farmer is dependent in every way upon the public highway. Unlike the city man, he must use it, not from choice, but of necessity. No matter how poor the road may be, he must travel over it in the course of his business. It is not a question with him of taking a ride in light buggy; it is a question of putting tremendous wear on the wagons, harness, and on the horses. Of frequent occurrence is the road so bad that farmers are unable to haul their produce to market, with the result that they either lose the market advantage or see their produce spoil for want of proper disposal. Business for the time being stagnates, and the mutual relationship that should exist between merchant and farmer is injured for the time being.

In a recent issue of a local paper we noticed the following headlines:—

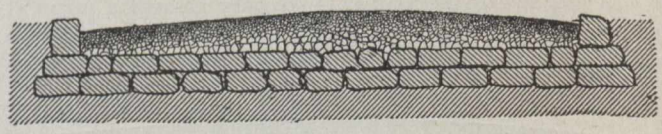
GOOD ROADS AND GOOD WEATHER MAKE EASY MARKET—EGGS ARE BRISK—BUTTER HAS UPWARD TREND—PRODUCE IS PLENTIFUL, AND WHEAT IS STRONG.

It shows plainly the interest the townspeople take in good roads and their immediate effect upon the market in necessities. The price of necessities depends not so much upon supply and demand as they do upon the regularity with which the supply meets the demand. If the farmer's wife is to hold her egg and butter customers, she must supply them with regularity. The same holds true with regard to the more bulky farm products. The writer has in mind the case of a farmer who resided some few miles from a thriving town, and whose farm lay along a macadamized road that led to the town. This same farmer always received a higher price for his produce than everyone else not so situated, for, as the dealers stated, he could be depended upon to get his stock and grain into market just when they wanted it, and in better shape.

The monetary feature of the good road is by no means all that is to be considered. The degree of comfort which the well-kept, up-to-date highway affords should commend it to every farmer. It makes him feel that he is, indeed, a part of "God's great plan," and puts him upon the plane of equality with his fellowmen. He can indulge in the luxury of a fine vehicle, relegating the old, cumbersome and uncomfortable road wagon to a primeval time. If circumstances permit, the automobile may be found among his transportation equipment. The boys and girls find it a pleasure to drive, to visit, and keep the young social standard of the community up to its proper level. They do not feel that they are isolated from the rest of the world, and in consequence are far less liable to despise the old farm home and hie themselves away to city scenes and city pleasures. The sphere of school and church is widened, land values rise, wealth increases, better homes and more of them result; in fact, the whole community finds itself uplifted and bettered as a result of the good road.

The farmer is in duty bound to give the highways their proper attention. He owes it not to himself alone, but to his fellowmen. Every day's work done should be put in with a conscientious regard for results. Many farmers are in the habit of sending the poorest outfit on the farm to work upon the highway, and they are concerned only with fulfilling the statute requirements. This is a mistake, and not only is it a mistake, but it is a theft, and a financial loss both to the individual and to the community. The farmer is far too apt to regard road expenditure as a forced waste of money. He fails many times to grasp the fact that the public highway belongs to him, that it exists for him and through him, and only in so far as he gives to it its due attention can he reap any benefits therefrom. Initial cost is the last thing to be considered, for this cost is distributed over a long term of years—years filled with comfort and wealth for the good road user.

In the automobile the farmer has something that will link town and comfort together. The man who lives in the town and owns an automobile is just as keen as the farmer, and even more so, for a good touring road. Without sober second thought one cannot grasp the immense improvement automobiles have had on good roads where they have come into general use. Occasionally one finds the individual bewailing the injury caused by automobiles on our highways. Such forget that the highways are made for use, and the more automobiles are used in rural sections the stronger will be the influence for making better roads and more of them. It is a matter of common observation that legislation looking to highway improvement has become much easier as automobiles are being more generally utilized. No one questions that high-power machines may injure roads. The



**Cross Section French Road (Roman Method) previous to 1775.**

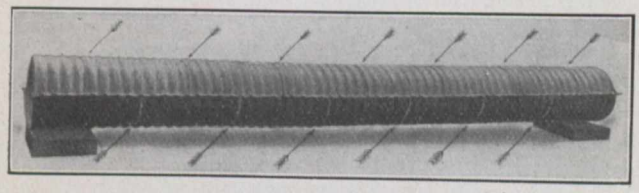
thing to remember is that there are many other advantages coming with automobiles which more than offset this deterioration to highways.

In a word, it is a matter of common knowledge that the advent of the automobile has directed popular attention to improved highways. The increasing number in use and the influence of those people owning cars are having a telling effect upon improvement. This is very fortunate, and many farmers look ahead to the time when they will personally be enjoying the use of cars on these improved roads.

## THE EVOLUTION OF CORRUGATED METAL CULVERTS.

It is probably ont generally known, but it is a fact nevertheless, that corrugated metal culverts have been in use in certain localities in the United States for over a quarter of a century.

Originally they were made with cheapness paramount, hence of very light gauge galvanized steel, with no pretentions other than that of temporary, or at the best uncertain, longevity. Many of these culverts have long since disintegrated, the result of varying deteriorating elements of the earth in which they were embedded; others, it is claimed, are still in a fair state of preservation.



**Are Set Up Like This.**

Ten years or more ago a commendable tendency was evidenced on the part of various corrugated culvert manufacturers to consider the future. They commenced to operate in the belief that corrugated metal culverts, if made of the right thickness and of a quality of metal superior to galvanized steel, could reasonably be expected to give practical and lasting service. With this in view, the use of extreme light gauge metal which had, therefore, prevailed, was discouraged, and increased gauges, such as Nos. 18 and 16 for smaller sizes and No. 14 for the largest, were adopted as a fair standard.

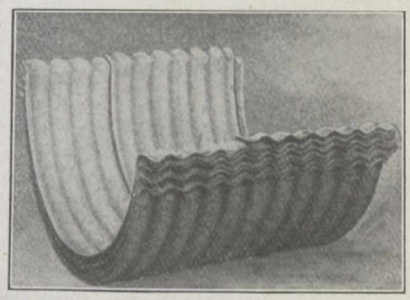
Still later experiments were commenced, and have continually progressed toward developing a metal on a commercial basis which should surpass steel and equal or excel, from the standpoint of anti-corrosive characteristics, the

**A 24-inch Corrugated Flat-Bottomed Culvert on a Highway, Where Conditions Prevented the Use of a Round Culvert of Proper Diameter for Required Drainage.**

well-known old-time iron products. That metal meeting these requirements has been perfected is now a matter of common knowledge to the trade.

In recent years calculations based on the adoption of heavy gauges and materials of this superior quality, properly galvanized, have been substantially confirmed, with the natural result that corrugated culverts have continued to grow in demand, to undergo improvements and to give satisfaction. To-day they are not only recommended by metallurgical chemists and specified by engineers generally, but are also in satisfactory use by the United States Government, various foreign Governments, and under the heaviest traffic-bearing railroads, city streets and country highways everywhere. And they are supplanting in a large degree all other kinds of culverts.

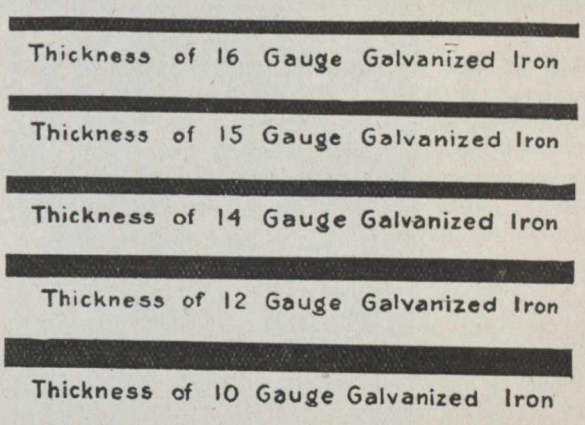
Up to about four years ago the common style of corrugated culverts was cylindrical and riveted. About that time a new and novel idea was evolved in a corrugated culvert made of upper and lower sections with lateral flanges, to be



**Shipped Like This.**

shipped knockdown, and nested and set up by the use of bolts. This culvert was also characterized by the embodiment in its manufacture of still heavier gauges of metal than had ever before been used, including for the smaller diameters Nos. 16, 15 and 14 and for the larger sizes Nos. 12 and 10 gauge metal of special anti-corrosive properties, overcoming to a great extent the common criticisms regarding lightness and the effects of corrosion so common to ordinary steel. These better grades of heavier gauge culverts—both the round-riveted and the nestable by reason of their comparative lightness and strength and their ease in handling, hauling and installing—have accomplished much toward revolutionizing permanent road improvement.

A State highway engineer of a Western State (Missouri), in a bulletin some time since issued on the subject of




"Bridges and Culverts," had the following to say regarding corrugated metal culverts:—

"Large quantities of corrugated metal for pipe culverts and similar products are put on the markets, some of which give good satisfaction, while others do not. Some of the pipe, used for culverts in this State, has stood but two years, while others have been in use six times that period and are still good. . . . A good weight and quality of corrugated pipe will last fifteen or twenty years. The difficulty is to know when you are getting a good quality, and for this reason we advise great care in buying corrugated culvert pipe. Do not buy unless you feel sure of the quality; there are all kinds on the market."

The State Highway Cmmissioner of an Eastern State (Pennsylvania) in a bulletin lately published on the subject of "Supervisors and Their Duties," says:—

" . . . From this fact comes the corrugated metal pipe, which has been on the market for several years past. If made of ordinary steel, the use of such pipe cannot be condemned too strongly, but if made of special material containing so small a percentage of impurities as to be practically pure iron, it will be found an economical investment for a township."

The sentiments expressed in the foregoing quotations have been corroborated in numerous papers and reports from time to time by the most eminent engineers and metallurgical chemists in this country.

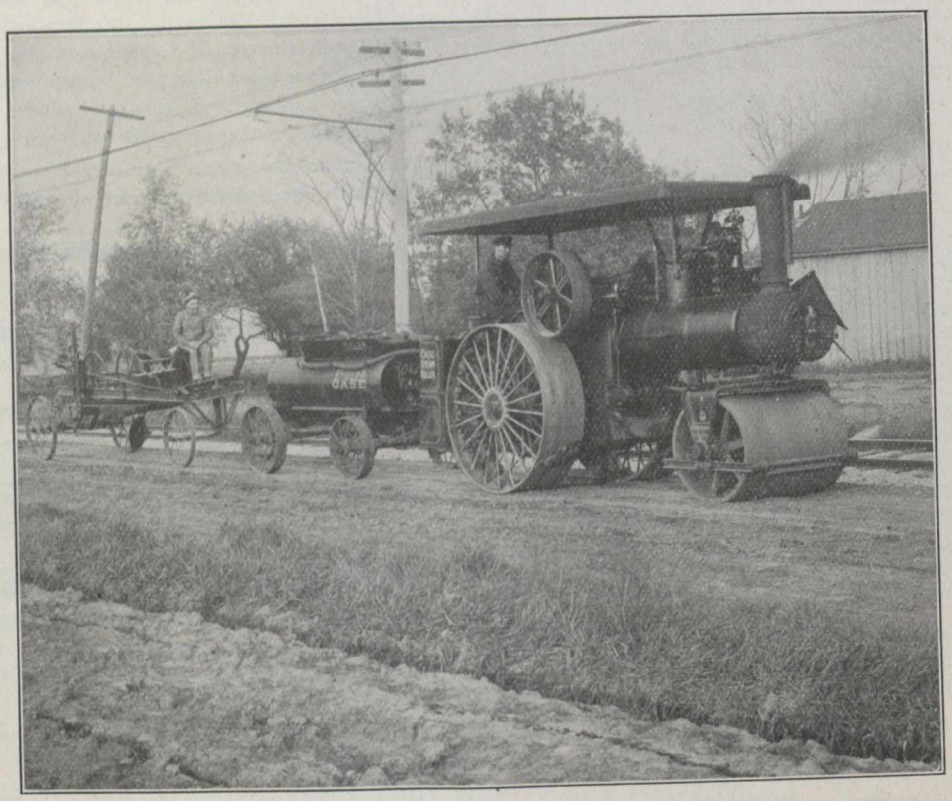
Dr. Allerton S. Cushman, formerly Assistant Director and Chemist, United States Department of Agriculture, Office of Public Roads, in a bulletin recently published said among other things:—

" . . . It seems to be a fact that carefully made metal, in which the ordinary impurities are cut down to mere traces, and in which the heat treatments have been carefully controlled, is much more resistant to corrosion than ordinary types of metal with a comparatively high percentage of impurities. . . . The demand for this type of metal appears to be growing, and it has been largely used for the manufacture of road culverts. . . . The fact that this new metal has been largely specified by culvert manufacturers, even at a somewhat added cost, is the best evidence that it is meeting a long-felt want in this and allied industries."

If any one feature is likely to militate more seriously than another against the prospective future success and permanence of corrugated culverts—whether of steel or purer metals—it is the continued detrimental exploitation of thin-gauge, flimsy material. If people will persist in buying too light weight and otherwise inferior corrugated culverts for no other reason than that they are cheap only to reap dissatisfaction, as they certainly must in a comparatively short time, they should at least be fair enough to withhold judgment until they have given the better culverts a trial, and not prematurely and indiscriminately condemn the various other worthy corrugated culverts, made of purer metal and heavier gauges, any of which may be bought at a reasonable price, with general satisfaction assured.

## TRACTION ENGINE HAULING.

Traction engines for hauling materials, pulling graders and ploughs, and for general heavy draft work are in wide use to-day, and are receiving increasing favor because they are proving satisfactory and economical, but they cannot be entirely successful unless the user gives them proper attention and observes certain simple, practical rules. Before attempting the use of this class of power, therefore, consideration should be given to the details of the problem, and an engine should not be placed on a piece of work to solve all difficulties unassisted.



**Road Roller Hauling Outfit.**

Traction engines appeared first in the early eighties in connection with agricultural machinery. These engines were not depended upon to do much hauling, nor even to propel themselves at first, but were merely expected to help the horses. The law then required horses to be attached to steam engines on the highway for the safety of travellers. So the engine was built with only chain drive or light gearing to propel the rear wheels, and that only straight ahead. The horses did the steering. Later a mechanical steering device was put on, but the engine was not yet asked to haul the load, nor was it capable of doing so.

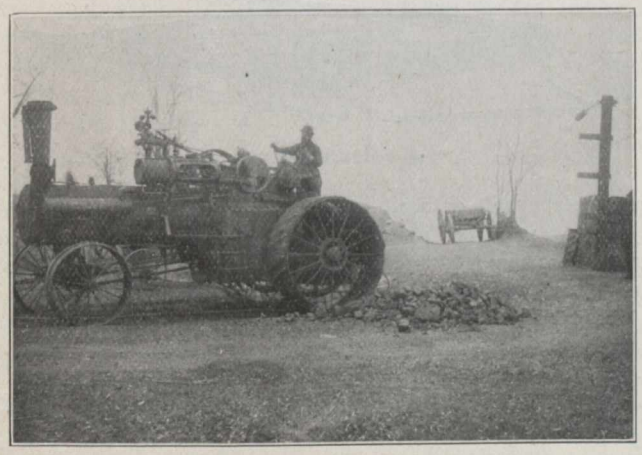
The early engines were only six or eight horse-power, and later, with the steering device, ten or twelve horse-power. Then on good roads the customer applied the engine

to pulling a part of the load, or, under good conditions, attempted to do some other draft work, and if it failed or broke, complaint was made to the builder. The builder would in many cases fix it up free of charge, and then, to avoid this, began making the engine stronger and more durable. The customer would continue doing harder work, and the

**Loaded Wagon on Grade.**

builder would improve his engine accordingly to get advantage of the advertising coming from this work, until to-day we have a powerful, well-built engine for road work, railroad work, sewers, reservoirs, and various heavy construction.

Now that these engines have been improved to meet the needs of a wide service on construction work, they are entering the list of equipment of a very large number of contractors. But the experience of a contractor purchasing and starting to operate his first engine is too often along the following lines: He starts a piece of work, hauling his materials by the use of horses. A salesman comes along selling traction engines, and starts the contractor figuring that his material can be hauled cheaper if he had one of the "most durable and everlasting" engines. The contractor finally decides to order one, and it is shipped. But when the engine arrives, the contractor finds that he has no driver for it, so he gets the first man obtainable for little money to run



**Traction Engine Hauling Wagon After Cable.**

the engine. He hooks on his first load, goes about one mile, and then finds he must take on some more water. There is no water at hand, so a team must be obtained and some water hauled. The load is again started, and after a time the end of the trip is reached. Here the contractor begins to figure so much material delivered in so many hours, engineer's salary, teams and driver. It comes out about even with team work, so he thinks he must put on more load to make it pay, and this he does.

On the second trip, the water gives out after three-quarters of a mile, and in addition there is not enough coal to make the entire trip; and more has to be hauled to the engine. He considers the cost again, and decides he must put on still more load to keep from losing money the next time. The consequence is that the train gets stuck at every unfavorable spot on the road and much time is wasted. In the confusion to start and save time, the engine or train is broken, and hauling by steam is condemned. As a matter of fact, the fault has been entirely with the contractor and his method and management, and not with the machine or hauling system.

The contractor should have a definite plan worked out for conducting this work to do it to best advantage. He should at the outset make a careful study of his engine before purchase, assuring himself that it is built for heavy hauling and will meet the conditions he has in hand. He should study its coal and water carrying capacity, getting provision in this matter for runs of about three miles without water and about six miles without coal. The wheels should be such that the road will not be damaged by the engine passing over it continually. A thorough study of the local conditions should be made to determine where water can be supplied at intermediate points and to determine whether the road will sustain heavy hauling at all points. Coal and water should then be provided at proper points along the route and the supplies properly maintained. A good man

to serve as engineer is the next essential, one who understands machinery and will take proper care of the moving parts, using plenty of oil where necessary and keeping bearings and gears free from dust and grit. Loads should then be taken which can be handled easily by the engine. A good man on the engine will recognize proper loads. Troubles along the road are thus avoided, and these are the chief source of expense.

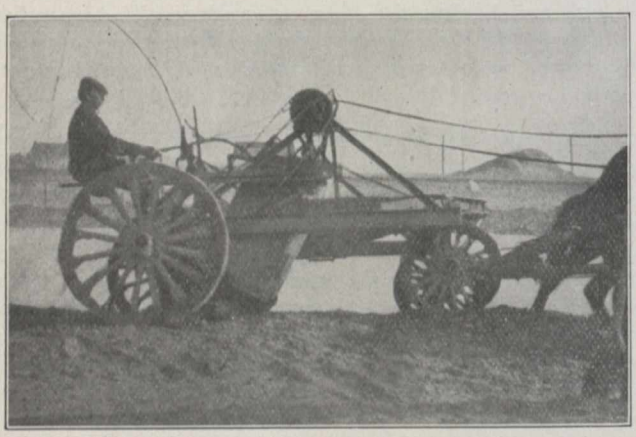
In short, success with traction engine hauling, as the handling of any other work mechanically, depends on a study of the work in hand and of the mechanical aid for doing it, together with proper attendance and proper care of machinery. No machine can be started haphazard on a piece of work and then be depended upon to do it without proper attention or care. Yet mechanical aids, properly applied, are the greatest cost reducers of modern business.

## THE MANEY FOUR-WHEEL SCRAPER.

More money is spent in earth excavation than for any other class of construction. Earth excavating machinery, beside the simple pick and shovel, was unknown in this country 50 years ago. Many inventions have been made in this line, and during these decades every earth mover has

sought for a practical self-loading and quick dumping vehicle of large capacity.

An excavator may be a valuable machine or tool, but it will not do cheap work when it is necessary to serve it with a large number of vehicles, to keep it busy. A wagon, car, or vehicle that does not dump and spread its load is likewise expensive to operate. A celebrated authority on earth excavation once said "The most useful tool or machine for earth excavation is one that not only loosens and loads the earth, but having transported its load, dumps and



**Dumping and Spreading Under Water.**

distributes it without additional cost. Such a machine, if its initial cost is small, will revolutionize earth work."

This was a prophetic remark and the Maney Four Wheeled Scraper is the realization of it.

It does work cheaper than any other excavator. It is simple in construction and operation. Its strength and durability are beyond question. It is in no wise an experiment, or an untried machine, as is evidenced by the many testimonial letters we have received.

In building an embankment for the Reclamation Service to be impervious to water, containing 170,000 cubic yards, the material being mostly hardpan, with an average haul of 400 feet, the cost with Maneys was only 14 cents, per cubic yard which included the cost of moving the plant to and from the work, which amounted to about $2,000. This, we believe, is the cheapest cost ever recorded for embankment work of this class.

The front wheels are 30 inches in diameter. The rear wheels 48 inches. The wheeler pan is elevated by a clutch and sprocket wheels, and when the pan is at the proper height for dumping, an automatic trip throws the clutch on the axle out of gear, stopping the winding and preventing the machine from becoming spool bound. The load is taken into the pan from the front, but it is dumped through a gate in the rear. The pan is 45 inches wide, 25 inches deep and 46 inches long.

In municipal affairs, nothing during the winter season is of more importance than the problem of keeping the streets clear of snow.

A decade ago our large cities and towns paid but little attention to such matters but the increase in business and in traffic has made this one of the chief problems the superintendent of street cleaning has to meet.

In New York City the work has been done in the past almost entirely by hand, a large gang of men being employed, shoveling the snow from the middle of the streets into the gutters, where it was piled for shoveling into the trucks and removed to the regular dumps. This, of course, is a very expensive method as the men receive $2 to $2.25 a day.

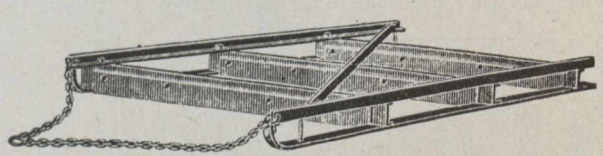
Commissioner Wm. H. Edwards, of New York, became convinced that the 20th Century Grader and Snow Plow, the Barron & Cole Company, sole agents, would solve this problem, as one of these machines does the work of 50 shovelers, and requires but two horses and one man to operate.

The machines work in gangs of two and three piling the snow in the gutters from where it is taken away. By the use of the Maney in connection with the 20th Century Snow Plows, streets that ordinarily are blocked during a heavy storm can be kept open to traffic. This was done during the past winter on Broadway and Fifth Avenue in New York. As soon as 3 inches or 4 inches of snow had fallen the Commissioner ordered the plows out and they were kept working steadily during the storm with the result that when the snow stopped falling the streets were open, the snow piled and ready to be carted away.

## ROAD HONE.

The implement illustrated above accomplishes a result which has never been obtained by any road-building machine of any kind; namely, smoothing crowning and puddling earth roads, at the same time removing inequalities and wavy effects in the surface. This is accomplished by the arrangement of the three blades between two runners, as shown in the cut, which in effect makes this implement a "Road Plane," cutting the high spots and carrying the surplus material which is cut from the high places and depositing same in the low spots. All implements of similar character now in use, while they do excellent work in filling ruts, follow the contour of the surface of the road, leaving waves or inequalities of the surface practically as they were.

In place of the cutting-edge on the first blade as shown in the cut, teeth of tempered steel spaced three inches apart may be substituted. By substituting these teeth, an



**Road Hone.**

extremely rough or hard surface may be leveled or smoothed by going over the road once. The cutting-edges on the angles are made of high-tempered steel, and are adjustable, and may be easily removed for sharpening or renewal.

All parts of this hone are made of steel and put together with hot rivets, making it practically indestructible. These machines are 10 feet in length, 3½, 4½ and 5½ feet in width and weighs complete with draft chains, 275, 300 and 330 lbs. respectively. It is easily drawn by one pair of horses.

Seventy-five per cent. of the primary work of the towns of Canada may be done by the use of these machines at one-third of the usual cost of doing this class of work. After a road has been properly shaped and crowned, it may be maintained in its best possible condition by the use of these machines after storms at a cost of four or five dollars per mile for the year.

## BITUMINOUS ROAD BINDERS.

Demand for a form of construction for main highways that will satisfactorily resist the destructive effect of motor travel, which, it has been found, the ordinary water-bound macadam or broken stone road fails to do, has led to the use of bituminous substances as a binding or cementing material for the mineral aggregate, with results which are generally accepted as being of great value. From the outcome of service tests, however, it is now recognized that the different forms of bitumen, petroleums of different origin, residues from these oils obtained by distillation of different consistencies and more or less carefully prepared; the native solid bitumens, such as the lake asphalts, and the by-products of various industrial processes, are of very different value for such a purpose. It is important, therefore, that the highway engineer should be thoroughly acquainted with the character of these bituminous materials and their relative value in order that he may use them intelligently.

The tars, being the products of industrial processes which are not regulated with the object of producing them as a principal output and of a high and uniform grade, but solely as by-products, do not compare in any way with the native bitumens in suitability for road-building. They have been used only because of the low prices at which they are put on the market to get them out of the way.

Tars are bituminous substances in that they resemble bitumen, but they contain no bitumen. Bitumen is the name given by Latin writers, especially Pliny, to various forms of hydrocarbons found in nature, and now recognized under the names asphalt, maltha, petroleum and natural gas. The Office of Public Roads, United States Department of Agriculture, in a recent circular (No. 93) has defined petroleum, maltha and asphalt as follows:—

"Petroleums.—Petroleums, or mineral oils, are fluid native bitumens of variable composition, depending largely upon the locality on which they occur. There are three general types of petroleum found in the United States: (1) Paraffin petroleums, (2) semi-asphaltic petroleums, and (3) asphaltic petroleums. Paraffin petroleums occur mainly in the eastern part of the United States, and are typified by the Pennsylvania oils. The semi-asphaltic variety occurs in the southern and middle western parts of the United States. Texas is one of the main sources of this type. Asphaltic petroleums occur in the western part of the United States, particularly in California."

Asphaltic petroleum is also found in the Island of Trinidad, British West Indies.

"Malthas.—Malthas are very viscous semi-asphaltic or as asphaltic native bitumens, holding an intermediate position between the petroleums of an asphaltic nature and the native asphalts.

