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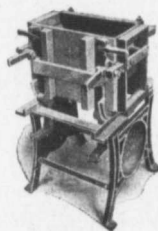
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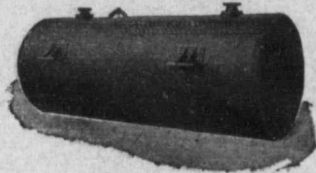
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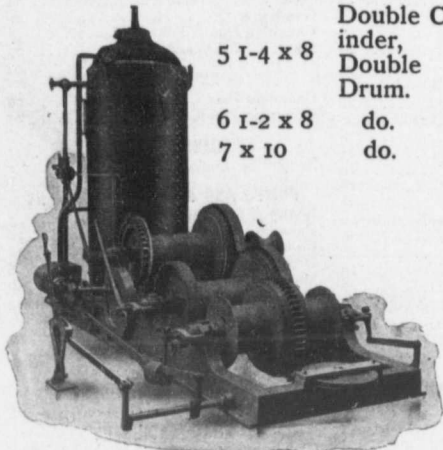
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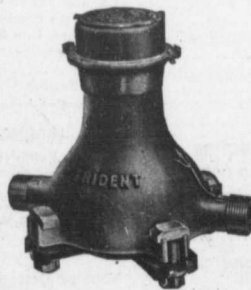
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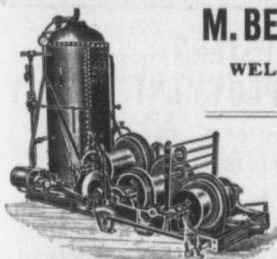
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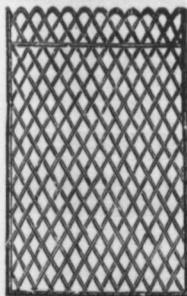
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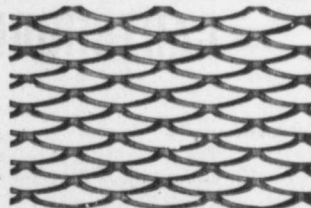
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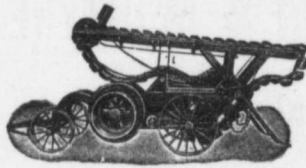
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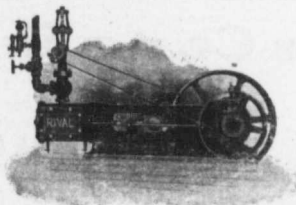
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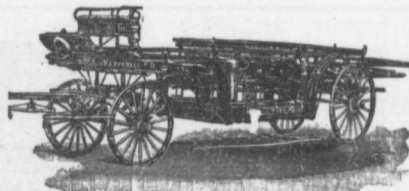
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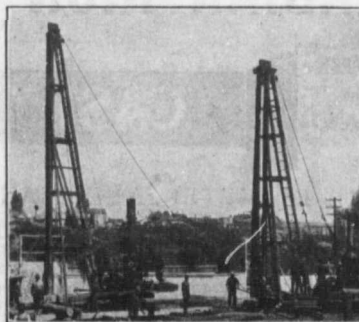
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GERMAN ALSEN, at higher prices than competitors has again this year been awarded the most important contracts of the World because practical tests by leading Engineers proved its merit and relative economy. Note the wing —

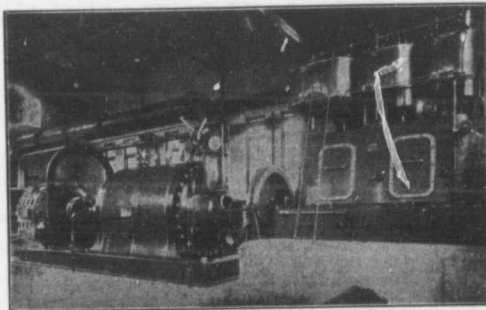
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MEXICO CITY	120,000 bbls.	U.S. PHILIPP COVMT	40,000 bbls.
MEGAXA DAM (shipping instructions so far 60,000 bbls.) approximate amount	175,000 bbls.	COVMT. ORDER SOUTH AMERICA	150,000 bbls.
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Also enormous quantities for the PACIFIC COAST, AUSTRALIA, ENGLAND, SOUTH AFRICA, &c.