"Asphalts.—Solid or semi-solid native bitumens, consisting of a mixture of hydrocarbons of complex structure, largely cyclic and bridge compounds, together with a small proportion of their sulphur and nitrogen derivatives, but free from any appreciable amount of solid paraffins, melting upon the application of heat, and evidently produced by nature from petroleums containing little or no solid paraffins. Solid or semi-solid residues, produced from probably similar oils by artificial processes are sometimes called apshalts, but should more properly be termed oil asphalts."

The point of the greatest interest in these definitions, as far as the use of these materials in road construction is concerned, is the differentiation of the asphalts into native and oil asphalts. The native asphalts are produced in nature at ordinary temperatures by natural causes, extending over a long period of time. The oil osphalts are produced industrially by the distillation of asphaltic oil. The first material is produced by natural causes; the second by industrial processes, subjected to all the variations inherent in such processes as manipulated by the hand of man. There is a very striking difference between the two materials.

While satisfactory sheet asphalt pavements have been constructed with both materials, this is due to the fact that the consistency of the bituminous binder in this case is much harder than where the same materials are employed in road construction. Where the oil asphalts are made of a sufficiently soft consistency to enable them to be used with the mineral aggregate of rock by the penetration or mixing processes, such material is very susceptible to the temperatures occasioned by the sun's heat. It is drawn to the surface and the road becomes sticky and unpleasant, and eventually the binder is altogether lost. The native asphalts, on the other hand, have a much greater body and stability. They remain where they are placed in the road, and are not drawn to the surface by the sun. On this account they have proved to be far superior to the oil asphalts.

In this connection it appears that much confusion has arisen from the statement that the asphaltic oils in use as dust palliatives, or as bituminous binders for road surfaces, contain certain percentages of asphalt, and this has frequently led to the belief that the stated percentages represent that amount of native asphalt which has been added to the oil. This, of course, is not the case. It merely means that if an oil, of whatever consistency, is heated until the more volative portion is removed, and the residue has a consistency such that a No. 2 cambric needle will penetrate 10 millimeters in one second under a weight of 50 grams 78° F., a residue will be obtained which may be regarded as an oil asphalt. It is a very different material, as used in road construction, from native asphalt, and should not be confused with the latter. It is far less stable at high temperatures, such as that existing when a road surface is exposed in the sun in summer.

The most important road-building of the past two years in Massachusetts and New York has clearly demonstrated the superiority of the lake asphalts as road binders. They do not "bleed"—coming to the surface to be carried away by vehicle tires or tracked into houses, nor do they volatilize, and so lose their cementing qualities.

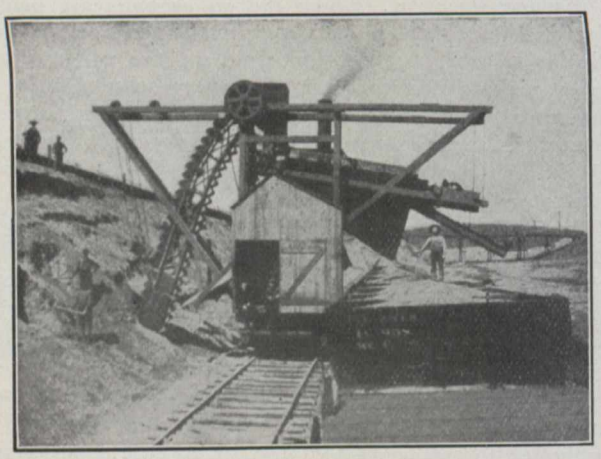
So far as the United States is concerned, the adaptability of asphaltic macadam for city boulevards and town streets, as well as country roads, is firmly established, and there is no doubt that this form of construction is destined to be very widely adopted wherever the conditions demand a smooth, dustless, durable highway of moderate cost.

## A SMALL PLANT FOR ROAD MATERIALS.

Much interest is being shown at the present time in the arrangement and operation of stone-crushing and gravel plants, since the importance of both portable and stationary plants of this sort has increased in proportion to the increase in good roads and concrete construction. Cities and county road boards maintain such plants in a large number of cases, and not infrequently private parties or contractors, who do large amounts of local road work and concrete construction, build and operate their own plants.

A small plant for excavating and preparing sand and gravel for road work, concrete and similar purposes, which is illustrative of what may be done in this line, is operated by the Mount Calvary Sand and Gravel Company, near Columbus, Ohio. There is a great deal of gravel surfacing done on the roads in the vicinity of Columbus, and the principal demand on the plant is from this source.

In the early extensive road improvements in the central and southern parts of the western half of Ohio gravel was used for the wearing surface. This early work was practically confined to the region where an abundance of gravel



**Elevating and Screening Plant.**

is found. The highways in and around Columbus have been improved rapidly in the past few years in a similar manner. The foundation bed in practically every instance is very hard stone, and the wearing surface is gravel. The use of the stone is the result of extensive gravel deposits in the western part of Columbus and vicinity, although strata of solid limestone and granite also occur.

In the Scioto Valley, in which Columbus is located, large areas are made up of alternating strata of sand and gravel. The latter is abundant in sizes, grading downward from the size of an egg. Boulders also occur in quantities in the deposits. Most of it consists of flint, extremely hard granite and limestone. These deposits were brought down by glaciers and spread over a wide territory. In this manner the valley was partly filled, and it is the opinion of geologists that the entire western side of the valley is sand and gravel at the bottom.

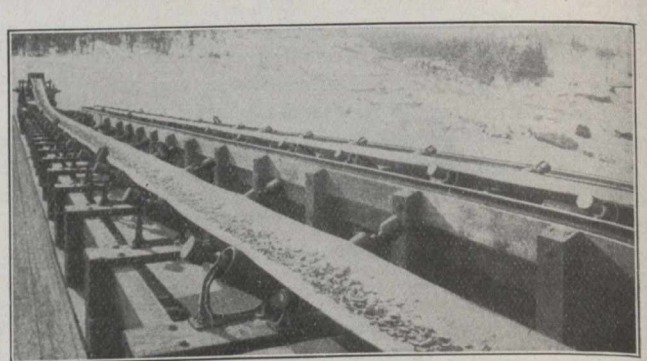
When the gravel pit used by the plant in question was opened several years ago, some twenty-four to thirty workmen were required to operate it. But within the last year a mechanical installation has been made, which enables nearly 80,000 cubic yards to be excavated, washed and delivered to cars or wagons each year with an average force of only nine men.

A steam shovel with a ⅝yd. dipper is used for excavating the material and loading it in 1½-yard side dump cars. A portable plank track provided for the steam shovel permits the latter to move about the pit readily. The shovel handles from 400 to 600 cubic yards per day, working against a face 15 to 25 feet in height.

The cars deliver the material to a receiving hopper placed below the ground surface at a distance of 150 feet from a screen house. At the bottom of the hopper is a four-way adjustable plate feeder for delivering the materials to a belt conveyer. This feeder is operated by a crank and connecting rod driven from the foot-shaft of the conveyer. The crank is fitted with an adjustment, which enables the flow of the materials to be regulated from 200 to 400 cubic yards per day, according to the desired capacity. The feeder is built with concentrating side plates, which gather the sand and small gravel and deliver them to the centre of the trough-shaped belt conveyer. The latter transports the materials up an 18-degree incline on a trestle to the top of the screen house. The conveyer is a 16-inch Jeffrey five-ply rubber belt, having an extra rubber cover. It travels at a rate of 250 feet per minute.

Approximately 50 per cent. of the deposit in which the pit is located consists of sand. The sand forms a convenient bed on the conveyer for boulders measuring 8 to 12 inches in diameter, so they are carried up on the belt without rolling. The conveyer discharges the material to an inclined Jeffrey revolving screen, which separates the sand from the stone. The sand drops to bins below the screen, while the tailings are dumped through a chute, set at an angle of 40 degrees, leading to a crusher. The latter can be adjusted for reducing the boulders to cubes from ½-inch to 2½-inch sizes. It discharges into a bucket elevator of the continuous Jeffrey type. This elevator has buckets 12 inches long by 8 inches wide and 12 inches deep, mounted on a continuous chain. It delivers the output of the crusher to a second revolving screen, which separates the material into four different sizes. The first part of the screen removes the dust; the second portion, the pea-gravel; the third part of the screen removes the curbing, or concrete gravel, and the tailings, consisting of 2½ to 3-inch pieces, used for heavy concrete and pavement foundation work. A 55-horse-power horizontal steam engine supplies power for operating the conveyer, elevator and screens.

The various sizes of stone are delivered by gravity to bins, from which they are discharged through gates into wagons, driven directly under the building. The bins also are arranged to discharge into railway cars on a track under the structure.



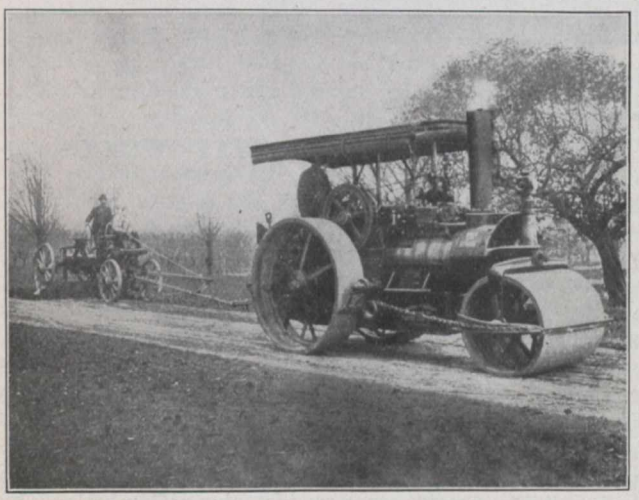
**Handling Crushed Stone at Plant of the Cedar Cliff Stone Company.**

On account a large portion of the deposits being sand, a washing system has been installed to insure a clean product. The sand is delivered by water from the bottom of the bin through a flume to two Jeffrey spiral conveyers, each set at an angle of 20 degrees in separate water-tight tanks. One of the spiral conveyers takes the sand from the bottom of the first tank and carries it into the bottom of the second tank. The conveyer in the second tank washes the sand again and discharges it directly to wagons. The water overflowing from both tanks carries away the loam and clay, leaving the clean sand.

## DOUBLE CYLINDER STEAM ROAD ROLLERS.

The Waterous Steam Road Roller is adapted to road making in all its processes. For breaking up old roads, the steel picks in the rear rolls are employed or a road plow or scarifier can be attached to the drawbar. Double speeds make the Roller particularly useful in consolidating the foundation and in putting on the road metal and top surface, as the slow speed will give the necessary compression for the foundation work and the fast speed can be put on when less rolling weight is required.

The Waterous Roller has proved itself the most practical power for hauling a road scraper. The cost of operation is about one-third the cost of hauling with horses, and by using a Roller the centre of the road is being thoroughly consolidated while the gutters or ditches are being scraped



**Waterous Road Roller Hauling Grader.**

with the road machine. The cuts on the preceding page illustrate the Roller doing this work on the level and on a heavy grade. This is only possible in a machine like the Waterous Roller, where the large steam space between the cylinders and the location of the dome on the boiler, permit running head-on down hill with little danger of flooding the cylinder with water.

Besides acting as a traction for plow and road machines the Roller can be used to haul material for road building, and by the use of the driving pulley it can be used as a power for driving a stone crusher. Thus with the Waterous Roller, stone may be broken, hauled, and later rolled into place, all with the same machine.

## BITULITHIC.

We publish on this page two pictures of a type of pavement which is steadily gaining ground all over the continent.

There are only a few good pavements when all is said and done, and they all wear out sooner or later. Engineers begin to admit generally, as they are reported to have done at the recent convention for arranging standard paving specifications, that the pavement illustrated here is a scientific design.

The modern conventional asphalt pavement is good, but Bitulithic is now admitted to be better. The one is an artificial bituminous sand stone, more or less granular and porous, the other an artificial bituminous limestone or trap, practically solid and waterproof.

Like many good inventions, bitulithic is really simple and consists only in covering well chosen broken rock in sizes varying from one and one-half inches, or one inch down to impalpable powder, with just enough bituminous cement to completely cover each particle of stone, no matter what size it is.

In order to do this effectually, it is necessary to dry the stone thoroughly, thus avoiding the well-known weakness of tar macadam—the stones of which have enough dampness to always prevent perfect contact with the tar.

The stone thoroughly dried is stored and sufficient of each size taken in each batch to reduce the voids in the whole to approximately 10 per cent.

Having by means of a mixer, with several sets of blades on two revolving shafts, covered this selected and dried stone with a carefully mixed bituminous cement at a temperature found from experience to be safe—that is, not hot enough to burn the bitumen and so injure its binding qualities, the product is spread on the street to the proper thickness and rolled when hot till it is completely closed.

Note the picture of section—if properly manipulated it is quite practical to "close up" bitulithic till not a pin point is visible in a sawn section.

After the surface is rolled to such a degree of density that the roller makes no further impression, there is then spread over it a thin coating of bitumen to fill the minute pores on the surface of the pavement, which is followed by the spreading of a thin layer of small stone chips which are rolled into the pavement and give it a rough grainy surface.

Engineers have also been slow to realize that for a pavement of this type, an expensive and non-resilient concrete foundation is not imperative. Western Engineers who have Portland cement at $2.50 per barrel to pay for, are more ready to lend a kindly ear to the suggestion that perhaps after all their conservatism as to Portland cement concrete may have approached superstition or fetish worship even. and that if a foundation of broken stone coated with bitum-

**(Surface) Columbia Bitulithic.**

inous cement is laid on a rolled sub-grade and a waterproof surface which can be kept waterproof, laid thereon, perhaps after all that pavement is a better pavement than one laid on concrete. Anyway they are doing it and the horsemen like it.

The Columbia Bitulithic Company has four miles of it to lay for the Province and some for the city, but most of the city work is on concrete on account of bad bottom, and very recent sewer excavations.

The second photograph shows the rough surface of the Vancouver pavement. Taking a look at the street as a whole the casual observer would not distinguish it from asphalt, but the horses do. The roughness is there and the animals feel it promptly and reach out differently and more confidently. Information regarding the plant necessary for laying this pavement can be had from the inventors, Warren Brothers, 59 Temple Place, Boston, who are prepared to instruct any town or city where there is not already a contractor laying bitulithic.

**(Cross Section) Columbia Bitulithic.**

## THE OPPORTUNITY FOR TECHNICALLY TRAINED MEN IN HIGHWAY WORK.*

**By A. N. Johnson, State Highway Engineer of Illinois.**

In 1905 it was my pleasure to have an opportunity to address the Society for the Promotion of Engineering Education, at which time I argued for more systematic instruction in highway engineering. Since then the arguments for additional attention to the subject of highway engineering in our technical schools have been considerably strengthened by the greatly increased activity in this line of work.

Possibly some of you who have not followed recent developments in highway construction are not aware of the magnitude of the public interest that is being aroused and of the already large practical results that have been secured. It may, perhaps, be well to pause for a moment to glance at what has been done in the past and trace briefly this growth.

In the early days of this country the art of road-building was recognized as important, and given considerable attention. Had it progressed as it began, we should have far different conditions to-day. Many of the roads first opened, that is, the through roads, were turnpikes. These were constructed during the period from 1800 to 1840, chiefly in the longer settled portions of the country along the Atlantic seaboard. While the principal rule in their location seems to have been the straight line, yet the roads which crossed the mountains were located, in many instances, with considerable skill. Their location, however, is not such as would be made to-day. They were usually contracted for with a limitation as to maximum grade, generally five degrees, or about eight and one-half per cent. The contractor, therefore, allowed himself in every instance the maximum grade, thus causing considerably more rise and fall than present good practice would permit.

The most noted of the roads built at this period is the National Road, which joined at Cumberland with the private turnpikes that had been built from Baltimore through Maryland to Cumberland. It was proposed that the National Road should run from Washington through the Alleghanies west to St. Louis. A portion of the road from Washington was already turnpiked, so that the actual construction began at Cumberland, Maryland, in 1804. At this point the first considerable range of mountains was encountered, and it was necessary to locate the road over them. The route taken was nearly the same as followed by Braddock during the French and Indian wars. The road crossed near Dans Mountain over a "saddle-back." Later on, about 1840, a portion of the road west of Cumberland was relocated, following Will's Creek, crossing just above Cumberland by a substantial stone bridge, thence along the bank of the creek through what is known as The Narrows, in this way avoiding going over the mountain and making a road with comparatively light grades. Moreover, the distance was not greatly increased.

Throughout the portion built as far as Columbus, Ohio, at which point the macadam proper stops, stone bridges were usually made of what is known as one-man stone, that is, the stones were no larger than could be handled by one or two men. It is evident that some contractors in the olden days were to a degree proficient in the gentle art of making what can be seen look like what it is not, for, while the faces of many of the arches are laid handsomely, the inner stones are put in very poorly, and the mortar has fallen out and exposed rock which are larger on the intrados of the arch than where they project through to the extrados. The natural result followed, and I have seen a number of these bridges which it has been necessary to support by timbers, and others that have entirely caved in; many others, however, are still holding, apparently the only damage to them being to the parapet walls.

The road, for the most part, was paved about twenty feet wide with large stones, which still remain, and where it has not been kept up and the layer of smaller material has worn away, a rougher road could scarcely be imagined. In times past there was an immense amount of travel over this road. Inns and toll houses were located at comparatively short intervals. Stages and caravans were scarcely out of sight of one another, as all of the trade to the Ohio country from the East went by this route. To-day many por-

* Paper presented before the American Association for the Advancement of Science, St. Paul, Minn., December, 1910.

tions of this road are scarcely used. The Baltimore and Ohio Railroad, which it parallels closely, has absorbed all the through traffic, and the travel in the neighborhood is on the roads at a right angle to the former line of travel.

It was the introduction of the railroads which turned the attention of the engineers of that day from locating wagon roads to the location of steam roads. From then until but a few years ago, highway construction and location received scant attention from the engineers, and there was apparently little interest taken in the rural roads in any section of the country until about the year 1890 and the few years following, when the advent of the bicycle called the attention of large numbers of people to the condition of the roads. The interest and agitation brought about at that time resulted in the States of New Jersey and Massachusetts considering the question of highway improvement from a state-wide viewpoint.

It was at this time, 1893, that the first course offered in highway engineering in this country was opened at Harvard University. Lectures were given at that time by Mr. W. E. McClintock, chairman of the Massachusetts Highway Commission. After that, up to 1905, eleven of the fifteen principal schools in the country gave courses in highway engineering, although the time devoted to such courses averaged but thirty-two hours. In the past few years a number of schools have greatly enlarged this work, and give nearly as much time to the subject as is given to other branches of civil engineering.

At about the same time that the States turned their attenion to road improvement, the Government also appointed a bureau of inquiry on the same subject. Unfortunately for the first few years of the history of this branch of the Government service, it was not conducted on a plane that could command the respect of scientifically trained men, and it has been only within the past six or seven years that it has been brought to a standard that makes it an aid to engineers generally.

We are now on the eve of a renewed interest, which will result in as great an advance as was made in the early 90's through the influence of the bicycle. A few years ago, if the roads extended for eight or ten miles in good condition, they satisfied the needs of that locality. To-day the automobile demands stretches of road from one to two hundred miles in length, and not only have the demands been made, but the construction of these long stretches of road is actually under way. In Massachusetts, the roads that were constructed have been gradually connected until there are long reaches, one piece so connecting with another that practically all sections of the State can now be traversed over improved roadways. New York is building roads throughout the Adirondack sections for little other purpose than to accommodate this class of traffic. Massachusetts, aside from the road work of its highway commission, has constructed many miles of boulevards and parkways, extending the park sytsems many miles in all directions, connecting the seashore drives with inland woods and ponds. Connecticut has constructed trunk line roads; likewise New Jersey; and yet, this work is but in its infancy.

It is, perhaps, well to glance for a moment at some of the expenditures that have been made for improved roads outside of those made by local communities for the improvement of their village or city streets. During the period since 1893, twenty-four States have made appropriations for road work to be done under engineering supervision. The total amount appropriated by the States for this work up to 1909 was about $56,000,000. In general, an equal amount has been added by the local communities, so that the total amount of road work done is not less than $112,000,000, practically all of which has been under engineering supervision, and two-thirds of which have been spent within the past six or seven years.

The past few years have seen a greater proportionate amount expended. Some of the counties of California are appropriating more than many States. Within the past two or three years, for example, Los Angeles county appropriated $3,000,000; San Bernardino county, about $2,000,000; San Diego county, $3,000,000. In each instance these counties secured engineers trained elsewhere.

In addition to the expenditure for improvements under the direction of highway engineers, there still remains a much greater amount spent annually on our roads and bridges, which, for the most part, is not spent under men with technical training in highway work. The statistics gathered by the United States Office of Public Roads show that a total of eighty millions of dollars a year is spent on our rural roads, the annual expenditure is nearly $7,000,000.

With the fact generally recognized, and becoming more and more apparent, that much of this money, through wasteful methods of construction, does not make to the taxpayers even a reasonable return, there is being placed, and will be placed, still more funds under trained men.

It seems to the writer that in our plans for road improvement, both those that have been carried out and those under consideration, we have neglected to provide the trained men, or if we have not wholly neglected it, are not giving it the consideration that is necessary if we are to have a well-balanced development. Generally, the comments that are made in comparing the work in this country with that in Europe, particularly in France, seem to be that, while there are as well-constructed roads built in this country as abroad and as scientific methods of construction used, our systems of maintenance are far behind, with the result that in general our roads suffer in comparison. Proper maintenance means proper administration; work planned and laid out on a scientific basis, necessarily involving the constant employment of men especially trained for maintenance work. France has provided for this most important feature of maintenance by a school, long established, for such training. There it is recognized that there is a definite career in administering the public highways.

In this country we have begun on an era of road improvement. We are interesting and educating the public at large to an appreciation of the value of this phase of improvement. The public is becoming convinced, and is investing, and ready to invest still more, money in such work. If such improvements are to be a success they must be maintained. It is necessary that the best methods of administration and construction be understood and studied together. A body of trained men will be needed; is in demand now. Are we preparing to take care properly of the expenditures made and to be made. Do we provide in our technical schools for this line of public work as we should provide in order to have it administered in the best fashion, and in a way to secure a system of roads equal to the needs of the near future.

It is the writer's opinion that we are not; that our technical schools, even where courses in highway engineering are given, are too confined in scope and conception; that the student is not, as a rule, given much encouragement as to the possibilities of a career in highway engineering.

It would seem, therefore, that the engineering schools have a twofold function in working toward the desired end. In the first place, they should enlarge the scope of their courses; study present methods of administration; devise improvements over present methods; study economic con-

ditions that govern a system of roads. And secondly, by instructing the young men in the various technical schools as to the possibilities and importance of the work they would exert a strong influence throughout the country for the betterment of conditions. To-day, people in many communities are ready to admit that their methods of administration are wrong and do not give the results they wish, but at the same time they do not know how to better them.

It may not, perhaps, be amiss to cite a specific point that has come under my experience. In Illinois, and the same applies to nearly all the States in the upper Mississippi valley, and to others situated in other sections of the country, there is expended on highway bridges not far from one-half of the total amount spent by the rural taxpayers on roads and bridges. That is, in Illinois, there is expended upwards of three millions of dollars per year on bridges. In but few instances, so few that we may say practically all, have bridges been erected under the supervision of an engineer retained by the local officials paying for the bridges. They have been designed almost exclusively by the companies erecting them, with the result that they were made as light as possible, and cost, in too many instances, much beyond the worth of the structure. Slipshod, ephemeral devices and contrivances were employed, and it is no unusual experience to replace a structure in the course of eight or ten years. The State Highway Commission of Illinois was, I believe, the first State Commission in the country to give specific attention to highway bridge construction. There was offered, without cost to the local officials, assistance in the design, estimates and supervision of the erection of such structures, with the result that a most marked change in the character of highway bridges has been made. Concrete bridges were introduced where formerly light, temporary steel structures had been built, simply because the local officials did not have the experience or knowledge to erect the proper structure.

Shortly after the inception of this work by the Illinois Highway Commission, it was taken up by Iowa, Wisconsin, Minnesota and a number of other States. So little attention, however, had been given to the subject that there were few text books or specifications extant that provided proper loading for the designing of these structures. Traffic conditions had changed, methods of construction had changed, with the result that it was necessary to develop specifications and many of the important details of construction.

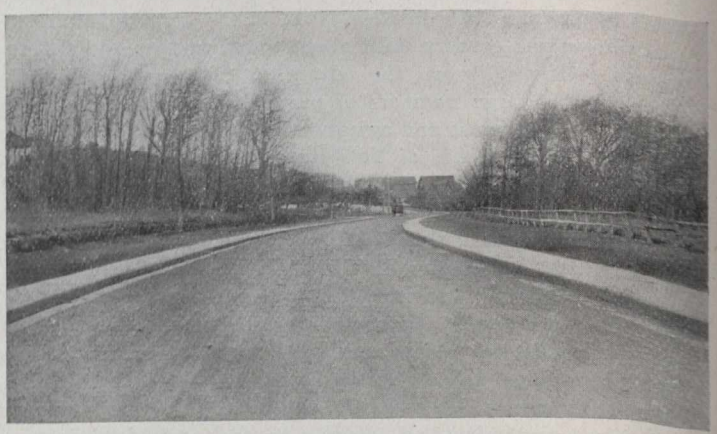
The appreciation of this work on the part of the public is manifest, and illustrates the opening that there would be for engineers if proper methods of administration were possible and better understood.

Improved methods of administration are studied and knowledge of them dispensed to-day almost solely through the various state highway departments that have been established from time to time. It seems now that the time has come when not alone the necessity but the opportunity for the practical application of these principles should be made a matter of more serious study in our universities, so that knowledge of them may be more widespread, and may be better understood by intelligent men everywhere.

## MODERN PAVEMENT CONSTRUCTION.

The zone between the paved streets of the business district and the country road has always been a difficult problem for the municipal engineer. Often confronted by traffic conditions that would warrant the use of stone block or other high cost permanent pavement, he is yet bound by considerations of cost and a long mileage that limit his choice to a pavement of a low cost of construction. In many situations the broken stone road or macadam, as it has come to be called from John McAdam, its greatest English expounder, has very well filled the roll of a cheap and fairly durable pavement.

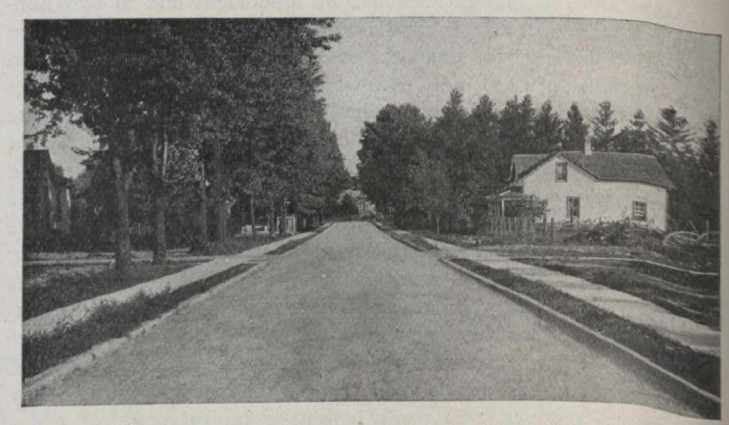
The change in traffic conditions in the last few years has altered the situation very materially. Where formerly good macadam was all sufficient for the traffic, to-day ruined roads are in evidence unless the authorities have kept abreast



**Westmount, Quebec, Westmount Avenue.**
**"The Modern Tarviated Pavement."**

of the times and treated their roadways to withstand modern traffic. The automobile has brought about this change. The soft pneumatic tires, at first looked upon as a solution of all road difficulties, proved the worst of enemies to good roads. Their griping, yielding surface took fast hold of the binder and even the stones of a macadam road, and the tractive effort of the vehicle was expended in throwing the road over the landscape.

Surface applications of bituminous materials, refined tar, oils, and the Tarvias, have served to hold the surface temporarily, but it has been recognized by good engineers everywhere, that the remedy should begin lower down and that the road should be constructed throughout to stand the increased strain put upon it.



**Stratford, Ont., Charles Street.**
**"The Modern Tarviated Pavement."**

Bituminous pavements constructed by the mixing method answer the requirements very well indeed, but their high cost limits their use except in favored situations. Excellent examples of this class of work are found in Ottawa and in Hamilton. The materials used have been refined tar and crushed stone. While the cost has been reasonable, it has not been low enough to recommend the method in general suburban use.

Another method of construction has lately come into prominence and has become known as the penetration method. The first of the modern work along these lines was put down in 1906 at Somerville, Mass., under the direction of A. B. Cowdery, formerly of the Barrett Manufacturing Company, and now the district manager of the Paterson Manufacturing Company, of Toronto and Montreal. The first street, Essex Street, proved such a success that the building of such streets has been widely copied.

Two years ago, Mr. Cowdery made further improvements in the method of building the pavement and gave it the name of the Modern Pavement.

During the past season, roads of this type were built in Berlin, Guelph, Picton, Westmount, Toronto, Stratford, Outremont, and by the Harbor Commission in Montreal and at Truro, N.S.

The Modern Pavement has been a gradual growth, but as it is laid to-day, many novel features are presented. The foundation is built as for an ordinary macadam road, but care must be exercised to get a good solid base, well drained and well consolidated. Putting a good surface on a poor base is not economy since the best of tops will go to pieces with a yielding foundation. Wherever the ground is soft or clayey, especial precaution should be taken to insure a well drained firm base.

The base course is laid with a good quality of broken stone, sized to pass a 3-inch screen and be retained on a 1-inch screen. Usually four inches are sufficient, but if the foundation is soft, a greater depth of stone should be used. The stone is consolidated with a ten-ton roller and filled with gravel or screenings, as is usual in the construction of a good macadam pavement. When the rolling is finished, there should be no free filler left on the surface.

A layer of sand or clean fine gravel is then spread over the surface. This layer should not exceed 4½ inches in thickness and the road should not be rolled after the application of the material. Tarvia, heated to a temperature of 250 degrees, is spread evenly over the sand using a little less than one gallon per square yard. The layer of sand or gravel retains the Tarvia and does not permit it to run down into the base course.

Over the Tarvia is then spread another layer of the same sized stone as used in the base, gauging the thickness so that it will add about 2½ inches to the road after rolling. The road is now well rolled. This rolling is an important feature in the construction of the pavement as by its means the Tarvia is mixed with the gravel or sand and then the combination of the two is forced up between the second layer of stone, forming a matrix, which holds the stone in place very firmly.

After the road has been well rolled and the matrix is shown to have come up between the stone, another layer of hot Tarvia is spread upon the road. This coating should be about 1¼ gallons to the square yard, and like the first, should be very evenly distributed to get the best results.

A light coating of ¾-inch stone is then spread upon the road and the road rolled until solid. Considerable care is necessary in applying this light layer of stone, as enough should be put on to thorughly chink in and smooth up the surface, but not enough should be applied to form a distinct layer. If a layer is formed, it is very apt to cause trouble when the third coat of Tarvia is applied.

In every part of the operation, the following coats of Tarvia should be so put on that they go through and unite with the coat beneath, thus forming a solid pavement thoroughly coated with Tarvia from top to bottom.

**A Westmount Pavement.**

If a rough surfaced pavement is wished, the road may be finished by adding peastone or gravel with further rolling. On level stretches of road, or where a smooth surface is wished, another coat of Tarvia is applied.

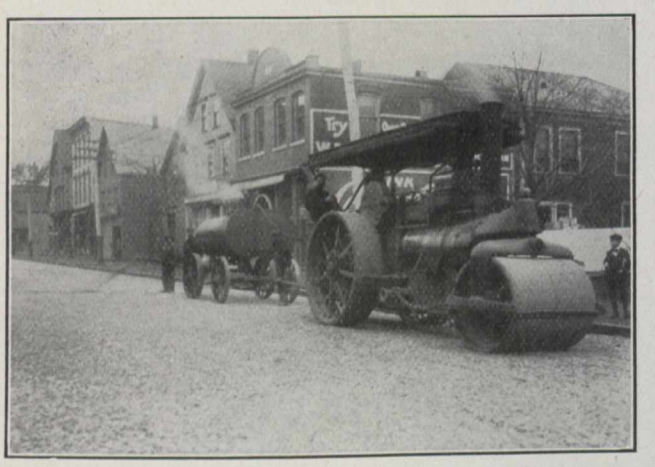
Under heavy traffic conditions or on level ground, this third coat of Tarvia is found to be economical and desirable. In the case of heavy grades or where it is desirable to have the rough surface produced by the faces of the stone coming to the top, it is omitted.

When the third coat is put on, it should be spread on very evenly to an amount not exceeding one-half gallon per square yard. A light coating of screenings, or gravel, is then applied and the road rolled again. If Tarvia shows on the road after rolling, more gravel or screenings must be supplied.

The novel features of this construction are the use of the large stone throughout the pavement from the foundation to the top. The added wearing qualities of a large sized stone have long been recognized, especially in England, but it has not been feasible to hold them in place in the ordinary water-bound macadam. The use of a bituminous binder permits, however, the solution of this part of the

problem, and a road is produced which will stand much harder wear than a road built with the ordinary ¾-inch to 1¼-inch stone on the surface. The employment of a larger stone also makes it feasible to use a bituminous pavement on a much higher grade than before, since the larger stone at the surface form a desirable roughness, giving a foothold for horses. Grades of upwards of 10 per cent. have been conquered in Westmount in this way where before it was not thought feasible to lay any kind of a bituminous pavement. The larger stone also gives a much greater stability to the entire pavement, and if ordinary care is used in the construction, no trouble is experienced with the rolling up of the pavement into waves, an undesirable feature which has been inherent in bitumious pavements constructed with a mineral aggregate of small sized particles.

The idea of using a matrix to bed the second course of stone, is not entirely novel, but the method of forming it by the penetration method is entirely new. The results



**Spreading Tarvia on.—Second Course.**

have been admirable so far; the method has seemed to be in every way equal to the older and much more expensive mixed methods. The pavement when finished and thoroughly consolidated, seems to be compact and stable throughout. Even with a comparatively heavy traffic, it stands up well and has all the desirable features of a macadam road without its drawback.

At this time, only a general idea of its cost in different situations can be given, but careful records have been kept in a number of places and the costs, even under unfavorable conditions, does not much exceed $1.00 per square yard. In favorable places, the work may be brought down to as low as 75c. per square yard. By modifying the specification, re-surfacing work can be done at an extremely reasonable figure, even below 50c. per square yard.

The methods of applying the Tarvia vary greatly in different places, due to the differences in transportation facilities, to the situation of the work and to the size of the contract. At Toronto and in Westmount, Tarvia was delivered directly from the factories of The Paterson Manufacturing Company to the job in tank wagons. These tank wagons were supplied with spraying apparatus giving an atomized spray of Tarvia. To operate the nozzles properly, pressure was necessary, and this was supplied by a steam connection from the road roller which was used to draw the tank wagons over the road. The apparatus works perfectly and a good workman is able to put on a coating, varying from one-fourth of a gallon per square yard up to two gallons per square yard, with perfect evenness. Some little experience is necessary to gain this skill, but once gained, better work can be done than with automatic sprinklers which distribute the Tarvia evenly over the whole surface. As it is impossible to apply a coating of stone evenly, some variations must be permitted in the coating of Tarvia and a skilled workman can do this with his hand and eye, so that a more perefct job is permitted than where an even coat of Tarvia is applied by machine over all the surface.

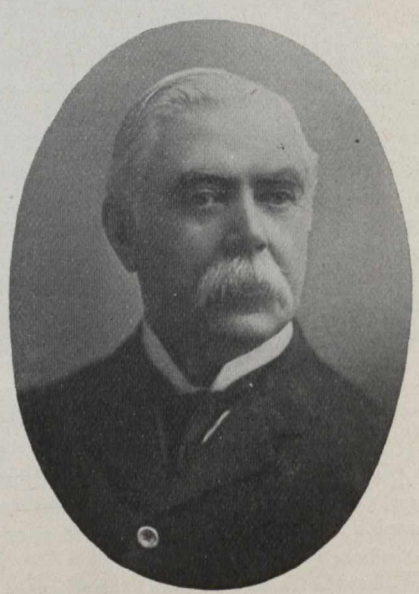
The use of tank cars equipped with steam coils makes this method equally favorable for contracts wnich are large enough to use a tank car of material. In this case, the Tarvia is heated in the tank car and then drawn into the tank wagons, which are equipped with fire boxes for final heating of the Tarvia and with spraying apparatus for distributing it on the road.

On smaller jobs and where it is more feasible to ship in casks, the Tarvia is heated in kettles and distributed with some type of pouring can, or in case wheel kettles are available, through a hose and nozzle attached to the kettle.

The care and cost of maintenance of the Modern Pavement will vary with the traffic conditions. In any case, however, it will be found to be a very practical pavement to keep in good condition. Repairs where necessary can be very easily made, since fresh applications of tar materials will unite easily with the surface of the old road and patching, when necessary, due to trench openings for pipes, can be made in an extremely satisfactory way through the employment of an inexpensive outfit. The Modern Pavement in this way differs from other pavements of a like quality of permanence, since these require in almost every instance an expensive plant for mixing and supplying the required materials. The surface also lends itself admirably to the application of thin tar materials as dust layers and as road preservatives.

Roads built with Tarvia materials and kept up by annual applications of thin Tarvia, have shown, in the vicinity of Boston, Massachusetts, a great economy of up-keep over other methods of maintenance.

A further development of this type of construction will be watched with interest throughout the Dominion. It attacks a problem which is presented to every road engineer in a very practical way. Future improvements may be looked for in the method of applying the Tarvia and in the arrangement and sizing of the stone.



**Capt. Killaly Gamble,**
**Secretary of the Ontario Land Surveyors.**

# The Canadian Engineer

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## CONTENTS OF THIS ISSUE.



## ROAD CONDITIONS AND INDUSTRIAL CONDITIONS.

In Canada, where agriculture is among the chief industries of people, the prosperity of the country will be reflected in the prosperity of the farmers. Good crops and activity of the farm has a beneficial effect on general trade conditions.

It follows, then, that conditions which detract from the prosperity of the farmer have a serious effect upon the trade conditions of the country, and an improvement in conditions which add to the farmer's income or profits will have a tendency to better the trade of the country.

One of the most serious drawbacks that the Canadian farmer has had to face was the condition of the highways in fall, winter and spring. In some communities to-day at certain seasons of the year the rural highways are almost impassable, and for weeks at a time the farmer never thinks of attempting to team to market. The farmer, knowing that such conditions recur with the seasons, has been in the habit of marketing his crop before the roads break up in the fall. This means that in the autumn there is an over-supply upon the market; prices drop to that point where the commission man, the merchant and the storehouse-keeper can afford to buy and store for distribution at a period of the year that the farmer cannot reach the market.

The farmer—the producer—loses on the sale, and the consumer, instead of paying the producer, pays the middleman. The producer, therefore, gets a lower price for his products than he would if he could supply the market more uniformly.

Aside from the lower selling price, the expense of hauling produce over the ordinary country roads is another source of loss to the farmer. The cost of hauling over ordinary unimproved roads varies from fifteen to sixty-five cents per ton mile, with an average of about twenty-five cents. On good macadam roads or better, properly maintained, the cost will be from twelve to ten cents per ton mile. It may be fairly claimed that this excess over the twelve cents per ton mile may be styled a loss to the farmer, and these losses work direct losses to the merchant and the manufacturer.

Not only does the country merchant and the wholesaler suffer because of this intermittent marketing of produce, but the railways find great difficulty in handling the irregular traffic for them. At one time they are working their men and rolling stock capacity, and at another time thousands of cars are idle.

Communities to-day realize that the market highways leading to commercial centres must be improved. The city of Toronto and the county of York are preparing to spend $300,000 on market roads leading into the city of Toronto. This is the first example of a Canadian city granting money to improve highways outside of the city limits, and it is confidently expected that results will encourage other centres to lessen the cost of living by transportation.

In Canada most of our roads have been maintained by the statute labor system, and frequently the money spent on repair work has been as good as wasted. With the establishment of good roads systems and the construction of roads to government standards, it is time that our roads were built and maintained under the direction of experts, that we may receive good value for our outlays.

## TORONTO'S WATER SUPPLY AND ITS CITY ENGINEER.

Toronto has of late been, and remains in a precarious position relative to its system of water supply.

Forty million gallons of water is daily demanded from the lake.

This water gravitates by means of an intake pipe from a point immediately south of the Island, proceeds under Toronto Bay, and discharges into a well, from which it is pumped to the city mains.

Within the last three months Toronto has been twice without water for short-time periods.

The cause of failure has been proved to exist in a break into the six-foot steel intake pipe at a point about 600 feet south of the Island. Consequently, Toronto has had to rely upon Bay water for its supply. Fortunately, the water is being disinfected in a most thorough manner by calcium hypochlorite. Consequently, very little inconvenience has resulted from the mishap, and the city has, with the exception of a few hours, been supplied with wholesome water of a sufficient quantity.

As is the case in practically all civic engineering mishaps, the permanent engineering staff has been the target for much adverse criticism.

This criticism has been in the most part grossly unfair, and of a nature to create reflections of an odious character upon the City Engineer and his lieutenant (Waterworks Engineer Fellowes).

The accident to the intake pipe is of a character which no engineering knowledge, supervision or efficient administration could have foreseen.

The method of dealing with an unknown cause, in probing it, and administrating under most critical conditions reflects the highest credit upon the engineering ability and adaptability of the City Engineer and his staff.

The City Engineer has said: "Criticize my department to your heart's content, but criticize fairly."

Surely such an appeal must hit straight the predominant sentiment of all Britons, that of **"Fair Play."**

Toronto is about to elect a commission of three experts to report upon the whole water question. Such a commission should prove valuable at the present juncture. Money will have to be spent on Toronto's water problem. The people will have to vote this money, and it must be granted that an affirmative vote will only be obtained on the assurance that the recommendations are based upon actual data and evidence, and are of such a nature that all chance of recent occurrences are entirely obviated.

Such a commission will prove of value to the permanent engineering staff, if the commission work in conjunction with the staff and not as critics.

The city of Toronto will gain nothing by ignoring their permanent staff of engineers, which is acknowledged to be the most efficient civic engineering staff in Canada.

The whole question of the water supply, for the present and future Toronto, requires to be dealt with on a broad basis by men who are acquainted with local conditions. The question is one of common sense, tempered with an engineering knowledge of possibilities and of impossibilities.

## ONTARIO GOOD ROADS ASSOCIATION.

There is a meeting this week in the city of Toronto of the Ontario Good Roads Association. This association is composed largely of those who have to do with the rural highways of Ontario, and it is gratifying to learn the wide interest that is taken in the work of this organization and the attention that is being given to local transportation, which is undoubtedly the greatest and most difficult problem in Canada.

In the struggle of the pioneer settler no one had time or money to do anything with the roadways, and as a result for years after the settlers hauled their freight over roads well-nigh impassable.

It is just now that people are realizing the leakages caused by the daily cost of such haulage. Organizations such as the Ontario Good Roads Association do splendid work making known the great value of good roads, and in showing that the poorest roads are the most expensive.

With the introduction of the automobile, both light and heavy, the time has arrived when new roads must be built, and existing roads put into such condition that interchange of products will be easy and cheap.

To do this efficiently and economically it will be necessary that the work be carried on by the provincial governments, so that this work may be directed from a central point, for, unless some broad, general plan is adopted and adhered to, local influence will be continually at work undoing much of the larger scheme. All this is going to cost money, and the taxpayer must be educated to know that it pays him to build good roads, and it is through the Good Roads Association that this work can best be done, for then the people will enter heartily into the project, for they will realize the advantage and importance of the movement to themselves personally.

## GOOD ROADS IN BRITISH COLUMBIA.

Under the direction of Premier Richard McBride and the Hon. Thomas Taylor, Minister of Public Works, the British Columbia Government has made up a budget of expenses for roads and bridge construction for the coming year, which covers a total expenditure of $4,107,400, according to figures that have just been given out from Victoria. This covers the fiscal year from April 1st, 1911, to March 31st, 1912. This, when the population of the Province of British Columbia is considered, which is somewhat less than 400,000, means a large amount of money spent per capita as compared to what is paid for road construction in the United States.

The result is already in evidence. British Columbia is building a system of the finest highways in the world. As to where this money will be spent, a prominent citizen of British Columbia stated in commenting on this feature that the three main expenditures for the coming fiscal year will be on the Canadian highway, the Pacific highway and Vancouver Island roads.

The remarkable feature of this appropriation is that it is in actual cash, that all the work will be paid for during the year, and that no bonds will be resorted to. This means that every man, woman and child in British Columbia is paying a per capita tax of $10.27 for highway improvement, and up to the present time there has never been any charge of excessive cost or any conflict of authority in any particular in this department.

Undoubtedly the British Columbia Government will see fit to increase this appropriation each year, as the policy of that province has been to progress at all times, rather than to go backward in the matter of internal development.

## THE ONTARIO LAND SURVEYORS.

The nineteenth annual convention of the Ontario Land Surveyors' Association will be held March 1st, 2nd and 3rd in the assembly-room at the Engineers' Club.

The Ontario Land Surveyors were first organized in 1886, but it was not until 1892 that they became an incorporated body.

With the organization and incorporation of the Alberta Land Surveyors during the past month we now have separate organizations, the members of which have to do with land survey work in each of the various provinces of Canada, and among these organizations the oldest and strongest is the Ontario Land Surveyors'. Not only do the members have charge of the land surveys in the province, but a large number of their membership carry on engineering works, and their annual conventions are of great assistance in that they provide for free interchange of ideas among the membership.

## CANADIAN CEMENT ASSOCIATION.

On March the 6th the Canadian Cement and Concrete Association will open their third annual exhibition. The prospects for 1911, in contracts, for concrete workers are particularly good, and a number of men will be present looking for new machinery, new products and the best ideas for their work.

The Executive have arranged for a number of interesting papers, and these papers will be read and discussed in the lecture-room of the Engineers' Club, 96 King Street West.

**The Engineers' Club of Toronto**

96 KING STREET WEST

TELEPHONE MAIN 4977

## Programme for March, 1911

THURSDAY, 2nd, 8 p.m.

"Care and Handling of Explosives." A paper read before the Canadian Section of Society of Chemical Industry.

THURSDAY, 9th, 8 p.m.

Open Meeting of Canadian Cement and Concrete Association. Papers by Mr. R. L. Humphrey, President National Association of Cement Users, Mr. Frank Barber and Mr. Gustave Kahn.

THURSDAY, 16th, 6.30 p.m.

Informal Club Dinner. Notice and Ticket herewith.

THURSDAY, 23rd, 8 p.m.

"Impressions of Engineering Work in Great Britain." Illustrated. Paper by Mr. Chester B. Hamilton, Jr.

THURSDAY, 30th, 8 p.m.

Meeting of Toronto Branch, Canadian Society of Civil Engineers.

R. B. WOLSEY,
Sec'y-Treas.

## THIRD ANNUAL CONVENTION CANADIAN CEMENT AND CONCRETE ASSOCIATION, MARCH, 1911.

The meetings will be held in the lecture hall of the Engineers' Club, of Toronto, 96 King Street West.

Engineers, architects, contractors, and the general public interested in concrete are welcome to attend the Convention and take part in the discussions.

Monday, March 6th, 1911,
8.30 o'clock p.m.

Formal opening of the Toronto Cement Show, St. Lawrence Arena, by the Hon. Geo. P. Graham, Honorary President of the Canadian Cement and Concrete Association.

Tuesday, March 7th, 1911,
2.30 o'clock p.m.

Annual address by the President, Peter Gillespie, Lecturer in Theory of Construction, University of Toronto.

CONCRETE BLOCKS.
R. F. Havlik, Ideal Concrete Machinery Company, South Bend, Ind.

CONCRETE PAVING.
M. A. Stewart, Engineer, Roadways Department, Toronto.

GRADING STONE AGGREGATE.
H. P. Bowes, Superintendent, Warren Bituminous Paving Company, Toronto.

8 o'clock p.m.

MANUFACTURE OF PORTLAND CEMENT.
W. M. Kinney, Assistant Inspecting Engineer, Universal Portland Cement Company, Pittsburg, Pa.

THE WHITE AND THE GRAY.
Joseph M. Carrere, Blanc Stainless Cement Company, Allentown, Pa.

THE NECESSITY OF INSPECTION IN CONCRETE WORK.
E. A. James, Editor Canadian Engineer, Toronto.

CONCRETE IN FACTORY CONSTRUCTION.
B. H. Prack, Prack & Perrine, Hamilton, Ont.

Wednesday, March 8th, 1911.
2.30 o'clock p.m.

CEMENT CONCRETE IN HIGHWAY CONSTRUCTION.
W. A. McLean, Provincial Engineer of Highways.

CEMENT SURFACES AND FINISHES.
Robt. Cathcart, Glidden Varnish Company, Cleveland, Ohio.

PREVENTION OF CORROSION IN METAL LATH.
C. W. Noble, Consulting Engineer, Toronto, Ont.

A FEW POINTS IN REINFORCED CONCRETE DESIGN.
C. S. L. Hertzberg, Engineer, Trussed Concrete Steel Company, Walkerville, Ont.

8 o'clock p.m.

The Annual Dinner of the Association,
(Particulars later).

Thursday, March 9th, 1911,
10.30 o'clock a.m.

Meeting of Committee on Specifications.

2.30 o'clock p.m.

Annual Meeting of Members.

8 o'clock p.m.

Joint Meeting with Engineers' Club of Toronto.
Address by Representative of the Engineers' Club.

BUILDING BY-LAWS AND REINFORCED CONCRETE.

Richard L. Humphrey, President National Association of Cement Users, and Director United States Structural Materials Testing Laboratories, Pittsburg, Pa.

ADAPTATION OF CONCRETE FOR LONG SPAN BRIDGES.

Frank Barber, Barber & Young, Bridge and Structural Engineers, Toronto, Ont.

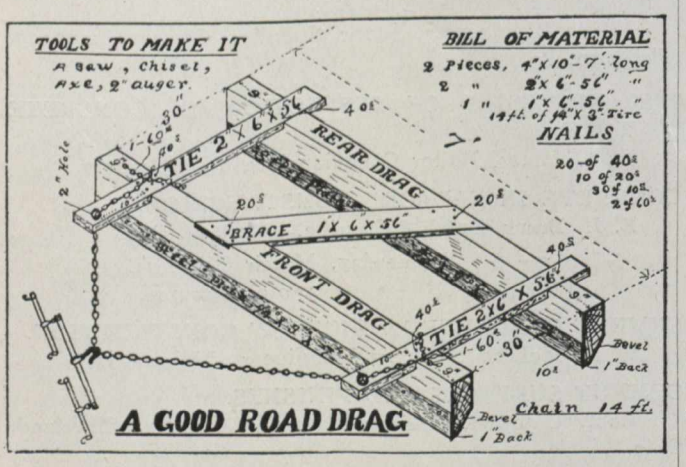
Delegates are requested to register at the Office of the Secretary, Mr. Wm. Snaith, 57 Adelaide St. East, Toronto.

## AN EFFECTIVE CHEAP DRAG.

Lately a great deal has been said and written regarding the road drag and its usefulness, and under certain circumstances its value can hardly be overestimated. On account of this fact, it has been thought advisable to present a practical form of drag that is applicable to any farm community and can be easily constructed by any one, even those who are not familiar with this machine. For this purpose a cut has been prepared which illustrates in detail how such a drag is made and gives the bill of material needed for its construction.