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Built for the Montreal Water and Power Co., to do 4,500 Imperial
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KORTUNG TWO CYCLE GAS ENGINES,
GRAVITY AND PRESSURE FILTER
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WHAT THE "IDEAL" FACE DOWN MACHINE WILL DO



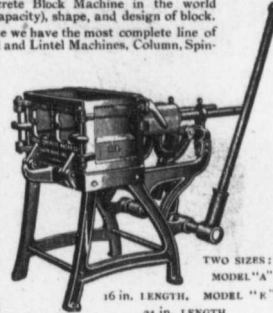
There is absolutely no limit to the artistic possibilities of the Ideal Concrete Block Machine. Of the almost endless forms and designs of blocks that a single machine can produce, samples of a few are shown in cut. The "Ideal" is the only FACE DOWN Concrete Block Machine in the world with practically unlimited adaptability as to size (within capacity), shape, and design of block.

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IDEAL Face Down Interchangeable Concrete Machines

are in profitable operation in the United States alone, and we have recently closed the largest single contract for block machines in the history of the cement industry. Within a period of 30 days we have made heavy shipments to Calcutta, Shanghai, Sydney, Khartum, Valparaiso, Mexico, Glasgow, Budapest, Bucharest, and Panama. Six carloads went to a single foreign country.

Our catalogue, magnificently illustrated, contains information of vital importance to Architects—Contractors—Builders and those who manufacture Concrete Stone. Sent FREE on application.



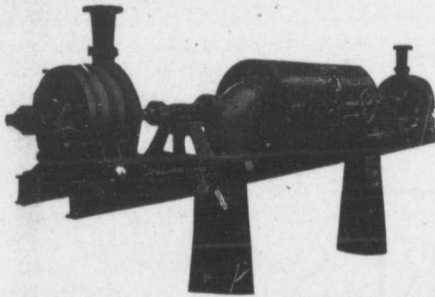
TWO SIZES:
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Boilers, (Return Tube and Water Tube,) Tanks, Penstocks, Mill Machinery.

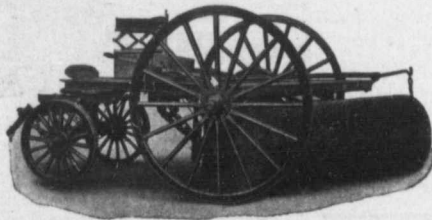
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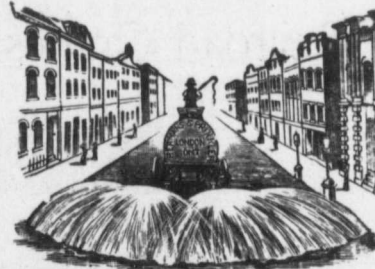


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Street Sweeping Machine

Is the Standard of Perfection

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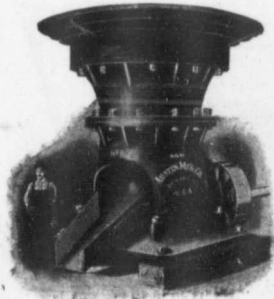


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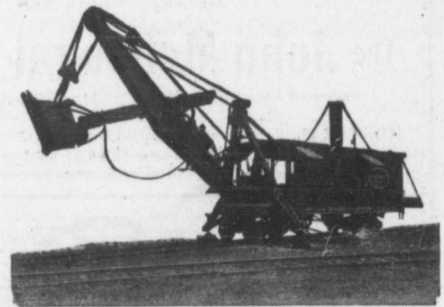
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CANADIAN
CONTRACT RECORD

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MUNICIPAL IMPROVEMENT.

Even the most casual observer cannot but be struck by the vast improvement in municipal conditions that has been made during the past decade. Good roads, good residences and improved sanitation are rapidly taking the place of the sloughs and unsanitary dwellings that were characteristic of our forefathers. In rural districts that twenty-five years ago were swamp and bush there are now to be seen brick dwellings, bank barns, furnace-heated schools and a telephone system. The township and town councils are composed of men of broad outlook in the majority of cases. They have traveled and made themselves acquainted with conditions lying beyond their own immediate neighborhood, and a wholesome rivalry has in many instances sprung up between neighboring districts in the carrying out of improvements.