In order to assist any one desiring to build one of these drags the following suggestions are given:

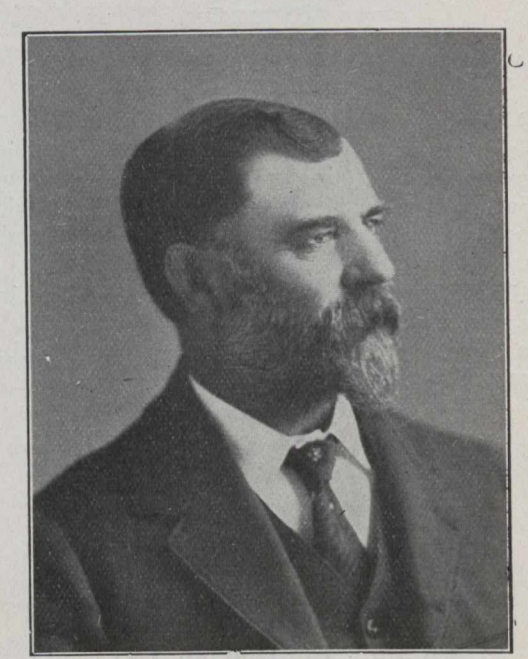
After the bill of materials has been assembled the work of construction should be commenced by setting the two drag pieces upon their edges thirty inches apart and in line with each other; that is, one just behind the other. Most drags




are dodged so that when they pull at an angle they will exactly "track"; but when the drag is made in that manner it can only be used to go one way on one side of the road, while if made as described above, it can be used up and down, back and forth on either side, which is often of very great advantage. After the pieces are set up as described, a piece may be tacked across the ends to hold them in place while sawing and fitting in the tie pieces. To fit in the tie pieces, lay them on the drag eight inches from the ends and mark the drags carefully so that when the places are sawed and chipped out for the ties, they will fit in tightly. It is a good plan to make them so tight that they must be driven in with a hammer, for then the nails will hold much better. After the two drags have thus been joined and the two ties set in as shown in the cut, nail them securely with five 40-penny nails at each place, as indicated. These ties should project 12 inches over in front, and 6 inches in the rear. A two-in h hole should then be bored in the front end of the tie, as indicated. This hole is for the chain to pass through for a hitch. Next lay the brace piece on and mark carefully, as shown, then cut and fit the brace in tightly and nail securely with 20-penny nails.

If the directions have been followed carefully, it is now ready to turn upside down. When turned, hew the back bevel on the drags with an axe, as shown in the cut, leaving the front edge of each drag 1-inch thick. While it is still in this position, nail securely the two steel plates so that they will extend about ⅛ of an inch lower than the face of the drag. This is done for the reason that the steel will have a better chance to get hold of the road and move more material than it would if it were placed flush. When this has been done, turn the drag right side up and it is ready for the chain and to be put to use.

To put the chain on, pass it around the tie and down through one hole, up through one hole, and around



**W. H. Pugsley,**
**President Ontario Good Roads Association.**

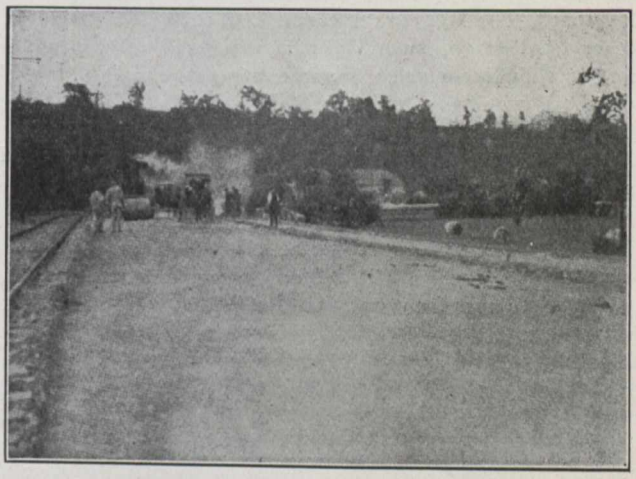
the second tie, as shown in the cut. The stretcher hook may be hitched in at any place desired to give the angle to the drag that is desired. This drag will work either end forward simply by a change in the hitch. All that is necessary is to move the hook on the chain. A little practice will soon make any one expert in the use of this drag.

To operate this drag, throw a board six feet long and ten or twelve inches broad on the ties and brace about midway between the drags, which is for the driver to stand on. It will be interesting to notice the effect of the driver changing his position on the drag. Step one foot on the front of the drag and it will cut and carry material until the weight is removed; step back on the rear drag and the front one will drop its load and the rear one catch it. Step forward again and the latter drag will drop its load. In this way a little practice on the part of the driver will enable him to become very proficient in filling up holes. If it is desired to crown the road up, stand with superior weight on the front and a little to the ditch end of the drag and let the drag have an angle of about forty-five degrees.

## THE "ROCMAC" METHOD OF ROAD CONSTRUCTION.

In "Good Roads" for December, 1909, there was printed a brief account of an English pavement known as "Rocmac." The pavement has been in use in Great Britain for a number of years, and has recently been introduced in the United States and Canada.

**Spreading Binder on "Rocmac" Road in Niagara Falls Park, Ont.**



**Rolling Road in "Rocmac" Construction.—Niagara Falls Park, Ont.**

The pavement consists of broken stone, similar to that used in macadam roads, and a cementing material consisting of finely crushed limestone and a chemical solution known as "Rocmac." In respect to the character and functions of the several materials entering into its composition, the pavement is somewhat similar to the many other forms of roads in which broken stone is used with binders of various kinds. Its construction is radically different, however, for while the general practice is to mix the stone and binder before laying or else apply the binder to the aggregate in place, in the construction of this pavement the binder is placed first and the aggregate last.

Before laying the pavement the subgrade is shaped to the required crown, watered and rolled. The rolling is done with a heavy roller, and is continued until the surface supports the roller without yielding.

A gauge-box having a capacity of ⅓ cubic yard is then placed on a mixing-board and filled with limestone crushed to pass a ¼-inch screen, and containing a certain per cent. of carbonate of lime. Next, the box is lifted off, the limestone spread out, and, if the weather be dry and water available, dampened to facilitate the chemical action referred to. Five gallons of solution are added and the materials turned until thoroughly mixed. In this condition the binder is of such consistency that it can be spread evenly, but is not as fluid as the usual mix of concrete designated as "wet."

**New York State Road between Rochester and Buffalo, paved with "Rocmac."**

The material is then spread evenly over the subgrade to form a matrix for holding the aggregate. The depth

depends upon the thickness of the pavement to be laid. The usual specifications call for depths as follows: 1 inch deep where a 3-inch finished coat is required, or about ⅓ cubic yard of matrix to 11-12 square yard of road surface; 1⅓ inches deep where a 4-inch finished coat is required, or about ⅓ cubic yard of matrix to 0.9 square yard of road surface. For each additional inch of pavement ⅓ inch is added to the depth of the matrix.

The aggregate is spread on the matrix immediately and rolled with a heavy roller, preferably one weighing over twelve tons. The aggregate consists of granite, trap rock or other hard stone, such is ordinarily used for macadam roads. It should comprise about equal parts of No. 2 and No. 3. Larger stones may be used, however, especially where the finished pavement is to be of unusual thickness. In dry weather it is recommended that the stone be dampened before spreading.

The road is rolled rapidly until the matrix appears at the surface, and is then rolled as slowly as possible. As the matrix rises it is brushed forward and diagonally from the sides of the road toward the centre in order to prevent it from lying in patches. If the stones are picked up from the road by the roller wheels, the latter are sprinkled with water, either from a watering-can or by sprinklers attached to the machine.

After the rolling is completed a thin coating of the limestone dust is spread over the surface to absorb the excess of solution, and to form a cushion while the process of setting is going on.

The binding action is said to be due to chemical reactions between the silicate of soda and other constituents in the solution and the limestone dust. The chemical action, it is claimed, continues for some time after the completion of the pavement, and holes made in the road are said to close up automatically, leaving the surface smooth and unbroken. The finished road presents a mosaic surface, which is said not to be slippery. Further advantages claimed for the road are that it is dustless, noiseless, sanitary and economical; that its construction is not affected by varying weather conditions, and that it can be laid by the regular working force after a little instruction.

The accompanying illustrations show roads built recently in New York State and in Canada. In New York State the pavement was laid on a portion of the main road between Buffalo and Rochester. The work was done under the supervision of the State Highway Department in 1910. The Canadian road shown is one in Victoria Park, Niagara Falls, Ont., and was laid for the Ontario Park Commission in 1910. Some of the pavement has also been laid in Fort Arthur, Ont.

Among the British cities in which it has been put down are Glasgow, Liverpool, Leeds, Sheffield, Bradford, Hull, Nottingham, Blackburn, and Halifax. In the last named city a section of the road known as the Skirtcoat Green road was laid with this pavement in 1907. The road according to the borough engineer, was selected to try out the material because of the severe usage to which it was subjected. It is the main entrance to the town from the west, and carried a very heavy traffic, and had always given trouble and been expensive to maintain. After two years, it is said, it showed comparatively little deterioration, and, according to the borough engineer, was in practically as good condition as when completed.

The cost is said to be only slightly greater than that of ordinary macadam, and the cementing material is said to be durable and little affected by temperature changes. The pavement is being introduced in America by Edward A. Paterson, of Port Arthur, Ont.

## DUSTLESS ROADS OF CALIFORNIA.*

**By Austin B. Fletcher, M. Am. Soc. C.E., Secretary-Engineer, San Diego County Highway Commission.**

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

As a result of these climatic conditions, for a large part of the year the roads are absolutely dry, and except where they are oiled or watered they are extremely dusty and disagreeable. Much of the soil, particularly along the coast, as an adobe. When wet it is extremely unstable, but when dry it packs very hard, and where the travel is light it makes a better road surface than soils composed of sand or silt, but when a considerable volume of travel uses an adobe road, clouds of very fine dust are raised and the conditions become intolerable.

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

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

Crude oils cost usually at the wells 75 cents a barrel of 42 gallons, and for refined residuums $1.10 may be taken as the average price. These prices mean 1.8 cents per gallon for crude, and 2.6 cents for the refined in tank car lots. Some of the oil is said to contain as much as 75 to 80 per cent. of asphalt.

*Paper presented at A. A. A. Convention, St. Louis, Mo

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

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

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

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

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

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

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

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

The following specification for "petrolithic macadam" is the most recent development in this kind of work:

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

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

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

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

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

"As the tamping progresses the surface shall be sprinkled with water as often as required to facilitate the tamping of the lower part of the stratum and to effectively prevent the solidification of the upper part before the lower portion of the oiled stratum has been made absolutely solid. After the lower stratum has been tamped until the shoes of the

tamper will not sink in more than 3 inches, use of the cultivator may stop, but the tamping must be continued, using enough water to keep the upper part of the layer very soft until the shoes of the tamper will produce no further solidification of the bottom layer of the oiled stratum.

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

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

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

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

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

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

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

The newest development in the use of asphaltic oil for country road purposes consists in combining the upper course of the macadam road with oil. This method has been used to a considerable extent in Pasadena, and it has been generally adopted by the Los Angeles county highway commission in its work. In brief, the process is as follows:—

The lower course of macadam is constructed in the usual way, except that an attempt is made to fill thoroughly all the voids and to leave the upper surface of the lower course smooth, true and unyielding. The second course of stone is then applied to such a depth that it will be approximately 2 inches in thickness after rolling. The stones in this course vary in size from 1½ inches to ¾ inch in their longest dimensions. This course is rolled thoroughly with a steam roller, and the depressions are filled with stone, as in the ordinary macadam work. Then ¾ gallon of oil is applied to each square yard, and a coat of sand or screenings is spread to a depth of ¾ inch. The surface is then watered and rolled, and ¼ gallon of oil to the square yard is applied. A light coating of screenings, ¼ inch and under in size, is then spread evenly to a depth sufficient to absorb all surplus oil and produce a uniform surface with no oil exposed and no patches of excess screenings. The road is then watered and rolled thoroughly until it becomes hard and smooth, true to grade and cross section, free from all hollows and irregularities.

For such work done under the supervision of the Los Angeles county commission, where the macadam is 16 feet in width, 8 inches in depth in the the centre, and 6 inches at the sides, with 7 feet of surface oiled, each shoulders on each side, the cost runs from $8,000 to $11,000 per mile. The broken stone is now being furnished from quarries owned and operated by the county and delivered to the contractors on the cars at the quarry. The cost of the stone on the cars at one of the quarries is said to be 55 cents per ton. The high freight rates which prevail in California account in part for the large cost per mile. About 40 miles of work of this character are already completed. The surface very much resembles sheet asphalt work, but such roads will undoubtedly have to be repaired from time to time, probably by surface coatings. In the opinion of the writer, for country roads, such work will prove to be very satisfactory, particularly where there is much automobile traffic.

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

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

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

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

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

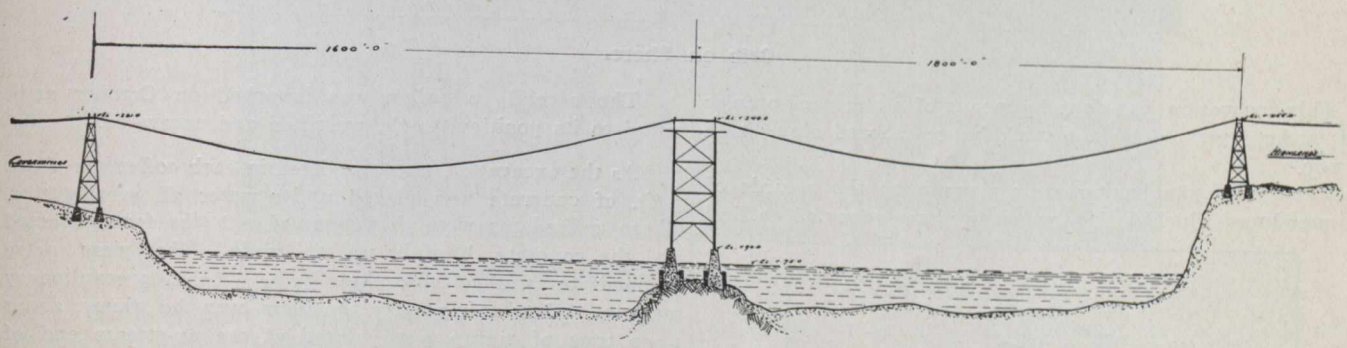
The writer believes that the oil macadam adopted by the Los Angeles county highway commission is a step in the direction of smooth, dustless roads for country highways. He is in doubt, however, whether or not it would be as cheap in the long run to build these roads in the ordinary way, and after they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

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

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

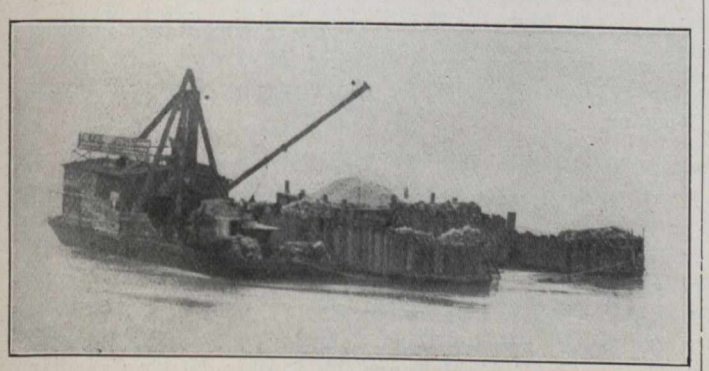
## THE ST. LAWRENCE RIVER CROSSING OF THE CANADIAN LIGHT AND POWER TRANSMISSION LINES.

The High Tension Transmission Lines of the Canadian Light & Power Company are to extend from St. Timothee, Que., to Montreal, a distance of about twenty-six miles. With the exception of certain points where greater height is required, these lines, consisting of 8 cables, are to be carried on steel towers 52 feet high, spaced at 500 ft. intervals. The crossing at the St. Lawrence River was, by necessity, one of these special points, and because of the difficulties faced may be of interest to the readers of The Canadian Engineer. The river at this point is about 3,400 feet wide, the water at its deepest point being about 30 feet deep, with a current of 7 to 9 miles an hour. After an exhaustive study had been made of the problem, it was decided to cross the river about 700 feet below the C.P.R. bridge, between Highlands and Caughnawaga. This crossing was to be made by means of erecting on each shore of the river two steel towers approximately 130 feet in height, and building at the centre of the river two concrete piers extending about 15 feet above water level, surmounted by a steel tower of 150 feet in height. After soundings had been taken, it was found that the formation of the river bottom was such that a knoll about 200 feet beyond the centre of the river towards the Caughnawaga shore could be taken advantage of. At this point, the water over-lying the bottom was about 12 feet deep, and this point was chosen for the location of the river piers. This means that the span of the cables from the Caughnawaga side to the river piers will be 1,600 feet, and that from the river tower to the Highlands shore approximately 1,800 feet.

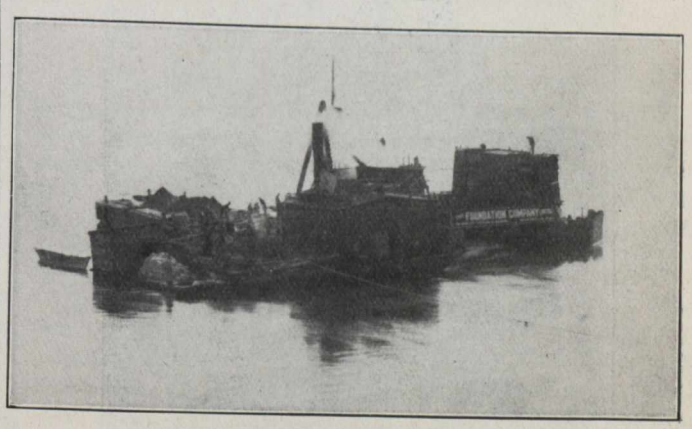


Sketch Showing The Exceptionally Long Span

The contract for the above work was not awarded until about the first of September. The contractors realizing the lateness of the season and the importance of not remaining out in the centre of the river any longer than was absolutely necessary, started work at once. They quickly assembled their plant and began the erection of the temporary buildings, and while waiting for the timber from which the coffer-dams were to be built, started work on the shore piers on the

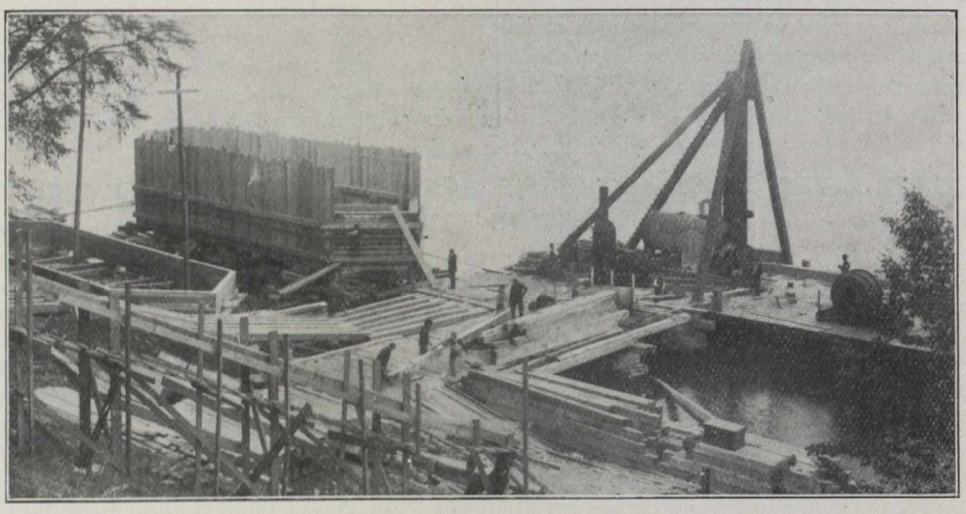


**Coffer Dam in Place.**



**Supply Barges.**

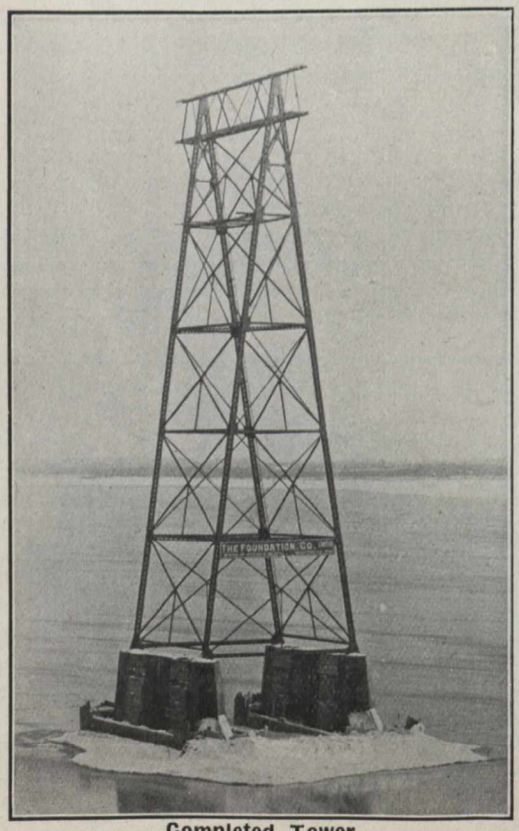
Highlands side of the river. By September 15th, the timber for the river cofferdams had arrived at the job, and the framing of these cofferdams was commenced. The first cofferdam was launched on October 4th, towed out to the site, anchored into position, weighted and sunk. The sheeting, which had been set up in position before launching, was then driven; the inside of the cofferdam carefully examined by the divers and the excavation started.



**Crib on Shore.**

This excavation was done by means of a one yard orange peel bucket operated by a derrick barge moored along side the site.

The contractors basing their plans upon the records of the soundings which had been given them expected to find




**Completed Tower.**

rock at a distance of from 5 to 6 feet below the bed of the river, but upon excavating to this depth, it was found that these soundings had stopped upon a heavy bed of large boulders instead of the rock. The engineers for the company were then called in and as the lateness of the season precluded any radical change of plan, it was decided to build the piers upon this boulder formation leaving pockets in the piers through which pneumatic caissons will be sunk the following year to bed rock. This was made necessary by the fact that the boulder formation did not extend down to rock, but over-lies sand and gravel of some depth.

The second cofferdam was launched on October 24th, towed to its position, sunk, weighted and excavated.

As the excavation was completed in each cofferdam about 3 ft. of concrete was placed under water all over bottom. These cofferdams were then pumped out, the forms erected and the concrete brought up to grade. The piers were finished to grade November 30th. As a precautionary measure and to safely carry the piers over the winter, about 1,000 tons of riprap were placed at the up-stream end of same.

Picture no.1 shows first cofferdam ready to launch, October 4th. Picture no.2, October 28th, shows both cofferdams in position and excavation in progress. Picture no.3, November 23rd, shows both piers practically to grade. Picture no.4 shows completed piers and steel tower erected on same. This also shows recesses left in piers through which pneumatic caissons are to be sunk.

The work was executed by the Foundation Company, Limited, Bank of Ottawa Building, Montreal, J. D. Evans, being resident engineer for the Canadian Light & Power Company.

## NEW INCORPORATIONS.

**Montreal.**—Montreal Packing Co., $50,000. J. Dow, E. D. Strachan, D. J. Tansey. British Canadian Paper Mills, $500,000. Cassidy's $5,000,000. E. R. Lynch, E. K. Williams, T. C. Davis. Fidelity Trust Company of Canada, $500,000. G. V. Cousins, F. E. McKenna, W. S. Weir. Belgo Canadian Steel, $550,000. E. Van Acker, A. Menager, F. A. Beique. H. A. McFarlane Company, $50,000. H. A. McFarlane, R. Parker, A. W. Herbert. P. P. Martin & Co., $500,000. G. R. Martin, C .E. Martin, R. A. Martin. Canadian Motor & Supplies Co., $15,000. B. Brosseau, J. H. Rainville, E. Drolet. Star Sealers, $100,000. W. Geraghty, J. F. Brewis, F. E. Fox.

## ROAD GRADER.

The secret of success in road building is drainage. A road grade must have liberal side ditches and they must be kept clean, and the grade must be high and well crowned so that rain will not soak into it, but will run off immediately into the ditches.

Only a machine that is a practical ditch plowing machine and grader is entitled to the distinction of the name "Road Grader." Every plow must have a landside to counteract the side thrust of the earth on its mould. This has been a known fact to all users and manufacturers of plows for about seventy-five years. Likewise, any ditch plowing machine that moves dirt sidewise must have a landside. In the sulky plow we find that most modern and efficient type of landside, namely, the leaning wheels or rolling landside.

**Crader throwing up first plowing.**

No farmer or road builder in this day of modern and improved machinery would even consider buying or using a plow made without the landside feature. There is even greater necessity of having the landside feature in a road grader than in a plow, because a road grader not only carries a side load like the plow, in that it cuts and moves earth sidewise with its share and mould, but in addition to this the road grader also works on an inclined surface, the sloping side of the road, and moves its side load of earth up this inclined surface.

So it is apparent that while the plow always turns the earth on the level or down hill the road grader always turns the earth up hill.

Then again the road grader has a much larger mould than the plow and makes a cut about four feet wide while the plow makes a cut approximately one foot wide. Therefore the side load on the grader must be at least four times as great as the side load on the plow, and the landside feature four times as valuable in the grader as in the plow.

The illustrations shown are from photographs of the King Junior in actual work with only four horses. The one on the left shows the machine moving material up into the centre of the road to make the grade. The one on the right shows the machine with the point of the mould extended outside of the wheels and plowing off a ditch bank. Note the sharp angle of the mould, which is essential to light draft and the large amount of earth that is being moved. Observe also how the leaning wheels hold the machine up against its load without any slipping sidewise.

In any non-oblique wheel machine, a very large part of the effort of the teams is wasted in overcoming the side draft and other losses. At the same time the teams are at a serious disadvantage because they are compelled to pull continually in a skew position while the machine drags sidewise along the road with its wheels pinching on the spindles.

This grader is, because of its light weight and great strength, equally suitable for four or six horses. It weighs 2,300 pounds, is 10½ feet long between centres of axles, and has a mould 7 feet long. Every machine is fully equipped with double and singletrees, evener, pull chain and extra cutting edge.

## EXPERIMENTS MADE IN WATERPROOFING WITH WATER.*

**By Cloyd M. Chapman.†**

It is of the first and greatest importance in making a waterproof concrete that the mixture shall be so proportioned as to sizes of the particles that the mass shall be of maximum density, and, therefore, of minimum voids. Yet, after the utmost diligence has been employed in the selection of the mixture and in proportioning it, there are other factors still to be considered, one of which, very often not considered, is the amount of water to be used.

It has long been recognized that the quantity of water used in mixing concrete had a large influence upon the impermeability of the resulting mass. This fact has been well established, and most works on the subject of concrete, however brief, call attention to it. That impermeability may be regulated to some extent by the amount of water used is of great importance to the concrete trade. It is perhaps

* Read at the N.A.C.U. Convention, New York city, December, 1910.

† Engineer-in-charge, Westinghouse, Church, Kerr & Co.

of as great importance to the block-makers as to any other branch of the industry. We frequently read the claims of the block machine makers to the effect that this or that machine produces an impervious block because it is made "Wet" or "Semi-wet" or "Dry." But we doubt that it is generally realized what a large difference in permeability a small difference in the percentage of water used will make.

The theory is generally held, we believe, that other conditions being the same, a wet mix makes a more nearly waterproof concrete, and that a dry mix produces a more porous mass unless very tightly compacted by much hard tamping or enormous pressure.

### Water Affects Porosity.

It was in an endeavor to make a very spongy, porous concrete for a special purpose that Westinghouse, Church, Kerr & Co. made up a series of block with varying percentages of water and noted the great difference in porosity made by slight changes in the percentage of water used. The block used in this series of experiments were about 3½ x 3½ x 2 in. high, with a circular depression or cup in the top about 2½ in. in diameter and 1 in. deep.

Fig. 1.

Some of these blocks were made of 1:2 and 1:3 mixtures of Portland cement and a good grade of building sand, while others were made of the same mixtures of cement and crushed granite, screened through a five-mesh sieve.

The molds were of wood, and the mixtures were tamped in by hand with a light tamper. A metal bell was used to form the depression or cup. In some cases the block were allowed to set in a damp closet for twenty-four hours before being exposed to the air, while in other cases the block were left in the air to set as soon as made. The day after being made the inside surface of the depression was brushed with a wire brush to remove any cement film or laitance from the surface, which might affect the results. When the block were one week old thirty cubic centimeters of water was placed in the depression of each block and the time noted which was required for the block to absorb all the water. Fig. 1 shows a few of the block under test, the type of molds in which they were made and the general method of molding them.

After the first test the block were allowed to dry out and were again tested when two weeks old. After the second test they were exposed to the weather on the roof and tested again at the end of a month. Many block were made of each mixture of materials and of each percentage of water, and the average time taken in absorbing the water was used in comparing results. In all, about 230 block were made and tested.

### Percentage of Water Would Vary.

The curves in Fig. 2 show graphically the results obtained at the first test when the block were one week old. The upper curve represents the results obtained on the block which were placed for twenty-four hours in a damp closet before being exposed to the air, and the lower curve shows results on block dried in air immediately after making and not sprinkled. The ordinates represent the time in hours required for the block to absorb thirty cubic centimeters of water placed in the depression, while the abscissae represent the amount of water used in percentage of the total weight of cement and aggregates. It will be noted that the results obtained with block which set in the damp closet were considerably better than those obtained with the block which set in dry air. There was so little difference between the results at the end of a week and those at the end of two weeks and one month that only the results at the age of one week are shown. The other curves would practically coincide with these. While the best percentage of water probably varies with different cements and aggregates, and should be determined for any particular combination that is to be used, yet it is evident that for the

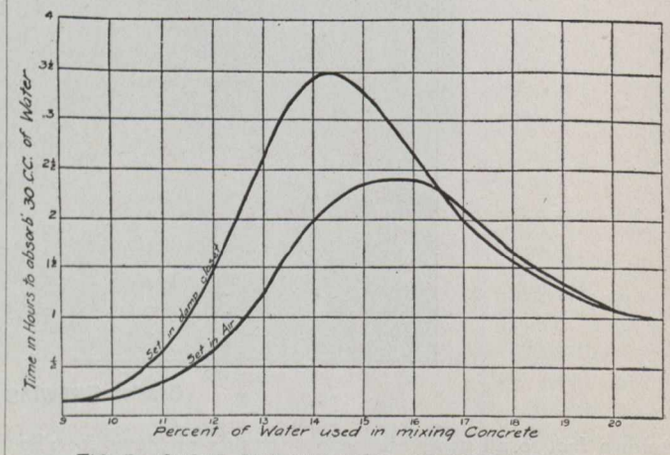


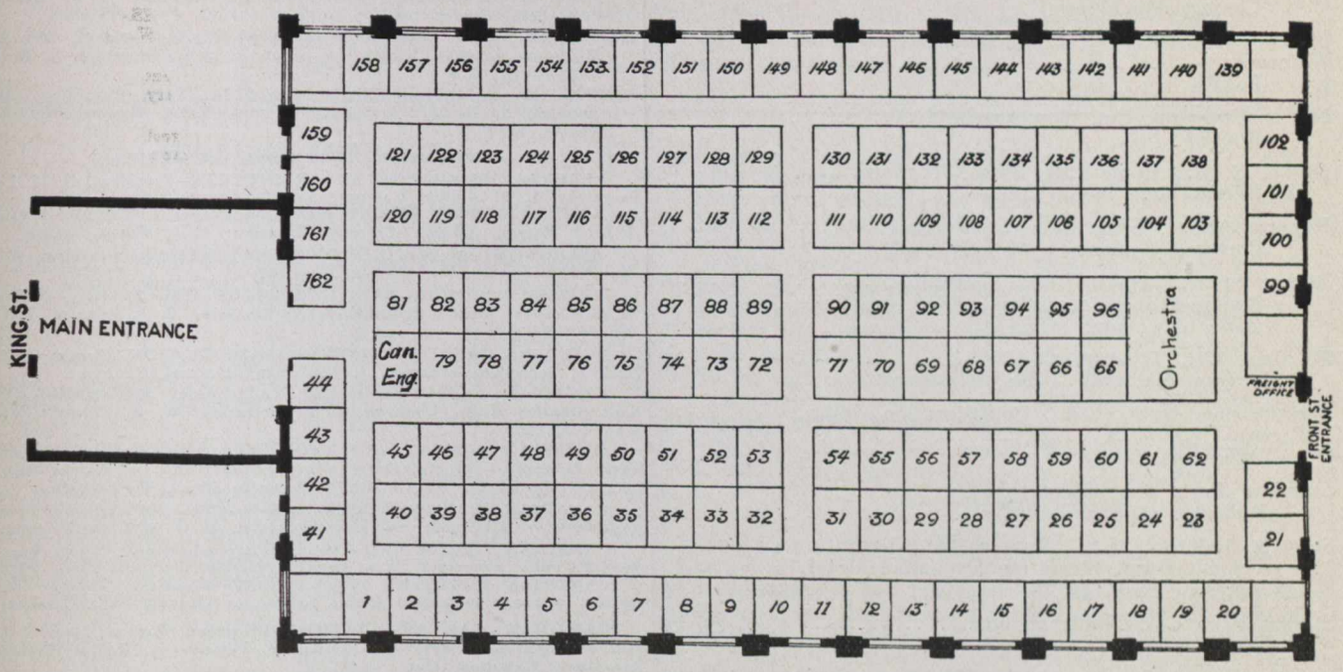

FIG-2_CURVE SHOWING RATE OF ABSORBTION

cement and sand used in these experiments the amount of water should lie between 13 per cent. and 16 per cent. of the total mixture by weight, if the block are to be cured in a damp place. When exposed to the air immediately after making, somewhat more water should be used, say, between 14 per cent. and 17 per cent. The point we wish to emphasize is the importance of using the right amount of water. We cannot state that under other conditions the percentages given here will be correct.

The above experiments indicate, not the amount of absorption of the block, but the rapidity or rate of absorption. After the block had had their third test at thirty days, they were dried out for a week in a warm room, carefully weighed and then immersed for twenty-four hours in water. The surplus water was then wiped from their surface and they were weighed again. Fig. 3 shows graphically the results of this series of absorption tests. In this curve the ordinates represent the percentage of water, by weight, absorbed by the dry block during twenty-four hours' immersion, while the abscissae represent the percentage of water, by weight, used in mixing the concrete. The relation to the former curves is at once apparent. The least absorption occurs with about 14 per cent. of water, and it is fairly uniform between 13 per cent. and 15 per cent. By either method of determination, that is, by rate of absorption or by amount of absorption, we arrive at the same conclusion. A concrete may be too wet or too dry to produce the most nearly impermeable product, and one extreme is as surely an evil as the other, if it is impermeability we seek.

## CANADIAN CEMENT AND CONCRETE ASSOCIATION.

**The arrangements for the Third Annual Convention and Exhibition by Canadian Cement Workers are nearing Completion. A Partial List of Exhibitors, together with the Arena Plan, is given herewith.**




### EXHIBITORS AT THE THIRD ANNUAL TORONTO CEMENT SHOW.

| Exhibitor | Space No. |
|---|---|
| American Saw Mill Machinery Co., Hacketts-town, N.J. ..... Saw Mills and Circular Saws for the use of Contractors and Builders. | 114 |
| Alderson, Hammond & Ritchie, Ltd., Yonge St. Arcade, Toronto ..... International Floor Machines. | 58 |
| Beath, W. D. & Son, 193 Teraulay St., Toronto ..... Triangular Wire Mesh Reinforcement. | 21, 22, 22A |
| Blystone Mfg. Co., Cambridge Springs, Pa.... Blystone Batch Mixer mounted on skids and belted to gasoline engine. | 116 |
| Builder & Contractor, Aberdeen Chambers, Toronto ..... A weekly publication of interest to Build-ers and Contractors. | 65 |
| Canada Cement Company, Montreal, Quebec... Cement Mill in Operation, Portland. Cement and Cement products. | 75, 76, 77, 78, 84, 85, 86 |
| Canada Foundry Co., King & Simcoe Sts., Toronto, Ont. ..... Concrete Mixers. | 112, 113, 128, 129 |
| Canadian Art Stone Co., Price St., Toronto... Art Stone, Decorative Exhibit of articles made of cement stone. | 66, 67 |
| **Canadian Engineer, Church St., Toronto..... A weekly journal for Civil, Mechanical, Electrical and Railroad Engineers and Contractors; books relating to cement and reinforced concrete.** | **80** |
| Canadian Inspection Co., Stair Bldg., Toronto. Modern Testing Laboratory. | 45 |
| Canadian Manufacturer, McKinnon Bldg., Toronto ..... | 50 |
| Cement Era, Chicago, Ill. ..... Cement Era and other publications. | 103 |
| Cement Products, 230 St. Clarens Ave., Toronto. Artificial Cement Stone Exhibit. | 69, 70 |
| Chillas-Black, Mail Bldg., Toronto ..... Toxement, a waterproofing. | 47 |
| Connor Ruddy Co., Wellington St., Toronto... Signs used in advertising the Cement interests. | 95 |
| Construction, Saturday Night Bldg., Toronto.. A journal for the Architectural and Con-tracting interests in Canada. | 81 |
| Contract Record, Nichol Bldg., Toronto..... A weekly journal of Building, Contract-ing, Engineering, Public Works, Muni-cipal Progress, Advance Information. | 57 |
| Concrete Form & Engine Co., Detroit, Mich.. Collapsible Steel Forms & "Belle Isle" gas engines. | 117 |
| Darling Bros., 77 York St., Toronto..... American Mason Safety treads for con-crete stairways. Webster system of steam heating for concrete buildings. | 59 |
| Eadie Douglas, Ltd., Victoria St., Toronto... Waterproofing. | 91, 92 |
| East Toronto Brick Co., 90 Pickering St., Toronto ..... Concrete Stone. | 56 |
| Gearless Co., Gloversville, N.Y. ..... Cement Brick Machines. | 48 |
| Hercules Waterproofing Cement Co., Buffalo, N.Y. ..... Waterproofing Cement. | 40 |
| International Correspondence School, Toronto. Technical Publications and books relat-ing to Cement and reinforced concrete. | 94 |
| Kent Mill Co., 170 Broadway, N.Y..... Kent Mill. | 110, 111 |
| Kerrigan Bros., Toronto, Ont. ..... Refreshments. | 99 |
| La Grange Specialty Co., La Grange, Ind.... The Little Giant Brick Machine. | 115 |
| Lehigh Clutch Co., Catasauqua, Pa. ..... Friction Clutch. | 109 |

| Exhibitor | Space No. |
|---|---|
| Lock Joint Pipe Co., 165 Broadway, N.Y..... Concrete Pipe. | 46 |
| London Concrete Machinery Co., London, Ont. ..... Cement Machinery. | 118, 119, 120, 121, 122, 123 |
| Moore, Benj., & Co., Cawthra & Grove Sts., Toronto ..... Paints. | 68 |
| National Roofing Co., Tonawanda, N.Y..... Roofing. | 43 |
| Noble, C. W., Home Life Bldg., Toronto..... Herringbone metal lath. | 83 |
| Rogers, Alfred, King St., W., Toronto..... Portland Cement. | 12, 13 |
| Roman Stone, Temple Bldg., Toronto ..... Roman Stone, decorative exhibit of articles made of cement stone. | 107 |
| T. Slack Co., Toronto ..... Cement Sidewalk Tools. | 49 |
| Specification Data, Ltd., Confederation Bldg., Toronto ..... Publication. | 93 |
| Standard Paint Co., Montreal, Que..... Ruberoid waterproofing, etc. | 139 |
| Steel & Radiation, Ltd., Fraser Ave., Toronto. Cement Gum, Steelcrete Expanded Metal, Fenestra Sash, etc. | 51, 52, 53, 54, 33, 32, 7, 8, 9 |
| Stinson-Reeb Co., Montreal, Que. ..... Waterproofing Compounds and Supplies. | 79, 82 |
| Swiss Concrete Machinery Co., Dayton, Ohio. Bricks and blocks made from cement, gravel, sand, clay, cinders, sawdust, tan bark, ground corn cobs, and refuse, on a machine press. | 108 |
| Tesco Products Co., Milwaukee, Wis..... Tesco Marble. | 138 |
| Trussed Concrete Steel Co., Walkerville, Ont. Kahn Trussed Bar, Rib Metal, Hy-Rib, Reinforcements, Waterproofing Compounds. | 71, 90 |
| United States Steel Products Co., New York, N.Y. ..... Triangular Wire Mesh Reinforcement. | 21, 22, 22A |
| Wert, C. S., Kendallville, Ohio..... The Perfect Brick Machine, the Perfect Tile Machine and Silo Moulds. | 130 |
| Wettlaufer Bros., 178 Spadina Ave., Toronto.. Concrete Mixers, block, brick, and tile machines, silo moulds. | 88, 87, 89, 74, 73, 72 |

## ENGINEERING SOCIETIES.

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

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

TORONTO BRANCH—
96 King Street West, Toronto. Chairman, H. E. T. Haultain; Secretary, A. C. D. Blanchard, Engineering Building, Toronto University, Toronto. Meets last Thursday of the month.

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

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

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

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

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

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

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

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

**CANADIAN TECHNICAL SOCIETIES.**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

WESTERN CANADA RAILWAY CLUB.—President, Grant Hall; Secretary, W. H. Rosevear, 109 Chestnut Street, Winnipeg, Man. Second Monday, except June, July and August, at Winnipeg.

# 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. |
|---|---|---|---|
| Brantford, Ont., sewer pipe | Mar. 2. | Feb. 16. | 69 |
| Calgary, Alta., concrete walks | Mar. 15. | Feb. 23. | 54 |
| Calgary, Alta., machinery and plant | Mar. 22. | Feb. 23. | 69 |
| Eglinton, Ont., granite and lime stone | Mar. 2. | Feb. 23. | 360 |
| Fort William, Ont., lumber | Mar. 2. | Feb. 23. | 54 |
| Fort William, Ont., line material | Mar. 2. | Feb. 23. | 54 |
| Fort William, Ont., cedar poles | Mar. 2. | Feb. 9. | 300 |
| Fredericton, N.B., concrete substructure and approach of bridges | Mar. 6. | Feb. 16. | 329 |
| Gleichen, Alta., waterworks and sewers | Mar. 16. | Feb. 16. | 69 |
| Hamilton, Ont., sewers | Mar. 9. | Feb. 23. | 70 |
| Hamilton, Ont., sewers | Mar. 9. | Feb. 23. | 70 |
| Minnitonas P.O., Man., bridge and piers | Apr. 15. | Feb. 23. | 70 |
| Montreal, Que., sewer | Mar. 2. | Feb. 23. | 360 |
| Monterrey, N. L., Mexico., gas plant | Mar. 1. | Feb. 2. | 66 |
| Moose Jaw, Sask., main drainage works | Apr. 10. | Feb. 23. | 66 |
| Oak River, Man., debentures for hall | Mar. 29. | Feb. 23. | 54 |
| Ottawa, Ont., supply of coal and fuel | Mar. 12. | Feb. 23. | 360 |
| Ottawa, Ont., public building, Harriston | Mar. 13. | Feb. 23. | 360 |
| Ottawa, Ont., breakwater | Mar. 15. | Feb. 23. | 360 |
| Ottawa, Ont., departmental bldg. | Feb. 28. | Jan. 5. | 131 |
| Ottawa, Ont., schooner | Mar. 1. | Feb. 9. | 300 |
| Ottawa, Ont., motor trucks | Mar. 17. | Feb. 9. | 300 |
| Ottawa, Ont., public building at Tillsonburg | Feb. 28. | Feb. 9. | 300 |
| Ottawa, Ont., public building at Mitchell | Mar. 1. | Feb. 16. | 329 |
| Ottawa, Ont., wharf | Mar. 8. | Feb. 16. | 329 |
| Oshawa, Ont., asphalt block pavement | Mar. 18. | Feb. 23. | 69 |
| Point Grey, B.C., pipe, valves, etc., excavating, etc. | Mar. 6. | Feb. 23. | 66 |
| Quebec, Que., railway | Mar. 10. | Feb. 23. | 360 |
| Regina, Sask., erection of bank. | Mar. 6. | Feb. 23. | 54 |
| Ridgeway, Ont., drain | Mar. 1. | Feb. 23. | 54 |
| Saskatoon, Sask., municipal commissioner | Mar. 17. | Feb. 23. | 67 |
| Souris, Man., laying pipe | Mar. 20. | Feb. 23. | 69 |
| South Middleton, Ont., schoolhouse | Mar. 15. | Jan. 12. | 163 |
| Strathcona, Alta., engine, boilers and generator | Mar. 1. | Jan. 26. | 65 |
| Swan River, Man., steel bridge. | Apr. 15. | Feb. 16. | 66 |
| St. Catharines, Ont., pipe and specials | Feb. 28. | Feb. 9. | 70 |
| Toronto, Ont., right to cut pulpwood | Apr. 10. | Jan. 19. | 203 |
| Toronto, Ont., cast iron pipe | Feb. 28. | Feb. 16. | 70 |
| Toronto, Ont., freight shed | | Feb. 16. | 329 |
| Toronto, Ont., reinforced concrete pipe | Mar. 14. | Feb. 23. | 66 |
| Toronto, Ont., assets of Belding Lumber Co. | Mar. 1. | Feb. 23. | 360 |
| Toronto, Ont., assets of Silver Bar Mining Co. | Mar. 1. | Feb. 23. | 360 |
| Toronto, Ont., building on Exhibition Grounds | Feb. 28. | Feb. 23. | 360 |
| Vancouver, B.C., supply of pipe, valves, etc. | Mar. 22. | Feb. 23. | 54 |
| Victoria, B.C. two-roomed school building | Mar. 1. | Feb. 23. | 54 |
| Victoria, B.C., supply of valves and pig-lead | Mar. 3. | Feb. 2. | 269 |
| Victoria, B.C., construction of pavements | Mar. 3. | Feb. 16. | 330 |
| Winnipeg, Man., supply of asphalt | Mar. 1. | Jan. 26. | 235 |
| Winnipeg, Man., motor car | Mar. 3. | Feb. 9. | 54 |

## TENDERS.

**St. John, N.B.**—Tenders will be received until March 18th, 1911, for the purchase of the whole or any part of an issue of two hundred and fifty thousand ($250,000.00) dollars "Saint John City Debentures," to be issued by the city of St. John. Adam P. Macintyre, Controller; Duncan G. Lingley, Chamberlain, St. John, N.B.

**Dartmouth, N.S.**—Tenders are invited by the Dartmouth Ferry Commission for the delivery of 5,000 tons of 2,240 lbs. of No. 1 slack or run-of-mine coal, to be delivered at Commissioners' coal wharves or sheds. Tenders will be received up to noon of February 28th. Prescott Johnston, Secretary, Dartmouth.

**Ottawa, Ont.**—Tenders will be received until March 20th, 1911, for supplying and delivering 190,000 Imperial gallons of illuminating oil and 55,000 Imperial gallons of oil fuel. A. Johnston, Deputy Minister of Marine and Fisheries, Ottawa.

**Ottawa, Ont.**—Tenders will be received until March 11th, 1911, for the supply of coal and fuel wood required to heat the Military Buildings, at Kingston, Belleville, Port Hope, Cobourg, and Peterborough, Ontario, for the year ending March 31st, 1912. Eugene Fiset, Col., Deputy Minister of Militia and Defence, Ottawa.

**Ottawa, Ont.**—Tenders will be received until March 21st, 1911, for the construction of a breakwater at Breen's Pond, Antigonish County, N.S. Plans and specifications may be seen and forms of tender obtained at the offices of E. G. Millidge, Esq., Dist. Engr., Antigonish, N.S.; C. E. W. Dodwell, Dist. Engr., Halifax, N.S., and R. C. Desrochers, Secretary Department of Public Works, Ottawa.

**Ottawa, Ont.**—Tenders will be received until March 11th, 1911, for the supply of coal and fuel wood required to heat the military buildings at Halifax, N.S., for the year ending March 31st, 1912. Full particulars may be obtained from the Director of Contracts, Militia Headquarters, Ottawa, or at the office of the Officer Commanding Maritime Provinces, Halifax, N.S. Eugene Fiset, Colonel, Deputy Minister of Militia and Defence, Ottawa.

**Ottawa, Ont.**—Tenders will be received until March 11th, 1911, for the supply of coal and fuel wood required to heat the military buildings at Winnipeg, and Brandon, Man. and Regina, Sask., for the year ending March 31st, 1912. Eugene Fiset, Col., Deputy Minister of Militia and Defence, Ottawa.

**Ottawa, Ont.**—Tenders will be received until March 11th, 1911, for the supply of coal and fuel wood required to heat the military buildings at St. Johns, St. Hyacinthe and Sherbrooke, Que., for the year ending March 31st, 1912. Eugene Fiset, Col., Deputy Minister of Militia and Defence, Ottawa.

**Ottawa, Ont.**—Tenders will be received until March 11th, 1911, for the supply of coal and fuel wood required to heat the military buildings at St. John, Fredericton, Woodstock and Sussex, N.B., for the year ending March 31st, 1912. Eugene Fiset, Col., Deputy Minister of Militia and Defence, Ottawa.

**Ottawa, Ont.**—Tenders will be received until March 11th, 1911, for the supply of coal and fuel wood required to heat the military buildings at London, St. Thomas, Windsor, Chatham, Woodstock, Stratford, and Guelph, Ont., for the year ending March 31st, 1911. Eugene Fiset, Col., Deputy Minister of Militia and Defence, Ottawa.

**Ottawa, Ont.**—Tenders will be received until March 13th, 1911, for the construction of one reinforced concrete bridge in the Township of Osgoode, and two reinforced concrete bridges, in the Township of Huntley. Chas. Macnab, County Clerk, Ottawa.

**Ottawa, Ont.**—Tenders will be received until March 20th, 1911, for the supply and delivery of British Columbia or "Douglas Fir" dimension timber and also for other lumber and timber required for use on the Rideau Canal for the year 1911-1912. L. K. Jones, secretary, Department of Railways and Canals, Ottawa. (Advertisement in the Canadian Engineer.)

**Guelph, Ont.**—Tenders will be received until March 7th, 1911, for the construction of "The Shelter" for the Guelph Humane and Children's Aid Society. W. A. Cowan, architect, Guelph, Ont.

**Kingston, Ont.**—Tenders will be received until March 7th, 1911, for the delivery of cement, in bags; sand, per cubic yard, and crushed limestone per cubic yard, to be delivered in gaol yard. J. W. Bradshaw, County Clerk, Court House, Kingston.

**Kingston, Ont.**—Tenders will be received until March 10th, 1911, for the several trades works required in the erection and completion of the Nicol Building for the Governors of the School of Mining. Plans and specifications may be seen at the University and at the office of Power & Son, Architects, Merchants' Bank Chambers, Kingston.

**Toronto, Ont.**—Tenders will be received until February 28th, 1911, for the construction of a small tunnel for waterway about 5 ft. wide, 6 ft. high and 135 ft. long. Plans and specifications may be seen in the office of the resident engineer, Mr. L. S. Rudder, Union Station, Toronto. A. L. Hertzberg, Div. Engr., Room 601, Union Station, Toronto.

**Fort William, Ont.**—Tenders will be received until March 11th, 1911, for the New Nurses' Home for the McKellar General Hospital. R. E. Mason, architect, Victoria Block.

**Fort William, Ont.**—Tenders will be received until March 10th, 1911, for alterations and additions to Central School. R. E. Mason, architect, Victoria Block.

**Fort William, Ont.**—Tenders will be received until March 6th, 1911, for the erection of the Free Library, Brodie Street. Hood & Scott, architects, 43 Murray Building.

**Warren, Man.**—Tenders will be received until March 4th, 1911, for the various trades required to erect a four-roomed school building for the Trustee Board of the Consolidated School District of Warren. Plans and specifications with the architect, R. L. Smith, 309 Builders' Exchange, or with M. S. Peacock, secretary-treasurer, School Board, Warren.

**Saskatoon, Sask.**—Proposals will be received until the 3rd of April, 1911, for a franchise for an electric street railway system. Jas. Clinkskill, Mayor, Saskatoon. (Adv. in the Can. Eng.)

**Moose Jaw, Sask.**—Sealed tenders will be received until the 10th day of April, 1911, for the supply of water and sewer pipe, hydrants, valves, etc. J. M. Wilson, city engineer, Moose Jaw, Sask. (Advertisement in the Canadian Engineer).

**Regina, Sask.**—Tenders will be received until March 4th, 1911, for the erection of a warehouse building at Regina, for the Great West Saddlery Company, Limited. Plans can be seen at company's office on Market Street East. Storey & Vanegmond, architects, Regina, Sask.