After all, neither more drastic legislation nor the rigid enforcement of existing laws is calculated to produce permanent good results. Citizens of a community must be educated into the right conception of government as a benefit to be equally enjoyed by all. That this is being recognized more and more is shown by the fact that from small hamlet to great city there is experienced an increasing difficulty in inducing the best men to undertake municipal office. The transition from the desire for personal aggrandizement to the desire of the greatest

good for the greatest number is slow but sure. The ideals of civic purity and excellence are higher than ever before, and the population as a whole is exerting itself to bring about in matters private and public higher standards of living. Even greater in the future will be the effect of this silent influence, when hundreds of intelligent and aggressive men and women in centralized communities occupy themselves in making a consistent and intelligent study of improved conditions.

U. S. FORESTRY SERVICE MAKES TESTS.

It is doubtful if any of the laboratories maintained by the government for scientific research are more unique in character, and yet bear promise of more important results, than one which has just been established in Washington by the United States Forest Service for investigating the structure of commercially important woods.

Laymen will not understand the significance of the proposed investigations carried on in this laboratory so quickly as architects, builders and other wood users, who in these days of growing scarcity of the more valuable woods are seriously perplexed in identifying substitutes. Mistakes of this kind in identification have, in the last few years, in several instances, meant the loss of thousands of dollars, and many embarrassing law suits.

Nearly any user of lumber can recognize, and name off-hand, all the usual trees of the forest when he sees them growing, and not much difficulty is encountered in identifying the common kind of lumber in a mill yard because he knows the few trees from which the yard lumber comes. But common kinds are growing scarce, and woods not often cut heretofore are appearing in the markets. The most experienced men are sometimes puzzled when they try to identify them, and persons with less experience have still more trouble. Is a certain wood gum or elm? Is another cucumber, linn, or poplar? Is a stick sugar maple or red maple? Doubts may arise whether a piece is hemlock

or spruce, or whether it is lodgepole pine or fir, or whether a shingle is eypress or cedar. A dealer may buy red oak and suspect that he is getting something else. There are thirty or more important species of oak. The best lumber dealer might not know which is which in the lumber pile, or if he knows he might not know how to prove it.

Many of these woods look alike, even to the trained eye of the millman or the builder, and yet they are widely different in value for certain purposes, and it is of the greatest importance to be able to distinguish them quickly and certainly. Again, a new wood may come to a man's notice for the first time, and it may be necessary for him to decide what it is and what it is worth.

The government has been helping individual lumber users for some time, but the facilities have not been nearly so complete as they are now. It is to meet such needs and answer such questions that the Forest Service has established the laboratory, and placed it in charge of a trained dendrologist. Architects, lumbermen, manufacturers and makers of woodware are already sending in samples of wood for identification, and asking if there are not some structural characters by means of which such woods may be conveniently separated for relative species having greater or less value for some specific purpose.

The laboratory will investigate in a practical way. The structure of the woods, sections lengthwise and crosswise, will be studied so as to separate by structure alone the various species of a genus. Analytical keys to the trees of each group will be worked out. These will be based on the arrangement and character of the pores discernible to the naked eye, or by a hand lens.

The results will be published from time to time with good illustrations and placed at the disposal of lumber users. After all the important groups of wood, such as oaks, pines and firs, have been studied and the results published separately, the several monographs will be collected and published in one volume
tion with the photographs of cross

been in demand by architects, builders and other users of lumber. It will, in most cases, enable even a non-technically trained man to determine quite readily the wood he deals with by means of an ordinary hand lens and by comparing the wood in question with the photographs of cross and long sections given in these monographs.

PROTECTION FOR CONTRACTORS.

Apropos of the remarks made on our editorial page last week re the difficulties of contractors, Mr. M. A. Pigott, of Hamilton, has addressed to us the following:

Editor, CONTRACT RECORD:

Dear Sir,—The only class of business people in the country that have a legal disability are contractors.

Many of the contracts now under way and contemplated are probably the largest enterprises that this Dominion has yet seen, and the contractors are without any protection or remedy in case of improvidence in plans and specifications, misinterpretation or unfair decisions of engineers and architects on same and on tracts and whose views are made supreme and binding upon the contractor owing to the nature and wording of the contracts that they are called upon to sign for the carrying out of the many extensive works placed under contract.

The working man is protected under government and corporation contracts by what is called the "fair wage clause," fixing the minimum rate of wages, and also payment assured by a clause inserted providing that wages, if not otherwise paid, shall be paid out of the moneys coming to the contractor, taking precedence of all other claims.