**Calgary, Alta.**—Tenders will be received until March 6th, 1911, for the excavation and concrete work required in the foundation work of a business block for Lieut.-Colonel James Walker, on Seventh Avenue, Calgary. Lang & Major, Architects, Board of Trade Building, Calgary.

**Calgary, Alta.**—Tenders will be received until March 7th, 1911, for the erection and completion of St. John's Church, Eighth Avenue, East Calgary. Lang & Major, architects, Board of Trade Building, Calgary.

**Calgary, Alta.**—Tenders are required up to March 10th, 1911, for the erection and completion of a solid stone and brick business building, five storeys and basement; to be built on Seventh Avenue, for His Honor Judge Travis. Hodgson, Bates & Butler, architects, Grain Exchange, Calgary.

**Calgary, Alta.**—Tenders will be received until March 6th, 1911, for the whole of the work required to be executed in connection with the erection and completion of a building on Seventh Avenue East, for the Alberta Club. D. S. McIlroy, architect, 118A Eighth Avenue West, Calgary.

**Bassano, Alta.**—Sealed tenders will be received until March 4th, 1911, for the construction of a four-room brick schoolhouse, to be erected at Bassano, Alberta. Plans and specifications may be obtained at the office of Wm. T. Williams, Medicine Hat, or Mr. H. Buckingham, secretary, Bassano School District, Bassano.

**Vancouver, B.C.**—Tenders will be received until March 15th, 1911, for clearing right of way on the Mountain, Shuswap and Arrow Lake subdivisions of the Canadian Pacific Railway. H. Rindal, division engineer, Vancouver, B.C.

## CONTRACTS AWARDED.

**Quebec, Que.**—Mr. Joseph Gosselin, of Levis, has secured the contract for the rebuilding of the Quebec Custom House, at a cost of $126,000.

**Toronto, Ont.**—Tenders received for the construction of storm overflow from sewage tanks in connection with the main sewage disposal system, were as follows:—

| Tender No. | Supplying material and laying Bulk Sum. | Furnishing and placing of bearing piles Per Lin. Foot. |
|---|---|---|
| 1 | $2,940 00 | 30c. |
| 2 | 3,479 00 | 40c. |
| 3 | 3,466 00 | 30c. |

The Board accepted tender No. 1, being the lowest, and in accordance with such acceptance awarded the contract to O. W. Rice.

**Winnipeg, Man.**—The contract for the erection and completion of the Selkirk Avenue Building for the Y.M.C.A., was awarded to S. Bryn Jolfsson and Co., Winnipeg, for all work, except tile, marble, heating and plumbing. Architects, Jackson & Rosencraus, New York; J. H. G. Russell, Winnipeg.

**Calgary, Alta.**—The contract for erection and completion of a residence for Lieut.-Col. James Walker, at East Calgary, to Messrs. Zang & Musgave, Contractors, Calgary. For plumbing, heating and gas-fitting to the E. J. Young Plumbing Co., Ltd., Calgary.

**North Vancouver, B.C.**—Tenders for cast-iron pipe were as follows:—

| | | Evans, Coleman & Evans, Vancouver. | | A. J. Forsyth & Co., Vancouver. | | Robertson, Godson Co. Ltd. Vancouver. | |
|---|---|---|---|---|---|---|---|
| | Eng. | Price per ton | | Price per ton | | Price per ton | |
| Size | tons. | Eng. | Total. | Eng. | Total. | Eng. | Total. |
| 4″ | 90 | $37.41 | $3,366.90 | $37.52 | $3,376.80 | $38.40 | $3,456.00 |
| 6″ | 74 | 36.91 | 2,731.34 | 37.52 | 2,776.48 | 37.71 | 2,790.54 |
| 8″ | 390 | 36.43 | 14,207.70 | 37.52 | 14,632.80 | 38.31 | 14,940.90 |
| 10″ | 261 | 35.92 | 9,375.12 | 37.52 | 9,792.72 | 38.12 | 9,949.32 |
| Fire 10″ | 211 | 35.92 | 7,579.12 | 37.52 | 7,916.72 | 38.12 | 8,043.32 |
| | 1,026 | | $37,260.18 | | $38,495.52 | | $39,180.08 |
| | | At wharf N.V. part Apr. 21, 1911 part May 20, 1911 Remainder 14 weeks. | | At wharf N.V. part May part June Remainder July. | | At wharf N.V. within 3 to 4 months | |

The contract was awarded to Evans, Coleman & Evans. George S. Hanes, City Engineer.

## RAILWAYS—STEAM AND ELECTRIC.

**Fredericton, N.B.**—It is understood that the I.C.R. management plan a number of improvements on the Canada Eastern branch during the coming season so as to make the road better fitted for carrying heavy trains. New steel bridges will, it is said, be placed this season across the Nashwaak River above Marysville, at Blackville, and also at Nelson Hall, between Caroll's Crossing and Doaktown. It is said that the survey has already been made for the bridge at Blackville.

**Montreal, Que.**—The announcement of an important new line of the C.P.R., which will cut into many of the towns and cities along the shore of Lake Ontario between Montreal and Toronto, tapping, among other places, Belleville, Cobourg, Port Hope, Bowmanville, Oshawa, and Whitby. The new line will commence at Bathurst, ten miles west of Smith's Falls, and proceed south-westerly to Belleville. The whole of this new line, it is stated, will be double-tracked, and as the line between Smith's Falls and Montreal is double-tracked already, the C.P.R. will have a double track the whole of the way between this city and Toronto, and an alternative route between Smith's Falls and Toronto, and will reach all the important industrial communities between Montreal and Toronto now served by the Grand Trunk alone. It is stated that the Railway Committee at Ottawa yesterday approved the route of this new line, so that the C.P.R. is now in a position to start its construction immediately. An incentive for pushing on the work with all possible speed is the fact that the Canadian Northern is now building a line from Toronto to Ottwa between the Grand Trunk and the Canadian Pacific main lines.

**Montreal, Que.**—The C.P.R. has introduced a policy of discarding trestle bridges, the important reason being their cost of upkeep. Tenders for work of a tunnel to be constructed at a point two miles north of Bala Station, Ontario, are being asked for, and the circumstances are interesting. At the spot there is a muskeg, through which a creek runs. Over the muskeg and creek is a trestle bridge, a new one. What the C.P.R. purposes doing is to divert the creek by means of the proposed tunnel through the rock, and then to fill in the muskeg, making the roadbed solid. The tunnel through which the water will run will be five feet wide, six feet high, and 135 feet long. The railway commission is partly responsible for the trestle abolition movement, having directed that a man watch such bridges, particularly in summer.

**Montreal, Que.**—Practically the whole of the steel work of the Canadian Pacific Railway's new viaduct on Notre Dame Street, between Montcalm and Berri Streets, is now in position. Work has been going ahead steadily on the structure since the 1st of January, and the superstructure of the bridge has been erected to a point where the tracks enter the Place Viger yards. The last span will be begun immediately, and then it will only be a short time till the concrete flooring is laid, and the bridge opened for traffic. When this is done steam shovels will be sent to work at the embankment at present carrying the traffic between Montcalm and Berri Streets, and the earth will be removed, turning the space on both sides of the bridge into one huge yard. More tracks will then be laid, and when operations are completed the C.P.R.'s yard at this point will be one of the largest of their system.

**Montreal, Que.**—The Pennsylvania Railroad has ordered nine more electric locomotives, aggregating 40,000 horse power, from the Westinghouse Company, to be used in hauling through passenger trains to and from the big station in the heart of New York city. The contract calls for them to be finished by July 1st. For changing from steam to electric or electric to steam engines at Manhattan Transfer, near New York city, the Pennsylvania allows each train four minutes, and a record has been made up showing that of the 108 trains that have to be changed daily, from 92 to 99 per cent. accomplish the process in less than the allotted time. On one day all of the trains went through with perfect records. The quickest time in which the exchange has been made thus far was 1 minute and 30 seconds. In warm weather, when steam couplings do not freeze, a reduction may be made in the time allowed.

**Montreal, Que.**—Mr. Robert W. Kerr, after twenty-six years of eventful service, has retired from his position as passenger traffic manager of the Canadian Pacific Railway.

**Ottawa, Ont.**—The Government has renewed, for one year, the contract with the Pickford & Black Steamship Company, for a service between St. John and West Indies. It is expected that the service, which was recommended by the commission which inquired into Canadian West Indian trade, will be inaugurated by the British Government, which will call for tenders, Canada contributing to the cost when the vessels are in commission.

**Ottawa, Ont.**—A return tabled in the Commons by the Minister of Railways shows that the total estimated amount required to complete the National Transcontinental Railway from Moncton to Winnipeg is $55,785,000. The amount spent to date is a little over $91,000,000. The track mileage now laid is 1,236, including sidings, etc.

**Toronto, Ont.**—The trainmen employed on the London and Toronto division of the C.P.R. will be furnished with a telephone kit which is to be carried on all trains. The new appliances will be placed in the baggage cars of all passenger trains and in the conductors' cabooses on freight trains.

**Welland, Ont.**—Now that the Welland Traction Company have practically received a Dominion charter for the operation of their street railway in Welland preparations are being made for the construction of the line. C. J. Laughlin, the promoter of the railway, reports that the construction of the line would be commenced in the fore part of May. Although the company had been granted a charter to run from Niagara Falls to Port Colborne, through Welland, they have not decided when the construction of that line will be recommenced. The local line will be built first.

**Fort Frances, Ont.**—If the plans of the Canadian Northern Railway are carried out and the land asked for by the company from the town of Fort Frances is secured, the company will build a $200,000 tourist hotel at Pither's Point park, situated east of the town on the shore of Rainy Lake. The place selected is most admirably adapted for a tourist hotel having a beautiful sand beach and ample grounds with shade trees, overlooking the lake and river and situated about 1½ miles from the centre of the town.

**Winnipeg, Man.**—It is said that Mr. J. J. Hill announces that negotiations for the use of joint terminals with the C.N.R. at Winnipeg are off, and he will build in Winnipeg this spring a million dollar station for his Great Northern, Northern Pacific and Midland Railways. Three years ago Mr. Hill purchased a right of way into the heart of the city at a very high figure. He will now construct a line from Emerson, where his lines enter Canada, to Winnipeg.

**Winnipeg, Man.**—Mr. William Hutchinson, the chief engineer who constructs all the railways and tram lines for the government of New South Wales, was in the city recently. Mr. Hutchinson said that he was on a tour of the world, examining methods of railway work in all countries. He will visit leading cities of the United States and Canada and then proceed to Europe. In addition to the building of the railway lines of New South Wales, the government also build the tram lines, and there is, in Sydney, a splendid tram system. There are 240 miles of track under operation, and an excellent service is given. Mr. Hutchinson said: "I have learned something new from the Canadian Pacific with reference to engineering, but I have not seen anything yet in the matter of trams on the public streets, which has appealed to me." Mr. Hutchinson explained the railway situation of Australia with reference to inter-state traffic. In his own state the railways are on the standard gauge, but every state has its own gauge, and one of the states has railways of two or three gauges. The result is a difficulty in the inter-state traffic, which has not been overcome.

**Vancouver, B.C.**—Grading has been completed on the E. & N. Railway on Vancouver Island from Cameron Lake to Alberni, on the Wellington-Alberni extension, and when the necessary bridge work, which is now in progress, is finished, a commencement will be made on the tracklaying. In the 26-miles stretch between Cameron Lake and Alberni several bridges of varying size have to be erected, and pending their completion by the bridge contractors, Culiton Brothers, little will be done on tracklaying. The bridge contracting firm has arranged for a supply of heavy timbers from Nanaimo, and a camp has been established west of Cameron Lake, where a large trestle has to be built. Janse, Macdonell & Timothy, the contracting firm having charge of the whole work, are at present operating near Alberni.

**Vancouver, B.C.**—The Grand Trunk Pacific Railway survey parties have virtually completed the location of the proposed branch between Fort George and Vancouver. The only unfinished gaps are those between Fort George and Big Bar, on the Upper Fraser river, which is now well advanced, and the short stretch from Harrison Lake to Burrard Inlet. It is not probable this last mentioned work will be undertaken until next spring. A party is being sent out from the coast to determine whether a short route can be secured from the Lillcoet district to the Fraser river via Stave river and Stave lake. The route has been surveyed from Harrison Lake to a point north of Big Bar on the

Upper Fraser. From Lillcoet the line will run up the west bank of the Fraser, 70 miles to Big Bar, where it will cross to the east side of the river which will be followed to Fort George. Two survey parties are now in the field, working in opposite directions between Fort George and Big Bar, and the work is so far advanced that next month will see the closing of the 150 mile gap.

**Victoria, B.C.**—Lieutenant-Governor Paterson turned the first sod of the Island section of the Canadian Northern Railway, recently. The ceremony was the formal inauguration of construction work upon the new road. There was a numerous attendance of thoroughly representative citizens, perhaps three hundred in all.

**Victoria, B.C.**—Official announcement is made that the British Columbia Marine Railway Co. will build a drydock to cost $3,000,000 at Lang's Cove, Esquimalt. The dock will be 900 feet long and 100 feet wide. It is the intention to equip a modern shipyard for the construction of cruisers and destroyers for the Pacific squadron of the Canadian navy at Esquimalt.

## LIGHT, HEAT AND POWER.

**Welland, Ont.**—Welland has secured power and water rights on the Welland Canal that will give the town of Welland, the commissioners believe, the finest municipal waterworks plant in the Province of Ontario. Following the concession made by the government, the commissioners will set on foot plans for the building of an entirely new waterworks plant on the east side. This will be located just north of the aqueduct. The commission propose building a thirty-foot intake and the plant will have immediate capacity of three million gallons per day with facilities for economically doubling this capacity.

**Saskatoon, Sask.**—The city commissioners are at present engaged in getting out specifications for the new electrical plant, which is to be installed at the powerhouse during the present year, and which will probably cost somewhere round $60,000.

**Victoria, B.C.**—The Alberni District Electric Light and Power Company, Limited, has been incorporated to supply electric light to Alberni, from steam power. Dr. A. D. Morgan is the president and Mr. W. W. G. McAllister, secretary-treasurer.

## SEWAGE AND WATER.

**North Toronto, Ont.**—On March 18 the property-owners of North Toronto will have an opportunity to record their votes for or against the sewage by-law, though the latter contingency seems unlikely. More than a year and a half has been wasted, but in the present case there seems little or no doubt that if the measure runs the gauntlet of the ratepayers, it will go through council and receive its third reading with no loss of time. The town council are a unit with respect to the necessity for installing the system, the local board of health as a whole warmly endorsed the scheme, and the Ratepayers' Association is certain to pass a strong resolution upholding the action of council in the submission of the by-law.

**Lethbridge, Alberta.**—The city of Lethbridge is about to install up-to-date sewage disposal works. Mr. T. Aird Murray, consulting engineer, Toronto, reported upon a scheme last autumn. The scheme has been adopted and Mr. Murray is retained as consulting engineer by the city. The scheme includes sedimentation tanks, biological filtration and final disinfection of the effluent. Much trouble has resulted in the past, owing to the raw sewage of Lethbridge passing direct into the Kelly River and several severe outbreaks of typhoid have been said to result from the pollution. The supervision and control of the work during progress will be in the hands of the city engineer, Mr. C. M. Arnold, who has already carried to completion several important schemes of sewerage and sewage disposal.

**North Vancouver, B.C.**—Despite the inclement weather sewer construction is being pushed rapidly onwards. The gangs are working in various centres, and the contractors are losing no time in having the work completed.

## CURRENT NEWS.

**Amherst, N.S.**—Work at the Canada Car and Foundry Co., is very brisk at the present time, including all branches of this industry, there are about 1,200 men steadily at work, In the Freight Department they are now turning out from twelve to fourteen cars a day for the Canadian Northern Railway Department, and they have orders on hand to keep this department working actively until the first of July. The passenger department is equally busy and the company expect to turn out either a passenger, baggage or dining car every week all during the summer months. The company has orders on hand in this department to keep the full staff at work until October 1st. The company will ship four baggage cars to the Canadian Northern this month.

**St. John, N.B.**—Building operations in St. John last year showed an increase of 41.17 per cent. over those of 1909, and there will be a very much larger increase in 1911 over the figures of 1910.

**Quebec, Que.**—The famous toll bridge over the Gatineau River, known as Cousineau's bridge, has been declared closed by an official proclamation, issued by the provincial government, owing to the necessary repairs, ordered in the report made by Provincial Engineer L. A. Valee in September last, not having been commenced.

**Montreal, Que.**—The Dominion Bridge Company have decided to rent the houses on the large blocks of property recently secured by them, on monthly lease holds only. This is held to mean that the company expects to need the sites of these houses for the enlargement of works and yards before very long. The rebuilding of the Lachine and Caughnawaga Bridge across the St. Lawrence, and the preparations for erecting the Quebec Bridge in addition to the other large contracts for bridges and other buildings, will make large additions to the plant of this company to be necessary.

**Montreal, Que.**—In response to the order of the Utilities Committee the Montreal Street Railway will, within a few weeks, equip all their cars with new fenders of the "H.B." pattern, from New York, as the most suitable for cars in a city where there are steep hills. The fender proper is under the front platform, and immediately in front of the wheels of the fore truck.

**Ottawa, Ont.**—Of interest with respect to the Canadian peat industry in the letter received by the secretary of the Canadian Peat Society, Mr. Arthur J. Forward, from Prof. Charles A. Davis, the peat expert of the United States Bureau of Mines, at Washington, in which he says: "You have certainly a much better start in Canada towards the ideal of using peat as fuel than we hve in this country as yet, and I am very glad that things are progressing so well under the wise leadership of Dr. Haanel, who has so successfully directed the work the government. The interest is great in the United States, but most people want to be shown what can be done before they put any money into peat enterprises in these days."

**Ottawa, Ont.**—The work of conserving head waters of the Ottawa River, which has been in progress for some two years, will go ahead still further this summer. The Department of Public Works will issue a call for tenders for the construction of the dam at the foot of Quinze Lake, the estimated cost of which is $59,000. The dam will be located eighteen miles distant from the head of Lake Temiskaming. The dam at the foot of Lake Temiskaming has already been completed, and will control 27,878,400,000 cubic feet of water, and the dam at Kippewa is now under construction. Tenders will also be called this spring for the new dam at the head of Gordon Creek.

**Chatham, Ont.**—A valuable find of iron ore is reported to have been made near Rondeau, on the shores of Lake Erie, by Archie Park, a Chatham manufacturer, and local capitalists will investigate. The samples of ore show it to be rich.

**Kingston, Ont.**—The North American Smelting Company paid the city $2,500 for a portion of the smelter site on the lower harbor. This company is about to erect a lead smelter here to treat the ore that comes from their mines in Loughboro' township. The Canadian Northern Railway will run close to the mining property to enable the running of a spur right to the mines.

**Collingwood, Ont.**—The report that the Northern Navigation Company would place an order for another passenger

and freight steamer of the type of the Hamonic was confirmed by Vice-President H. Y. Telfer. It will cost $600,000.

**Porcupine, Ont.**—The government is apparently putting forth every effort to make good their effort to have the railway into Porcupine by June or July next, and are crowding the camps all along the right of way with men until now there are probably between 600 and 700 men at work cutting right of way and doing other preparatory work. At camp No. 5, located just near Hill's, there are about 150 men at work, and they have the right of way cut to the Golden City. Several miles of the road have been graded and the track layers have made considerable progress. Some 60 men are engaged erecting big camps just south of Golden City, where the try lines crosses at a point a few yards south of the engineers' camp that was erected some time ago.

**Hamilton, Ont.**—The Oliver Plow Works Company, which let the contract for a $200,000 assembly building, recently announced that it would spend six hundred thousand dollars here this year enlarging its plant.

**Orillia, Ont.**—Orillia's newest industry, the Canada Refining Company's smelter, commenced operations here last week. Cobalt ores are being treated, and the silver bullion shipped to England. The buildings are of brick, and the plant is a very fine one. Thirty men are now employed, but the number will be increased to 150 by spring.

**Port Arthur, Ont.**—Stewart & Hewittson, general contractors, are preparing to double the capacity of their stone crushing plant by adding 2 steam shovels and another crusher, and remodelling the plant. The Canadian Swift Co. will erect a cold storage plant here to cost about $75,000.

**Vancouver, B.C.**—The city is now planning to lay another large main from the present intake to the mouth of Seymour Creek. $200,000 having been voted for this purpose at the January elections with the understanding that another by-law to complete the project would be submitted in the future. The suggestion of Burnaby is that the municipality shall make a contribution to this by-law fund and thus permit of the laying of a larger main to the south side of the Inlet. At the south side of the second Narrows submerged main Burnaby would tap the supply main and divert a portion of the water to the southwest. As the city will be obliged to furnish Hastings with water it is thought a large distributing main could be placed on the boundary line, between Hastings and Burnaby from which each district could draw its supply as needed.

**Vancouver, B.C.**—There is a report in circulation that the great English contracting firm of Messrs. Norton, Griffiths & Co., which opened an office in Vancouver several months ago, may undertake the construction of a dry dock in Vancouver under the terms of the statutory subsidy offered by the Dominion Government. Mr. Burton Stewart, who represents the contractors in Canada, has left for England, and will return in April.

## SOCIETY NOTES.

The sixty-third meeting of the American Society of Mechanical Engineers will be held in Pittsburgh, Pa., from May 30th to June 2nd, inclusive. The society has not met in this city since 1884. The American Society of Mechanical Engineers is one of the foremost organizations of technical and professional engineers in the world, with a membership of over 4,000 in this country as well as abroad. The headquarters of the society are in New York city, and Col. E. D. Meier of St. Louis is president this year. The society has in the Pittsburgh district alone a membership of about 160. Last year the society held a joint meeting in England with the British society, the Institution of Mechanical Engineers. George Westinghouse, who was president of the society last year, presented a paper on the "Electrification of Railroads," which aroused a great deal of interest. The British society through its local committees in Birmingham and London, entertained the American engineers by showing them many things of professional interest, as well as providing delightful social functions. An Executive committee consisting of E. M. Herr, chairman, George Mesta, J. M. Tate, jr., Chester B. Albree, D. F. Crawford, Morris Knowles and Elmer K. Hiles, secretary, will have charge of the Pittsburgh meetings. It is expected that from 300 to 400 members and ladies will be in attendance. There will be professional sessions when papers will be read and discussed. There will also be inspection trips through the leading local industrial establishments, besides automobile trips through the parks, a visit to Carnegie Institute, Memorial Hall, etc.

**Alberta Association of Architects:** The fifth annual general meeting of the Alberta Association of Architects, was held on January 30th and 31st, 1911. This year the meetings instead of being held at Edmonton as in previous years were held at Calgary. This arrangement was the outcome of a desire expressed by the outgoing council of the association that the members of the southern portion of the province should have a more active share in the work of the association than has hitherto been the case. The meetings were the best held for some years and were well attended by members from all parts of the province. Unfortunately the retiring president, Mr. E. C. Hopkins was unable to attend owing to sickness and Mr. Henderson of Edmonton filled his place. The reports of the president, secretary and treasurer were read, the latter being very satisfactory showing a balance in favor of the association of upwards of $1,100.00. The president reported that the Societe Academic had honored the association by requesting the council to accept a medal of honor, the method of its award to be decided by the council. It transpired from the report from Mr. R. W. Lines, the honorary secretary, that a committee had been formed to deal with the revision of the mechanics' Lien Act and that much valuable work had been done in this connection. The officers for the coming year were elected with the following results: Honorary president, E. C. Hopkins; president, G. M. Lang; first vice-president, James Henderson; second vice-president, W. S. Bates; honorary secretary, R. W. Lines, Edmonton; secretary, L. M. Gotch, Calgary; honorary treasurer, D. S. McIlroy; council, Messrs. Geo. Fordyce, L. C. Gibbs, F. J. Lawson, J. J. O'Gara, board of examiners, Messrs. W. S. Bates, James Henderson, G. M. Lang, R. W. Lines, L. M. Gotch; librarian, R. W. Lines. To be in accordance with the provisions of the Act of Incorporation, it is necessary that the headquarters of the association be nominally at Edmonton, consequently though Mr. Lines was appointed honorary secretary, to comply with this the work will devolve upon Mr. Gotch, to whom all correspondence should be addressed. On the Monday evening the visitors were entertained to a dinner given by the members of the Calgary Chapter, at which the Mayor of Calgary and representatives of the leading building trades were also present. On the Tuesday the chief business was the discussion of the adoption of one contract form to be used throughout the province. A deputation from the Calgary Builders' Exchange was received in connection with this subject and committees were appointed to meet and deal with it in detail. It was decided that the meetings for 1912 should also be held in Calgary.

**Ontario Land Surveyors:** Result of the annual provincial examination.—At the annual examination for Ontario Land Surveyors, which has just been concluded, the following passed the final examination and were granted certificates as Ontario Land Surveyors: Ralph Mackenzie Anderson, Harry William Tate, John Thomas Ransom, Calvin Bruce Allison, William Emerson Taylor, William Graham McGeorge, Nicholas James Slater, Albert McMeekin, John Edwin Jackson, Alex. Roger, Charles Hartley Attwood, John Alexander Brown, Albert Ernest Jupp, Russell Grant. The following passed the preliminary examination: Oliver Smith, Joseph Albert Marck, Erling Peter Gibson, Earman Rice Kenny, Joseph Patrick Power, Charles Vincent Gallagher, Robert Lorne Campbell, Frank Herbert Muckleston, Roy Stanley Kirkup.

## PERSONAL.

**Mr. C. W. Vaux,** general passenger agent for the Grand Trunk Railway, has resigned owing, it is said, to ill-health. This will necessitate several changes on the G.T.R. system. Mr. H. G. Elliott, assistant general passenger agent of the company, at Chicago, becomes general passenger agent, with headquarters in Montreal. Mr. James D. McDonald, district passenger agent of the Grand Trunk Railway, has been promoted to be assistant general passenger agent of the system, with headquarters at Chicago. Mr. A. E. Duff, general agent for the company at Winnipeg, will go to Toronto in place of Mr. McDonald.