The owners, whether government, company, or individuals as proprietors, are protected by the engineer or architect that he or they employ—the wording of the contract making him the sole arbitrator and the sole court from first to last, to which the contractor can have recourse in any dispute whatever from any cause, be it price, kind and quantity or quality of work or construction or the fixing of time for doing it as well as naming

and exacting penalties in any default which he also decides contractor has made.

Added to this is the fact that every year a greater maximum of work is demanded by the contracts that are offering, within a smaller minimum of time for the execution of same and the uncertainty of labor supply.

Money stringency or scarcity gives the banks and moneyed corporations a choice of loans that are nearly beyond the element of risk, while loaning money to contractors is accompanied by a large amount of risk, and particularly delay, in the repayment of the loan to the moneylender, depending upon the knowledge on the part of the proprietor or corporation of what he or they expect the contract covers. Depending also upon the thorough consideration and providence of the engineer or architect in first fully investigating and then explaining and illustrating the work to be done, so as to avoid misunderstandings and omissions by him in making out his approximate estimate of all works that are necessary to complete the contract as the owner or corporation intended it to be.

In almost all cases the engineer or architect is employed by the proprietor or corporation, as the case may be, as their agent, and they in turn accommodated by the engineers or architect they have employed to carry out the work efficiently and economically to their satisfaction, as their agent, which the engineer or architect is admitted to be.

To do this the engineer or architect has to keep up the efficiency of the entire work and keep down the expenses, even though items have been omitted from the plans or specifications, and, in consequence, omitted from the contractor's estimates, but notwithstanding this, have to be done to complete the work to the expectation of the proprietor and, as agent, nothing less than this will satisfy or be acceptable to the engineer or architect, and under all those circumstances the contractor finds that he has either to fight or carry out the additional works without additional remuneration, rendering himself unable to promptly repay his loan and

his debt incurred or make a decent margin for living on, as he should be entitled to do considering the immense amount of thought and labor he has to expend in carrying out his contracts.

His only hope is first, an appeal to the engineer or architect; second, an argument; third, a fight, and fourth, no Court of Appeal and no relief from the decisions of the "one man power" which the contract provides for or from the man who has been named in the contract as the sole arbitrator in all matters of dispute.

Under all those circumstances and the large number of very young men annually graduating with a theoretic knowledge only from the colleges of engineering and architecture, and the comparative scarcity of men eminent either as engineers or architects in whose hands large interests might possibly not suffer, it sometimes occurs that men without sufficient knowledge or training or desirable ethics are entrusted with the charge of affairs requiring much greater experience than they have had and for want of which frequently confusion, difficulties and loss follows, particularly to the contractor.

Under all those circumstances I suggest to contractors to wake up to the situation and ask for legislation such as will give them such protection as both themselves and their creditors are really entitled to and can rely upon.

Every other class of manufacturer or producer, where the article is portable, can retain possession and control by keeping on his premises his manufacture until a satisfactory settlement has been arranged for.

The contractor alone enters upon the premises of other people, erects and creates the structures under his contract and is powerless to take them away or hold possession of them. The lien law is only applicable under certain limited circumstances, including architects' or engineers' certificates, which may or may not issue and must precede a lien, and does not apply to enterprises covered by Dominion charter or coming under the general act for the benefit of Canada, and in all such cases the contractor is helpless.

Therefore, contractors should unite and ask for legislation, both provincial and federal, that would give them an appeal from the engineer or architect to a permanently composed arbitration board created by the Dominion Government with local provincial branches, to whom disputes and misunderstandings could be referred and whose decision would be available to put either the contractor, the owner, the engineer or the architect right when they go wrong, and their finding to be legal and binding.

Some such arrangement worked out in some such way for the above reasons would produce a new era of hope and reward for that very large class of strenuous business people of this country who are entrusted from time to time with many of the largest enterprises in the Dominion and under the most difficult circumstances, in many cases being the pioneers of civilization in their undertakings and carrying them out.

I would respectfully invite the attention of contractors and others to this proposition with a view to seeking some legislative remedy that every other class of business people in the country has already been more or less supplied with as they have required it.

M. A. PIGOTT.

Hamilton, Jan. 22, 1908.

CONTRACTOR SUES GOVERNMENT.

Railroad Contractor Reid, promoter of the Reid Newfoundland Company, has filed a claim for \$1,250,000 damages against the Newfoundland Government. Mr. Reid claims that the Government subsidized a line of steamers competing with one of his lines, which has been in operation for several years.

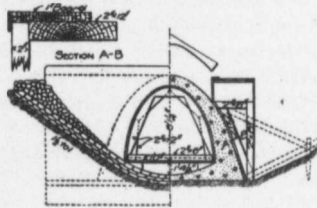
The litigation between Reid and the Newfoundland Government has existed for some time, due to disagreements over contracts. Reid has already obtained several millions of dollars from the colony as damages, due to the Government amending a railway contract made with him in 1898. The contractor has also a claim of \$550,000 against the Government for rolling stock furnished.

Construction of the Guelph and Goderich Railroad

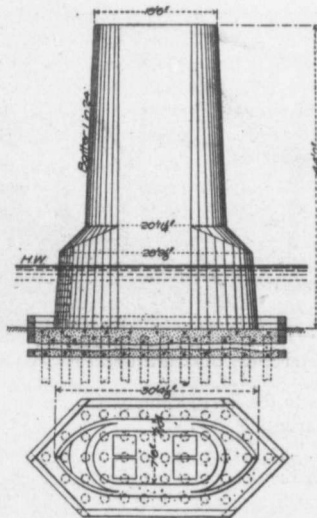
By J. GRANT MACGREGOR M. Am. Soc. C.S.
(in Engineering Review.)

A charter for the construction of a line from Guelph to Goderich in the Province of Ontario was granted in 1884, but it was not until September,

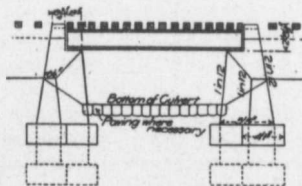
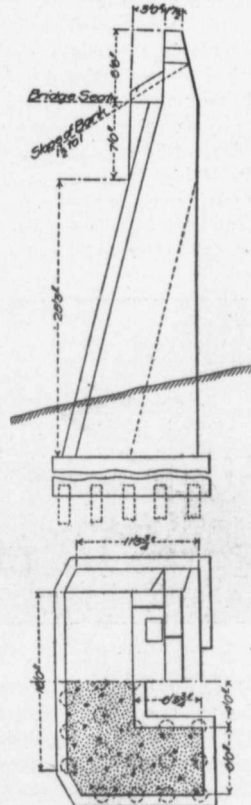
Railway for the use of velocity grades wherever practicable, such limitations being based on experiments made on an extensive scale by the Northern



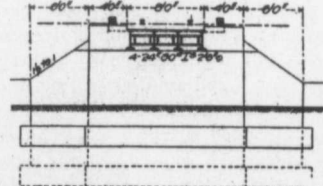
Standard Concrete Culvert.



Pier and Abutment, Grand River Bridge.



Standard I-Beam Culvert, Guelph & Goderich Ry.



1904, that the present company, under the auspices of the Canadian Pacific Railway Company, began construction. The limits of grade and curvature were fixed by rules and diagrams issued by the Canadian Pacific

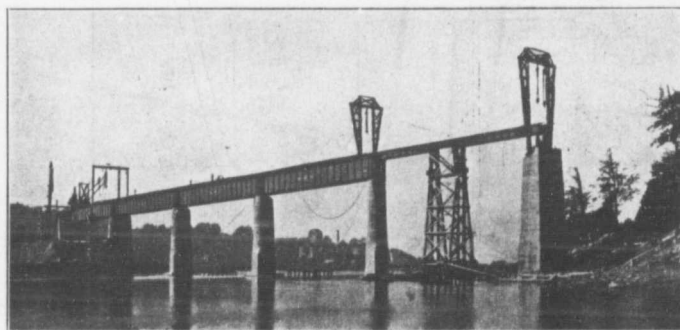
Pacific Railway, and from which the diagrams referred to had been prepared. The application of the velocity grade diagrams to the original grade profiles eliminated much heavy work and established on an economic

basis a virtual 0.60 per cent. profile for east-bound traffic, for a minimum speed of 10 miles per hour, the train load assumed being 1,631 tons. The only exception was a one per cent. helper grade for the first 6 miles east-bound from Goderich. In extreme cases the above limitations may have been exceeded, depending, perhaps, on an increased acceleration to overcome some of the higher summits.