**Mr. H. E. Vautelet** has resigned from the Quebec Bridge Commission. Mr. Vautelet some time ago intimated his intention of resigning when the bridge plan was accepted, and has now carried out his intention on account of his health not being robust.

**Mr. F. H. Schwitzer** has been appointed mechanical superintendent at the Printing Bureau, at Ottawa. He graduated in the engineering course at McGill University and has had a variety of useful experiences with Canadian companies and in the Navy Department at Washington, Mr. Schwitzer is a brother of the recently deceased chief engineer of the Canadian Pacific Railway.

**Mr. Arthur H. N. Bruce, C.E.,** of the firm of A. and R. Bruce, has been appointed chief engineer of the Quebec and Saguenay Railway. He left for Quebec on Monday, the 27th inst. The company have filed plans with the department of railways from the present terminus of the railway to a point about ten miles east of Murray Bay, a distance of about 65 miles, and purpose commencing construction as soon as the melting of the snow will permit.

## MARKET CONDITIONS.

Halifax, February 28th, 1911.

Generally the markets are very steady. The demand in the hardware business being particularly strong, continued advances in the price of the linseed oil and turpentine has necessarily effected the prices of paints. The purchases for the spring work have hardly commenced yet, and, therefore, the trade is not particularly brisk, although the outlook is good.

**Axes.**—Ordinary chopping axes, single bit, $6.50 per dozen, double bit, $11. Special brands, prices on application to jobbers.

**Bar Iron.**—The market for bar iron is open, but the situation is firm, and prices range as high as $2.25 base.

**Black Sheet Iron.**—This commodity is in good demand. We quote 24-gauge, $2.40.

**Cast Steel.**—The market is steady at 10 to 15c., according to makers.

**Cement.**—Stocks are low and market is steady, $2 per bbl.

**Coil Chain.**—The jobbing prices of English proof chain in Halifax are as follows: 3-16 x 4, $7.15; 3-16 x 3, $6.25; ¼, $5.35; 5-16, $4.30; ⅜, $3.90; 7-16, $3.85; ½, $3.60; ⅝, $3.60; ¾, $3.50; ⅞, $3.50; 1, $3.50; 1⅛, $3.50.

**Fencing Wire.**—We quote: Plain, twisted and galvanized at $3.25 per 100 lbs.; barb at $2.75 per 100 lbs.; bright staples in 100-lb. kegs at $3, and in 50-lb lots, $3.25. Galvanized staples are 25c. extra.

**Galvanized Sheet Iron.**—The wholesale prices are as follows: 16 to 20-gauge, $3.45; 22 to 24, $3.80; 26, $4.30; 28, $4.55. These prices are for less than case lots.

**Ingot Tin.**—The tin market as usual is a fluctuating one, and the present price is about 38c. net cash.

**Lead Pipe.**—Quotations here are open, and the price quoted to-day is about $4.75 for ordinary jobbing quantities.

**Linseed Oil.**—Raw is fully worth $1.20, and boiled, $1.25 per gallon. Orders are small, stocks low, and the outlook firm.

**Nails.**—Nails are firm. Wire nails, $2.45, and cut nails, $2.60. Business in this line is reported fairly active.

**Peavies.**—There is a better enquiry than last year. Prices are unchanged at $11 to $13 per dozen, according to make, but we are advised that there will be an advance.

**Pig Lead.**—We quote $4.25 for English and $4 for Canadian. The outlook is for higher prices.

**Pipe.**—Wrought iron, 1-in., $5.25.

**Roofing Paper.**—The demand is good. Tarred paper, $1.70 per 100 lbs.; three-ply roofing 90c. per 100 lbs.; two-ply roofing, 65c.; sheathing paper, 30 cents per roll; tarred sheathing, 40 cents per roll.

**Rope.**—The price of cordage for next spring's supplies is unchanged. For large lots dealers should write jobbers for quotations. Small lots are as follows: Sisal, 9½c. base; lobster rope, 9¾c.; British manilla, 9½c.; base, best manilla, 10¾c. base.

**Sheet Lead.**—The price of sheet lead is also very firm, 3 lbs. and heavier, $4.75 per cwt., in rolls, and $5.75 in smaller quantities.

**Steel.**—Tire, $2.50; spring, $2.70; machine, $3.25; toe caulk, $3.50; sleigh shoe steel, $2.50; the above are all base prices.

**Tin Plates.**—I. C. coke, $3.95 to $4.10; I. C. charcoal, $4.75; I. X. charcoal, $5.50.

**Turpentine.**—Prices now quoted are as high as $1 to $1.10 in bbls., and $1.05 to $1.15 in smaller quantities. The market is open.

**White Lead.**—For Canadian pure, in 50 and 25-lb. irons, $6.25 is being asked. Brandram's B.B. genuine in 25, 50, and 100-lb. irons, $7.35, and B.B. No. 1, $6.10. The trade expect prices to be much higher before long.

**Zinc.**—This commodity is very firm, $7.50 for casks and $8 for smaller quantities. Spelter is $2.75 per cwt.

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Montreal, March 1st, 1911.

The feature of the week, not only in the iron and steel markets of the United States, but in those of the world, was the announcement of the Interstate Commerce Commission with respect to the proposed increase in the railway freight rates of the United States. The Eastern and Western roads were ordered to restore their former rates by March 10th.

This question of railway freight rates has now been an issue for many months in the United States. During 1910, the railways made an attempt to advance their rates, and were ordered to suspend advances until the merits of the proposal could be investigated by the Interstate Commission. Ever since, the iron and steel market has been in a more or less unsettled condition, the fear being constantly before the minds of the trade that the decision might be adverse to the railway companies. Several times it was stated that the decision was about to be announced, and the market worked constantly lower, no doubt partly as a, consequence. The worst is now known, and the full market effect has been experienced.

While some express the opinion that the adverse decision will have the effect of cutting down railway estimates for rails and equipment of various kinds, others are not of this opinion. In a general way it seems to be expected that the situation will now become better defined and there will be little further delay in placing such orders as it is the intention to place. This should have a good effect upon the iron and steel trades, and upon industry in general.

After a severe break, Wall Street recovered, although it still holds below the price of a week ago. This shows that the financial centre of the country most affected does not greatly fear the effect of the decision on the prosperity of the roads, or the industry of the country.

The iron situation continues in its recent unencouraging state. Orders for iron this week in the New York district have been small. Inquiries for small lots from 500 to 1,000 tons, are the rule, and few of these are reported. The fact that several independent steel concerns, including the Pittsburg Steel, Inland Steel, and the Crucible, have announced their intention of building additional furnaces, when the production of iron is already far greater than the consumption, seems to add to the gloom of the merchant producers. The latter, in the Valleys district, are asking for basic iron, of which they have immense stocks. Jobbers are, however, reported to be selling basic at $13.75. Virginia iron is still quoted at $13 at furnace, with $2.80 freight rates from the furnace to New York. There is still considerable Virginia iron stocked. Southern No. 2 foundry iron is selling at $11.25, third quarter. Heavy stocks in that district are the rule.

Reports from the south are more hopeful again. One report says that there appears to be nothing to keep the price of pig-iron down to $11 much longer. On the contrary, it looks very much as if the $11.50 level has been reached. The liberal sales of pig-iron during the past three weeks and heavy movements from stocks in yards, as well as the rush orders from the consumers, together with the brisk inquiries for third quarter delivery, all of which have been turned down, contribute to this conclusion. The southern iron makers are more optimistic than they have been for many months.

There is no news from Great Britain, and as for the local market there is no change worthy of comment. It would seem that other markets are all marking time while all eyes are turned towards the United States to watch the effect of the rate decision.

**Bar Iron and Steel.**—Trade is reported first-class. Bar iron, $1.90 per 100 pounds; best refined horseshoe, $2.15; forged iron, $2.05; mild steel, $1.95; sleigh shoe steel, $1.95 for 1 x ⅜ base; tire steel, $2.05 for 1 x ⅜-base; toe calk steel, $2.75; machine steel, iron finish, $2.00; imported, $2.05.

**Antimony.**—The market is steady at 8¼c.

**Building Paper.**—Tar paper, 7, 10, or 16 ounces, $1.80 per 100 pounds; carpet felt, $2.50 per 100 pounds; tar sheathing, 36c. per roll of 400 square feet; dry sheathing, No. 1, 28c. per roll of 400 square feet; tarred fibre, 55c. per roll; dry fibre, 45c. (See Roofing; also Tar and Pitch).

**Cement.**—Canadian cement is quotable, as follows, in car lots, f.o.b., Montreal:—$1.35 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, $7 per ton, net; furnace coal, $6.75, 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 easy at 13¾c.

**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., $4.04. 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 following quotations are now given, basis of carloads, ex-store:—No. 1 Summerlee, $21.50 to $22 per ton; selected Summerlee, $21 to $21.50; soft Summerlee, $20.50 to $21; Carron special, $21 to $21.50; Carron soft, $20.50 to $21; Clarence, $18.50 to $19; Cleveland, $18.50 to $19.

**Laths.**—See Lumber, etc.

**Lead.**—Prices are firm at $3.65.

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

**Lumber, Etc.**—Prices on lumber are for car lots, to contractors, at mill points, carrying a freight of $1.50. Red pine, mill culls out, $17 to $21 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, $12 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, $1.60; XX, 2.60; XXX, $3.

**Nails.**—Demand for nails is steady and prices are: $2.40 per keg for cut, and $2.30 for wire, base prices. Wire roofing nails, 5c. lb.

**Paints.**—Roof, barn and fence paint, $1.25 to $1.45 per gallon; girder, bridge, and structural paint for steel or iron—shop or field— $1.45 to $1.55 per gallon, in barrels; liquid red lead in gallon cans, $2 per gallon.

**Pipe.—Cast Iron.**—The market shows a firm tone and trade is said to have been most satisfactory Prices are firm, and approximately as follows:—$33 for 6 and 8-inch pipe and larger; $34 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 63 per cent. off for black, and 48 per cent. off for galvanized; ½-inch, $8.50, with 69 per cent. off for black, and 59 per cent. off for galvanized. The discount on the following is 72½ per cent. off for black, and 62½ per cent. off for galvanized; ¾-inch, $11.50; 1-inch, $16.50; 1¼-inch, $22.50; 1½-inch, $27. On the following the discount is 73½ per cent. for black, and 63½ per cent. for galvanized: 2-inch, $36; 2½-inch, $57.50; 3-inch, $75.50. Discount on the following is 71½ per cent. off on black, and 61½ per cent. off for galvanized: 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. Roofing cement in bbls., of 40 gallons, 15c.; in 5-gallon tins, 20c. per gallon. (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, $4 per barrel of 40 gallons, weighing about 500 pounds; roofing pitch, No. 1, 75c. per 100 pounds; No. 2, 55c. per 100 pounds; pine tar, $9.50 per barrel of 40 gallons; refined coal tar, $4.50 per barrel, pine pitch, 3c. per lb.; rosin, 3¼c. (See building paper, also roofing).

**Tin.**—Prices are firm at $44.

**Zinc.**—The tone is easy, at 6¼c.

### CAMP SUPPLIES.

**Beans.**—Prime beans, $1.85 to $1.90.

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

**Canned Goods.**—Per Dozen.—Corn, $1.00; peas, $1.20 to $2.00; beans, $1.00; tomatoes, $1.45; peaches, 2s, $1.90; and 3s, $2.90; pears, 2s, $1.80; and 3s, $2.40; salmon best brands, 1-lb. talls, $2.07, and flats, $2.25; other grades, $1.40 to $2.10.

**Cheese.**—The market ranges from 12 to 13c., covering all Canadian makes.

**Coffee.**—Mocha, 22 to 30c.; Santos, 18 to 21c.; Rio, 15 to 18c.

**Dried Fruits.**—Currants, Filiatras, 6¾ to 9½c.; dates, 5½c.; raisins, Valentias, 7¾ to 8¼c.; prunes, 8½ to 12c.

**Eggs.**—New laid eggs, 30 to 35c.; No. 1 candled, 17 to 18c.

**Flour.**—Manitoba, 1st patents, $5.60 per barrel; and patents, $5.10, strong bakers', $4.90.

**Molasses and Syrup.**—Molasses, New Orleans, 27 to 28c.; Barbados, 34 to 36c.; Porto Rico, 40 to 43c; syrup, barrels, 3c.; 2-lb. tins, 2 dozen to case, $2.25 per case.

**Potatoes.**—Per 90 lbs., good quality, $1.10 to $1.20.

**Rice and Tapioca.**—Rice, grade B, in 100-lb. bags, 3¾ to 3⅞; Tapioca, medium pearl, 5½ to 8c.

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

**Sugar.**—Granulated, bags, $4.60; yellow, $4.20 to $4.45; Barrels 5c above bag prices.

**Tea.**—Japans, 20 to 28c.; Ceylons, 20 to 40c.; Ceylon, greens, 19 to 25c. China, green, 14 to 60c.

**Fish.**—Salt fish.—No. 1 green cod, $8 to $9 per bbl.; herring, $4.50 per bbl.; salmon, $8.50 per half barrel. Smoked fish.—Bloaters, $1.25 per large box; haddies, 8c. per lb.; kippered herring, per box, $1.20 to $1.40.

**Provisions.**—Salt Pork.—$24 to $25 per bbl.; beef, $18 per bbl smoked hams, 14 to 19c per lb.; lard, 14 to 15c. for pure, and 11½ to 12c. per lb. for compound; bacon, 13 to 18c.

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Toronto, March 2nd, 1911.

With respect to the iron and steel trade there is more activity in the United States, and a continuation of it is predicted as a reaction from the low point of December. Confidence is returning in that country, United States Steel put out an increase of 436,000 tons in January. And the decision of the Commission on railway rates will not vex these interests seriously, while it tends to settle the doubts and apprehensions of producers, and so tends to steadiness of trade. The tone of the American steel market is towards advance. Pig-Iron is higher in Pittsburg, and furnaces are increasing their capacity.

In this market a very fair business is passing for a time of year when stock-taking is being finished by iron and steel dealers. In lumber, the factories are all busy, but in yard trade the season occasions some slackness.

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

**Antimony.**—The demand is less active, and the price remains 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 to $9; 2¼-inch, $10; 2½-inch $10.50; 3-inch, $12.10; 3½-inch, $15; 4-inch, $19.

**Building Paper.**—Plain, 27c. per roll; tarred, 35c. Nothing doing.

**Bricks.**—In active movement, with very firm tone. Price at some yards $9.50, at others, $10.00 to $10.50 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, or Quebec Province. In October and November competition forced prices of limestone up to 90c., the city and the province competing for several thousand tons. But the reservoir and the hydro-electric being both supplied, normal prices have been resumed. One quarry (Maloney's) will run all winter to supply stone for the Island.

**Cement.**—Car lots, $1.65 per barrel, without bags. In 1,000 barrel lots, $1.55. In smaller parcels $1.90 is asked by city dealers. Bags, 40c. extra.

**Coal.**—Anthracite egg and stove, $7.25 per ton; chestnut, scarce, $7.50; pea coal $6.00 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; coke, Solvey foundry, which is largely used here, quotes at from $5.75 to $6.00; Reynoldsville, $4.90 to $5.10; Connelsville, 72-hour coke, $5.00 to $5.25. Shipments falling off on account of season drawing to a close. Dealers are buying only such quantities as are actually required so as to facilitate stock taking on April 1st. Nut coal still continues scarce, being held at a premium by miners. The soft coal market is practically unchanged and prices continue stiff as shipments are somewhat blocked by storms.

**Copper Ingot.**—The market has reached a firm basis, and holders are quite stiff at $13.50 per 100 lbs. Demand is active, and a large quantity moving.

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

**Dynamite.**—The price is determined by the point at which it is to be delivered. Here we quote 21 to 25c. as to quantity.

**Felt Roofing.**—Not much moving, price continues as before, $1.80 per 100 lbs.

**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; ¾-inch, $4.15; 7-16-inch, $3.95; ½-inch, $3.75; 9-16-inch, $3.70; ⅝-inch, $3.55; ¾-inch, $3.45; ⅞-inch, $3.40; 1-inch, $3.40, per 100 lbs.

**Iron Pipe.**—At present quotations are lower, thus:—Black Pipe, ¼-inch, $2.03; ⅜-inch, $2.25; ½-inch, $2.63; ¾-inch, $3.16; 1-inch, $4.54; 1¼-inch, $6.19; 1½-inch, $7.43; 2-inch, $9.54; 2½-inch, $15.24; 3-inch, $20.01; 3½-inch, $27.08; 4-inch, $30.78; 4½-inch, $35.75; 5-inch, $40.75; 6-inch, $52.85. Galvanized Pipe, ¼-inch, $2.86; ⅜-inch, $2.86; ½-inch, $3.48; ¾-inch, $4.31; 1-inch, $6.19; 1¼-inch, $8.44; 1½-inch, $10.13; 2-inch, $13.14, 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. Any change must be upward.

**Lead.**—A fair business is doing at prices unaltered from $3.75 to $4.

**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.

**Lumber.**—Demand less brisk, because of the late season of the year, but prices are not materially altered. 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, $32 to $42.50; hemlock is in demand and held quite firmly, we quote $17.50 to $18.00; spruce flooring in car lots, $22 to $24; shingles, British Columbia, are steady, we quote $3.30; lath, No. 1, $4.60; white pine, 48-inch, No. 2, $3.75; for 32-inch, $1.85 is asked. The factories are all busy; the yard trade necessarily more slack, because of the season of the year.

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

**Pitch and Tar.**—Pitch, unchanged at 70c. per 100 lbs. Coal tar, $3.50 per barrel. Season is over.

**Plaster of Paris.**—Calcined, New Brunswick, hammer brand, car lots, $1.05; retail, $2.15 per barrel of 300 lbs.

**Putty.**—In bladders, strictly pure, per 100 lbs., $2.60; in barrel lots, $2.10. Plasterer's, $2.15 per barrel of three bushels.

**Ready Roofing.**—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, 9½c. 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. | 8-in. | 12-in. | 24-in. |
|---|---|---|---|---|---|
| Straight pipe, per foot | $0.25 | $0.40 | $0.65 | $1.00 | $3.25 |
| Single junction, 1 or 2 ft. long | 1.00 | 1.60 | 2.60 | 4.00 | 13.00 |
| Double junctions | 1.25 | 2.00 | 3.25 | 5.00 | 16.25 |
| Increasers and reducers | .... | 1.60 | 2.60 | 4.00 | 13.00 |
| P. & H. H. traps | 2.00 | 3.20 | 6.50 | 15.00 | ..... |
| Bends | 0.75 | 1.20 | 1.95 | 3.00 | 9.75 |

Above is the October list, as changed. The retail price is less 65 per cent. off these figures on all sizes 9 inches and under, or less 60 per cent. off these figures on anything over 9 inches. For car-load lots 73 per cent. off list at factory. Demand normal.

**Steel Beams and Channels.**—Active.—We quote:—$2.25 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, $2.40; 12-gauge, $2.45; 14-gauge, $2.20; 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, and an advance is not unlikely.

**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. Active and firm at these prices.

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

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

**Tin.**—Control of the market is still evident, and the upward trend continues. We now quote 47c. to 48c.

**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.**—Demand not so brisk, and the market easier at $6.

### CAMP SUPPLIES.

**Beef.**—By carcases, $8.50 to $9.50.

**Butter.**—Butter is firmly held since last issue, dairy prints are to 22c., creamery prints, 27 to 28c. per lb.

**Canned Goods.**—Peas, $1.35 to $1.75; tomatoes, 3s, $1.45 to $1.50; pumpkins, 3s, 97½c.; corn, 95c. to $1.00; peaches, 2s, $1.87½; yellow, $1.82½ to $1.87½; strawberries, 2s, heavy syrup, $1.80; raspberries 2s, $1.80 to $1.97½.

**Cheese.**—Moderately firm, large, 13 to 13¼c.; twins, 13¾ to 13½c.

**Coffee.**—Rio, Green, 15½ to 16c.; Mocha, 23 to 25c.; Java, 25 to 31c.; Santos, 16 to 17c.

**Dried Fruits.**—Raisins, new, Valencia, 8 to 8½c.; seeded, 1-lb. packets, fancy, 8c.; 16-oz. packets, choice, 7½c.; Sultanas, good, 8½c.; fine, 9½c.; choice, 10 to 11c.; fancy, 12c.; Filiatras currants, cleaned, 7½ to 8c.; Vostizzas, 9 to 10c.; uncleaned currants, 7 to 7¼c.

**Eggs.**—Strictly new-laid, 23 to 24c.; storage, 15 to 17c.

**Flour.**—Prices unchanged thus far; thus, Manitoba flour, first patents, $5.20; second, $4.70; strong bakers', $4.60; Ontario flour winter wheat patents, $3.90; $4 per barrel.

**Feed.**—Bran, $22 to $23 per ton; shorts, $23 to $24 per ton.

**Lard.**—Tierces, we quote 11½c. here; tubs, 11¾c.; pails, 12c.

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

**Pork.**—Not much doing, short cut, $26 to $26.50 per barrel; mess, $1 off, heavy, $22 to $22.50.

**Rice.**—B. grade, 3½c. per lb.; Patna, 5 to 5¾c.; Japan, 5 to 6c.

**Salmon.**—As before stated. We quote Fraser River, talls, $2.05; flats $2.20; River Inlet, $1.90; cohoes, $1.75.

**Smoked and Dry Salt Meats.**—Long clear bacon, 11 to 11½c. per lb., tons and cases; hams, large, 12 to 13c.; small, 15 to 16c.; rolls, 12 to 13c.; breakfast bacon, 17 to 18c.; backs (plain), 19 to 20c.; backs (peameal), 19 to 20c.; shoulder hams, 13c.; green meats out of pickle, 1c. less than smoked.

**Spices.**—Allspice, 18 to 19c.; nutmegs, 30 to 75c.; cream tartar, 28 to 30c.; compound, 18 to 20c.; pepper, black, pure Singapore, 14 to 17c.; pepper, white, 25 to 30c.

**Sugar.**—Granulated, $4.35 per 100 lbs., in barrels; Acadia, $4.25; yellow, $3.95.

**Syrup.**—Corn syrup, special bright, 3¼c. per lb.

**Teas.**—Japans, 20 to 35c. per lb.; Young Hysons, 16 to 35c.; Ceylons, 17 to 38c. per lb.

**Vegetables.**—Potatoes—Ontario, $1 per bag, on railway track, Toronto; Ontario Delawares bring $1, and New Brunswick Delawares $1.10; onions by crate, Spanish, $3; Canadian, $1.85; cabbages bring from $1.25 to $1.50 per; barrel; carrots, 60c. per bag; beets, 75c. per bag; turnips, 40c. per bag. Fall apples sell at $4 per barrel, for ordinary, but first-class scarce at $5.

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Winnipeg, February 27th, 1911.

The situation in Winnipeg is becoming more active every day, the weather has now moderated, and there is every appearance of an early spring, and already many excavations have been started for large structures in this city. Interior work has also been progressing satisfactorily on several large buildings throughout the winter.

Dealers in builders' supplies are going to have a busy year, and it can safely be said in so far as the whole West is concerned that this will be the case with every line of building trade.

There is very little talk of any increase in price of material, although we are told that cement will in all probability be higher this season, as well as some grades of lumber.

Country orders for all lines of builders' hardware are coming in very well, and it looks as though business in the country would be just as brisk as in the city. There is no change in quotations to report this week, and the general outlook could scarcely be brighter than it is.

**Anvils.**—Per pound, 10 to 12½c.; Buckworth anvils, 80 lbs., and up, 10¾c.; 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. 2 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 6in., $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, $2 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.**—Coppered 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; ¼-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, 5¼c. per lb.; 12 inches up, per lb., 4¾c.

**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.

**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 67½cc. per roll.

**Rope.**—Cotton, ¼ to ½-in., and larger 23c. lb.; deep sea, 16½c.; lath yarn, 9½ to 9¾c.; pure Manila, per lb., 13¼c.; British Manila, 11¾c., sisal, 10½c.

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

**Spikes.**—Basis as follows:—1¼, 5 and 6, $4.75; 5-15 x 5 and 6, $4.40; ⅛ x 6, 7 and 8, $4.25; ⅛ x 8, 9, 10, and 12, $4.05; 25c. extra on other sides.

**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 base; cast tool steel, lb., 9 to 12½c.

**Staples.**—Fence, $3.40 per 190 lbs.

**Timber.**—Rough, 8 x 8 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.

# Tenders Called For

(Continued on pages 69 and 70.)

## CIVIC CAR LINES.

### TENDERS FOR RAILS AND TIES.

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on Tuesday, April 4th, 1911, for delivery of thirteen hundred and forty (1,340) tons of open hearth steel rail, 80-lb. section, also thirty thousand (30,000) untreated wood ties, white cedar preferred, although other woods will be considered.

Envelopes containing tender must be plainly marked on the outside as to contents.

Specifications and forms of tender may be obtained upon application to the office of the City Engineer, Toronto.

The lowest or any tender not necessarily accepted.

G. R. GEARY (Mayor),
Chairman Board of Control.

City Hall, Toronto, February 28th, 1911.

## FOR SALE

### FOR SALE.

One second-hand No. 1 Smith Concrete Mixer, with engine and boiler complete.

One second-hand 7 x 12 hoisting engine, 3 drum D.C., and boiler complete, nearly new.

One 5-ton derrick with cables and sheaves.

One ¾-yard clam shell bucket, nearly new.

Apply to A. J. CROMAR,
Brantford, Ont.

### FOR SALE.

1 70-ton Atlantic Steam Shovel in exceptionally fine condition.

34-yard Western Two-way Dump Cars.

2 18-ton American Locomotives.

THE BARRON & COLE CO.,
127 Franklin Street, - - - New York City.

### FOR SALE.

A good 15-in. dumpy Berger level-erecting eyepiece, in perfect condition, nearly new. Price, $7,500. Address, Box 162, Canadian Engineer.

### PATENT NOTICE.

**Anyone desiring to obtain the invention covered by the Canadian Patent 117063, dated March 9th, 1909, for Grinding Lathes, owned by the Tindel-Morris Co., may do so on application to Latham & Groves, Ottawa, or to the undersigned. All reasonable demands on the part of the public for the invention will be filled. Fetherstonhaugh & Co., 5 Elgin St., Ottawa. Russel S. Smart, resident.**

### PATENT NOTICE.

**Anyone desiring to obtain the invention covered by Canadian Patents No. 111966, granted on May 19th, 1908, and No. 112334, granted June 9th, 1908, to Henry C. Newton and Anthony C. H. Mitchell, of Melbourne, Australia, for Cipher System, may do so upon application to the undersigned, who are prepared to supply all reasonable demands on the part of the public for the invention, and from whom all information can be obtained. Fetherstonhaugh & Co., 5 Elgin St., Ottawa, Canada. Russel S. Smart, resident.**

### NOTICE

**Western Canada firm with large connection, open to handle Builders' Iron Work and Mechanical Specialties on Commission basis. Correspondence solicited.**

**WESTERN STEEL & IRON CO., WINNIPEG, Can.**

**When writing to Advertisers mention The Canadian Engineer —you confer a favor on both Advertiser and Publisher.**

## POSITIONS WANTED

**A PRACTICAL** Portland cement maker, 30 years' experience, able to superintend erection of works; rotary process, and supply plans, etc.; also patentee, wishes to associate with capitalists to erect new works, or will take management of existing mills. Highest references and testimonials Address "Cement," care of Canadian Engineer, Toronto.

**SEWERAGE AND WATERWORKS**—A.M. Inst. C.E., F.C.S., F.R.M.S., London, arriving Toronto, March 11th, wants berth. Adaptable, energetic, excellent testimonials. Latest Bacterial treatment. Box 164, Canadian Engineer.

**ELECTRICAL ENGINEER** (34), at present engaged as Deputy Borough Electrical Engineer in England, is anxious to obtain a similar post in Canada or as an Engineer in charge of the erection of plant, will pay all own expenses in getting out to Canada. Thorough experience in every branch and can produce excellent references from the best known British Engineers. Very moderate salary asked. Nine years in present berth. Box 166, Canadian Engineer.

## POSITIONS VACANT

### MUNICIPAL COMMISSIONER WANTED.

### CITY OF SASKATOON, SASKATCHEWAN.

Applications will be received by the undersigned City Clerk up to and including March the 17th, 1911, at the hour of 5 o'clock p.m., for the position of Municipal Commissioner.

Applications must be marked "Municipal Commissioner."

Further information may be had on application to the City Clerk.

JAMES CLINKSKILL, Mayor.
A. LESLIE, City Clerk.

Saskatoon, Sask., February 16th, 1911.

**CANADIAN AGENT** wanted for an old established European firm, manufacturing a special line of Electrical Apparatus. Apply "Electrician," Canadian Engineer.

**WANTED**—Construction Engineer having several years' experience in concrete and general construction work. Apply Smith, Kerry & Chace, Confederation Life Building, Toronto, by letter only, stating experience fully.

### ELECTRICAL SUPERINTENDENT.

Applications for the position of Electrical and Mechanical Superintendent for the City of Saskatoon, will be received up to 15th March, 1911.

Applications must be accompanied with references, and be addressed to City Clerk, Saskatoon, and marked "Electrical Superintendent."

JAS. CLINKSKILL, Mayor.
W. B. NEIL, Commissioner.

Saskatoon, Saskatchewan, February 21st, 1911.

# Index to Advertisements

# TENDERS CALLED FOR

### TENDERS FOR A STEEL BRIDGE.

THE RURAL MUNICIPALITY OF SWAN RIVER, in Manitoba, invite tenders for one ninety-four (94) foot centre to centre of end bearings Steel-riveted Pratt Truss Bridge and two Concrete Piers with (Steel) Stringers, and three (3) inch Tamarac Plank Floor. To be erected over the Woody River, east side of Section 36, Township 37, Range 27, west of the Principal Meridian in Manitoba, in accordance with Specifications, which can be obtained from the Provincial Department of Public Works, Parliament Buildings, Winnipeg, Manitoba.

The bridge site is within one mile of Bowsman Station on the Canadian Northern Railway.

Sealed Tenders to be delivered to the undersigned on or before the 15th day of April, A.D., 1911.

JOSEPH ARMSTRONG,
Secretary-Treasurer, Municipal Council,
Swan River, Manitoba.

### MUNICIPALITY OF POINT GREY, WATER SUPPLY, DISTRIBUTING MAINS.

**Contracts Nos. 6, 7, and 8.**

The Corporation of the Municipality of Point Grey invite sealed tenders (1) for the work of taking delivery of steel pipes, valves, hydrants and special castings; (2) for hauling the same to the different sites in the Municipality; (3) for excavating and refilling trenches and laying and jointing about 38 miles of pipes, ranging in diameter from 25 to 4 inches.

Specification, Schedule of Quantities and Forms of Tender may be obtained at the office of the Engineers, Messrs. Cleveland & Cameron, 506 Winch Building, Vancouver, on payment of $20 which will be refunded on receipt of a **bona fide** tender and return of the documents.

Tenders made out on the Schedule of Quantities and forms supplied only will be received.

Tenders endorsed on outside of envelope, "Pipe Laying," and addressed to the undersigned and accompanied by a certified cheque for a sum equivalent to 5 per cent. of the amount of Tender, to be delivered at the Municipal Hall, Kerrisdale, not later than 5 p.m., on Monday, 6th March, prox.

The Council will not be bound to accept the lowest or any tender.

H. FLOYD, C. M. C.
Kerrisdale, B.C., February 15th, 1911.

### THE CITY OF CALGARY.

Tenders will be received by the City Commissioners up to 12 o'clock noon on the 22nd day of March, 1911, for the following machinery and plant:

One 1,500 K.W. Turbo Generator set with condenser, etc
One 100 K.W. Exciter and Switchboards, complete.
Three 1,000 K.V.A. single-phase Transformers, 12,000 to 2,300 volts, with switching gear, etc.

An accepted cheque for 2 per cent. of the tender must accompany all bids. Cheques will be returned after the contract has been signed.

The successful tenderer will be obliged to enter into a bond with the City for the fulfilment of his contract on a date to be agreed upon by the City and Contractor.

The City reserves the right to accept any or reject the whole of the tenders submitted, or to depart from the specification as may be deemed advisable by the City.

W. D. SPENCE,
Dated at Calgary, Feb. 9th, 1911. City Clerk.

### TOWN OF SOURIS, MAN.

Sealed Tenders will be received by the undersigned until six (6.00) o'clock p.m., on March 20th, 1911, for the following work to be done during the season of 1911:

Excavation, laying and back filling for approximately 31,500 feet of Standard Vitrified Sewer Pipe (8 in. to 20 in.) and all necessary Tees, Wyes, etc., etc.

Excavation, laying and back filling for approximately 31,500 feet of Standard Cast Iron Water Pipe (4 in. to 12 in.) and all necessary Tees, Reducers, etc., etc., also setting Gate Valves and Valve Boxes.

Excavation, setting and back filling for seventy (70) Standard Fire Hydrants.

Construction of approximately seventy-five (75) Manholes, and setting covers and frames of same.

The construction of a Brick Building 60 ft. x 40 ft. x 14 ft., on Concrete Foundation, together with all necessary machinery, consisting of Compression Tanks, Gasoline Engines and Pumps, etc., etc.

Interested parties desiring to tender on any or all of the above work can obtain further information and forms for tender by applying to the Town Engineer or Secretary-Treasurer. Plans, profiles and specifications may be seen at the office of the Town Engineer, Souris, Manitoba.

V. H. WILLIAMS, Town Engineer.
J. W. BREAKEY, Secretary-Treasurer.
Souris, Man., February 14th, 1911.

### CITY OF MOOSE JAW, SASKATCHEWAN.

**Main Drainage Works.**

Sealed tenders endorsed "Tender A" and "Tender B," will be received by the undersigned City Clerk until 8.30 o'clock p.m. on Monday, April 10th, 1911. Any tender received after the above stated time be declared informal.

**Contract "A."**

Supplying materials for and constructing a Sewage Disposal Plant complete, including a Pump House, Sedimentation Tanks and Percolating Filters, also the supplying of materials for and the laying of a Trunk Sewer and Water Main.

**Contract "B."**

Supplying two Electrically-driven Centrifugal Pumps and Auto Starters complete with all piping, connections, etc.

Plans and specifications for contract "A" may be obtained from the City Engineer, Moose Jaw, upon receipt of a marked cheque for the sum of $25, to be held until return of plans and specifications; and for contract "B" plans and specifications will be sent upon request.

The lowest or any tender not necessarily accepted.

J. M. WILSON, City Engineer.
W. F. HEAL, City Clerk.
Moose Jaw, February 18th, 1911.

### TENDERS FOR A STEEL BRIDGE.

The Municipal Council of THE RURAL MUNICIPALITY OF MINNITONAS invite TENDERS for the supply and erection of a Steel Warren Truss Bridge, and Two Concrete Piers. Bridge to be 60 feet centre to centre of end bearings with Steel Stringers and Three-inch Plank Floor in accordance with Plan (No. F 10), and specifications on file at this Office, and also at the Office of the Chief Engineer, Department of Public Works, Parliament Buildings, Winnipeg, Manitoba.

Tenders under Seal to be delivered to the undersigned on or before the 15th Day of April, A.D. 1911.

The lowest or any Tender not necessarily accepted.

E. WIDMEYER,
Secretary-Treasurer, Municipal Council,
Minnitonas, P.O., Manitoba.

# Tenders Called For

### ELECTRIC STREET RAILWAY SYSTEM.

The Council of the City of Saskatoon is prepared to receive proposals for a Franchise for an Electric Street Railway System.

Communications giving full details to be addressed to the City Clerk marked "Street Railway," and will be received up to the 3rd of April, 1911.

JAS. CLINKSKILL, Mayor.
W. B. Neil, Commissioner

Saskatoon, Saskatchewan, 21st February, 1911.

### CITY OF MOOSE JAW, SASKATCHEWAN.

### SEWER AND WATER EXTENSIONS.

Sealed tenders endorsed "Tender 28," "Tender 29," "Tender 30," and "Tender 31," will be received by the undersigned City Clerk until 8.30 o'clock p.m., on Monday, April 10th, 1911.

Any tender received after the above stated time will be declared informal.

CONTRACT 28—

The laying of approximately 30,700 lineal feet of tile pipe sewer, building manholes, etc.

The laying of approximately 29,700 lineal feet of cast iron water main, placing valves, valve boxes, hydrants, etc.

CONTRACT 29—

The supplying of approximately:

| | |
|---|---|
| 29,600 | lineal feet of 6-in. C.I. Water Pipe. |
| 112 | " " of 4-in. " " " |
| 132 | 6-in. cast iron reverse curves. |
| 34 | 6-in. cast iron crosses. |
| 72 | 6-in. cast iron tees. |
| 29 | 4-in. off 6-in. cast iron tees. |
| 28 | 4-in. cast iron tees. |
| 95 | 6-in. cast iron plugs. |

CONTRACT 30—

The supply of approximately:

| | |
|---|---|
| 26,600 | lineal feet of 8-in. Vitrified Tile Sewer Pipe. |
| 5,225 | " " of 10-in. " " " " |
| 1,100 | " " of 12-in. " " " " |
| 25 | 8-in. Tees. |
| 75 | 6-in. Tees. |
| 25 | 8-in. Bends, 9 degrees. |
| 100 | 6-in. ⅛ Bends, 90 degrees. |
| 25 | 8-in. Stops. |
| 25 | 10-in. Stops. |
| 400 | 4-in. to 6-in. Increasers. |

CONTRACT 31—

The supply of approximately:

| | |
|---|---|
| 65 | 6-in. 3-way Hydrants. |
| 147 | 6-in. Gate Valves. |
| 29 | 4-in. Gate Valves. |
| 150 | 6-in. Valve Boxes. |
| 29 | 4-in. Valve Boxes. |
| 88 | Manholes, Frames and Covers. |

Plans and specifications for Contract 28 may be obtained from the City Engineer, Moose Jaw, and from the offices of the Canadian Engineer at Toronto and Winnipeg.

Plans and specifications for Contracts 29, 30, and 31, will be sent upon request.

The lowest or any tender not necessarily accepted.

J. M. WILSON, City Engineer.
W. F. HEAL, City Clerk.

Moose Jaw, Sask., 24th February, 1911.



### RIDEAU CANAL.

### NOTICE TO CONTRACTORS.

SEALED TENDERS addressed to the undersigned, and signed, and endorsed (a) "Tender for Timber," or (b) "Tender for Timber and Plank," will be received at this office until 16 o'clock on Monday, the 20th March, 1911, for the supply and delivery of British Columbia or "Douglas Fir" dimension timber and also for other Lumber and Timber required for use on the Rideau Canal for the year 1911-1912.

Specifications, Bills of Timber and full information can be obtained from the Purchasing Agent of the Department of Railways and Canals, Ottawa, on and after this date.

The lowest or any tender not necessarily accepted.

By order,
L. K. JONES,
Secretary.

Department of Railways and Canals,
Ottawa, 22nd February, 1911.

Newspapers inserting this advertisement without authority from the Department will not be paid for it.

# CATALOGUE INDEX

Some of the most valuable information on engineering and contracting subjects is to be found in the trade literature of the large supply houses.

**The Canadian Engineer maintains a card index upon which is kept an up-to-date list of manufacturers of contractors supplies and engineering equipment. If you want the catalogues of any of these firms all you need do is to send us a postal giving your address and the list numbers (as printed below) of the catalogues you wish sent. This will save you time and labor and insure prompt service. This department can put you in direct communication with the principal manufacturers of and dealers in engineering equipment of all kinds.**

1 Air compressors.
2 Air lift pumping machinery.
3 Alloys.
4 Aluminum.
5 Angles (see structural steel).
6 Architects' supplies.
7 Asbestos and Asbestos Products.
8 Asphalt.
9 Asphalt plants and tools.

10 Bars (steel)
11 Bearing Metals.
12 Bearings, ball and roller.
13 Belt dressing.
14 Belt tighteners.
15 Belting, chain, link, canvas, etc.
16 Benders (rail).
17 Blacksmiths' tools.
18 Blast furnaces and fittings.
19 Blasting powder.
20 Blocks and tackle.
21 Blowers.
22 Boiler fittings, mountings and tubes.
23 Boiler tubes.
24 Boilers (tubular).
25 Boilers (water-tube).
26 Bolts.
27 Bolts (machine).
27A Bonding for Concrete.
28 Bonds (Contractors').
29 Books (engineering and technical).
30 Boots.
31 Brackets and cross-arms
32 Brick and tile.
33 Brick (paving).
34 Bridge builders.
35 Bridge engineers.
36 Bridges (concrete).
37 Buckets.
38 Buckets (clam shell).
39 Buckets (concrete).
40 Buckets (dredging and excavating).

41 Cables (manila).
42 Cableways.
43 Caisson Foundations.
44 Car replacers.
45 Carbolineum.
46 Cars (ballast).
47 Cars (concrete).
48 Cars (dumping).
49 Cars (industrial).
50 Cars (inspection).
51 Carts and wagons (ash and dump).
52 Carts (concrete).
53 Castings (malleable iron).
54 Castings (steel).
55 Cement.
56 Cement block and brick machines.
57 Cement-making machinery.
58 Cement testing machines.
59 Cement waterproofing.
60 Centers.
61 Chemists.
62 Chimneys (concrete).
63 Chimneys (steel).
64 Clutches (friction).
65 Coal and ore-handling machinery.
66 Cofferdams.
67 Compressed-air tools.
68 Concrete block machines
69 Concrete reinforcement.
70 Conduits (steel)
71 Conduits (vitrified clay).
72 Contractors' (general).
73 Conveying machinery.
74 Conveyers (belt).
75 Conveyers (cable).
76 Cordage.
77 Cranes and hoists.
78 Cranes (derrick).
79 Cranes (electric).
80 Cranes (hand-power).
81 Cranes (locomotive).
82 Cranes (travelling).
83 Crusher castings (rock).
84 Crushing rolls.
85 Culverts.
86 Curb (steel).

87 Dams (concrete).
88 Derails.
89 Derricks (pile driving).
90 Derricks (steam).
91 Drafting Instruments and supplies (see engineers' and surveyors' instruments and supplies).
92 Dredging machinery.
93 Drills (pneumatic).
94 Drills (rock).
95 Drums (hoisting).
96 Dryers (cement, asphalt and sand).
97 Dynamite.

98 Elevators (bucket).
99 Engineers and contractors.
100 Engineers' and surveyors' instruments and supplies.
101 Engines (compressed air).
102 Engines (gas, gasoline, oil).
103 Engines (high duty—pumping).
104 Engines (hoisting).
105 Engines (oil).
106 Engines (steam).
107 Engines (traction).
108 Excavating machinery.
109 Explosives.
110 Fans.
111 Fence, railing and posts
112 Filters (feed water).
113 Filters (water).
114 Fire brick and fire clay.
115 Forgings (steel).
116 Foundations.
117 Foundry equipment and supplies.
118 Frogs and switches (ry.).

119 Garbage crematories.
120 Gas producers.
121 Gates and valves.
122 Gauges (steam), (see steam specialties).
123 Generators (electric).
124 Governors (water-wheel).
125 Grain elevators and storage tanks.
126 Grinding & Mixing Machinery.

127 Hand cars.
128 Heating and ventilating machinery.
129 Hoists (chain and rope).
130 Hoists (pneumatic).
131 Hoists (steam).
132 Hydrants.

133 Ice and refrigerating machinery.
134 Incline cableway engines.
135 Inspection of materials.
136 Irrigation supplies.

137 Jacks (screw and lever)
138 Jacks (hydraulic).
139 Jacks (pneumatic).
140 Jacks (track).

141 Kilns (cement).

142 Lamp posts.
143 Levels.
143A Lights (Contractors' & Municipal).
144 Locomotives (industrial and light).
145 Locomotives (steam)
146 Locomotives (traction).

147 Manganese steel.
148 Manhole covers.
149 Meters (water, oil and gas).
150 Mixers (asphalt).

151 Oakum.

152 Paints and metal coatings.
153 Paving joint filter.
154 Penstocks.
155 Pile driving machinery.
156 Pile protection.
157 Piling (interlocking steel).
158 Pipe (galvanized iron).
159 Pipe (reinforced concrete).
160 Pipe (riveted steel).
161 Pipe (wood).
162 Portland cement.
163 Pulverizers.
164 Pumps (pneumatic).
165 Pumps (centrifugal).
166 Pumps (diaphragm).
167 Pumps (waterworks).

168 Rail joints, fastenings and specialties.
169 Railroad track supplies.
170 Rails and track.
171 Rails, second-hand.
172 Railways, industrial and narrow-gauge.
173 Reinforcement steel for concrete structures.
174 Riveting hammers.
175 Riveting machines.
176 Road machinery.
177 Road oils.
178 Road rollers.
179 Roofing.
180 Rope (wire).
181 Rubber boots.

182 Sand-blast machines.
183 Scarifiers.
184 Schools and colleges.
185 Scrapers, road.
186 Second-hand machinery and supplies.
187 Sewage disposal.
188 Sewer braces.
189 Sewer buckets.
190 Sewer flushers (automatic).
191 Sewer pipe.
192 Shovels (steam).
193 Shovels and picks (hand).
194 Sluice gates.
195 Steam specialties.
196 Steel substructures for tanks.
197 Street-cleaning implements, machinery and snow plows
198 Street sprinklers.
199 Structural materials
200 Structural steel.

201 Testing laboratories (chemists, etc.).
202 Ties (steel and wood).
203 Tile.
204 Track tools.
205 Traction ditching machines.
206 Transits.
207 Trench excavating machi
208 Turbine pumps.
209 Turntables (overhead).

210 Valves (sluice).

211 Wagons (contracto
212 Wagons (garbage).
213 Wagons (oil).
214 Well-drilling machin
215 Wheelbarrows.
216 Winches.

# AMONG THE MANUFACTURERS

**A department for the benefit of all readers to contain news from the manufacturer and inventor to the profession.**

## PANAMA SENIOR.

The "Panama Senior" Grader, the modern road machine, has been proven the most complete and practical road builder ever offered to the road building men of this country. Designed after entirely new ideas, the result of long study and actual tests. Built to meet the requirements of a machine for general work, such as opening ditches, grading, leveling, irrigating, spreading stone, cleaning snow from pavements and, in fact, any kind of work requiring the moving of earth and similar material. Will do more work in this respect, with the least expenditure of money and power, than any machine ever introduced.

**New Principles in Tilting the Blade.**—Examine carefully the cuts of this machine and you will readily see both the mechanical and operating advantages. The new feature of raising, lowering and tilting the entire frame with the blade, is in itself very important, as it does away with all weak parts between the frame and blade, allows a better clearance, keeps the weight and strength where it is most needed and allows for tilting the blade to an extreme degree. This is a particular advantage in cleaning or digging a deep narrow ditch.

**Two or Four Horses. One or Two Men.**—One man with one team can operate this machine, but for heavy work four horses should be used. An extra seat is provided for a driver if the operator does not care to do his own driving. The front truck is so arranged that a very short turn can be made.

The Westinghouse Electric & Manufacturing Company has received a contract from the Perine Machinery Company, Seattle, Wash., for four alternating current induction type CCL motors to be used in operating exhauster fans for removing chips, shavings, sawdust, etc., from the joiner and boat shops at the Puget Sound Navy Yard, Bremerton, Wash. The fan rotors will be overhung on the motor bearings; this direct connection of the units is probably the most interesting feature of the work. The four motors will have capacities of 10, 15, 50, and 75 horse-power each. The work in connection with the installation of the motor-driven fans will be done under the cognizance of the Bureau of Construction and Repair, Navy Department.

Messrs. Broadbent & Sons, of Huddersfield, England, have just sold the Nova Scotia Steel & Coal Co. three half-ton electric capstans. This is a repeat order, as one capstan of the same design was sold last summer to the company by Messrs. Broadbent & Sons. Broadbent's capstans are self-contained, the casing is accessible though watertight, and control is fool-proof. They have a good reputation for giving excellent service. Broadbent's are also makers of cranes of all sorts, which are likely to have a good sale in Canada in the future. The representatives for Canada for Broadbent's are Mr. Geo. H. Tod, of Toronto, formerly chief engineer of the Polson Iron Works, and Mr. Arthur Brittain, of Victoria, who has had an unusually extensive experience in handling machinery of all kinds.

## NEW INCORPORATIONS.

**Fort William, Ont.**—Chapples, Limited, $50,000; C. E. Chapple, D. Reid.

**Galt, Ont.**—Newlands & Co., $250,000; A. Newlands, J. Stauffer, M. A. Newlands.

**Inwood, Ont.**—Inwood Rural Telephone Co., $25,000; J. H. Morrison, W. R. Dawson, J. Brown.

**North Hatley, Que.**—North Hatley Manufacturing Co., $20,000; T. V. Reed, J. G. Robinson, J. J. McRae.

**Frankford, Ont.**—Frankford Canning & Preserving Co., $40,000; J. F. MacGregor, W. H. Walter, J. R. Corkery.

**Shawinigan Falls, Que.**—Shawinigan Pulp & Paper Co., $100,000. J. L. Marchesseault, J. E. Thibaudeau, Shawinigan Falls; J. Boivin, Three Rivers.

**Ottawa, Ont.**—Nepean Realty, $150,000; R. A. Sibbitt, J. N. Rattey, A. Gay. All Red Line Steamship Co., $100,000; J. A. Ritchie, O. Ritchie, J. N. Rattey.

**Brantford, Ont.**—Commonwealth Oil & Gas Co., $300,000; A. Sheard, L. J. Hastings, T. Linscott. Herod Machine & Motor Co., $40,000; C. H. Herod, C. J. Harris, M. E. Harris.

**British Columbia.**—Canadian Crude Oil Co., $750,000. Canadian Ideal Gas & Light Co., $5,000. Essex Shingle Co, $10,000. Nanaimo Brick & Coal Co., $200,000. Western Canadian Lumber & Fuel Co., $150,000.

**Winnipeg, Man.**—Rocmac Road Co., of Manitoba, $100,000; W. A. Preston, Fort Frances; W. Blackwood, Winnipeg; F. H. Keefer, Port Arthur. Co-operative Manufacturing Co., $500,000; A. L. Neilson, C. Roberts, G. F. Brown.

**London, Ont.**—Albemarle Zinc Company, $450,000. C. T. Campbell, S. Woolverton, C. B. Hunt. Andrews Toggery, $40,000. F. J. Andrews, A. Selak, A. E. Dufton. Moore Fruit Co., $25,000. F. G. L. Moore, E. W. G. Moore, D. S. Hamilton.

**Toronto, Ont.**—Brown Furniture Company, $200,000. A. Foulds Jr., W. W. Davidson, F. C. Carter. West Domes Mines, $3,000,000. A. W. Ballantyne, C. F. Ritchie. Forest Lawn Mausoleum Cemetery Co., $15,000. J. S .Lovell, W. Bain, R. Gowans. Canada Wire & Cable Co., $500,000. E. A. Wallberg, Montreal; H .H. Horsfall, R. J. Parke, Toronto.

**British Columbia.**—A. G. Brown-Jemison Co., $75,000. Alberni District Electric Light and Power Co., $25,000. Coast Shale Brick Co., $100,000. Consolidated Electric Heaters, $100,000. Cranbrook Garage Co., $25,000. Eastern Sales Co., $50,000. Lillooet Power and Light Co., $50,000. National Coal and Coke Co., of British Columbia, $2,000,000. Pacific North-West Fisheries, $50,000.

**Winnipeg, Man.**—Northern Investments, $100,000. E. L. Taylor, C. D. H. MacAlpine, M. M. Nesbitt. General Assets and Agency Corporation, $95,000. A. J. Long, R. F. McWilliams, G. H. Aikins. Sheppard Investment Co., $150,000. F. S. Andrews, H. A. Burbidge, F. M. Burbidge. Enderton Investment Co., $300,000. F. S. Andrews, H. A. Burbidge, F. M. Burbidge. Inland Mortgage Corporation, $300,000. N. T. Macmillan, W. A. Vrooman, J. B. Hugg. General Investment Co., $20,000. H. A. Burbidge, F. M. Burbidge, D. L. Bastedo. Red River Metal Co., $40,000. W. H. Irwin, F. G. Irwin, I. W. Dafoe.