In order that the effect in such cases could be determined, the diagram had to be abandoned and the usual theoretical rule substituted. This led the writer to compare the data obtained by experiment with the results obtained by theory in expectation of being able to modify the 0.60 per cent. and 10 mile per hour requirement to embrace the new condi-

It is evident that the greatest speed of the wheel is at its point of contact with the rail, and is no greater than the speed of the train, the centrifugal force in the wheel itself being dependent on and maintained uniformly with the momentum of the train throughout its entire movement. On this account and for other reasons the factor for potential energy has invariably been omitted from formulas for velocity grades, the result being a closer approximation to velocities obtained from actual experiments.

The distance from Guelph to Goderich is 80 miles, and with the exception of 20 miles at the Goderich end the location presented but few difficult engineering problems. The location of the last 20 miles, however, was repeatedly revised, leaving no doubt



LOWER MAITLAND BRIDGE DURING CONSTRUCTION, GUELPH & GODERICH RY.

tions, but he was unable to do so with the class of locomotives expected to be put in operation on the division. This requirement had, therefore, to be departed from in some cases, reducing the speed at summits to six miles per hour and even lower. The velocity heads shown on speed diagram are substantially those given in table 118 of Wellington's "Railway Location," and are derived from the formula for finding force of gravity in falling bodies, $h = v^2/2g$, to which is added 6.14 per cent. for the rotative energy stored in the wheels. As stated elsewhere, the writer is inclined to attach very little importance to the so-called potential energy stored in the wheels of a moving train and doubts if such force has any value in addition to the momentum of a train in its ascent or descent upon a grade.

as to the final location being the most favorable.

The average quantity of earthwork in the first 60 miles was 18,300 cubic yards per mile, that of the last 20 miles 42,000 cubic yards per mile approximately. No rock had been encountered throughout the whole line. The classifications specified were "solid rock," "loose rock" and "common excavation," the latter embracing all materials which could not be classed as loose rock. To avoid disputes and simplify questions arising from the calculations of overhaul, the usual clause was annulled and a fixed amount included in the contractor's tender to cover the cost of all overhaul, such amount being previously determined by estimating the extra cost of removing from the line excavation the quantity in gutters of suf-

ficient width to permit of the additional widening being done by train haul. Earthwork was paid for by quantities measured in excavation. The rate of shrinkage observed in embankments was from 5 to 8 per cent., the material being almost uniformly a clayey gravel where observations for shrinkage were made.

The structures are absolutely of a permanent character and are built entirely of concrete, the only exception being the upstream cutwaters of the piers of large bridges at two places, there are no wooden bridges or culverts on the whole line. Concrete pipe culverts were used up to 24 inches in diameter, and concrete arch culverts from 5 feet to 10 feet in diameter, also concrete rail culverts up to 10 feet clear span in low embankments. For greater spans than 10 feet in low embankments, I-beam spans with concrete abutments were used. The proportions of concrete used were for piers and abutments, the 1:4:7, and for arch culverts and foundations under water 1:3:5. There was no difficulty in procuring good gravel for concrete, and frequent tests were made in order that the correct proportion of sand could be added before mixing.

In the designing of piers and abutments the standard designs of the Canadian Pacific Railway were adhered to as closely as circumstances would permit. The graceful form of the piers of the larger structures was evolved from the application of the Gothic shape cutwaters, it being found a circular end above the cutwater base permitted a shorter base than would be required if the radii of the cutwater had to be struck from the corners of a rectangular pier of equal dimensions at the bridge seat. According to Cresy's experiments this form of cutwater is as near as practicable the one that offers the least resistance to the current, in addition to being a more massive form of concrete work where exposed to the erosion of grit and ice.

There are altogether twenty-nine bridges with steel superstructures and, although four of them are of considerable magnitude, there are no lattice spans — plate girders being used exclusively up to 110 feet in

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length. The four largest bridges worthy of note are the Grand River and Conestoga River crossings, and two crossings of the River Maitland. The Grand River bridge consists of three 100 foot and two 50 foot spans, the Conestoga River bridge of four 105 foot spans, all being deck plate girders. The upper crossing of the River Maitland consists of three 105 foot through plate-girder spans. The lower crossing of the River Maitland near the town of Goderich is spanned by five 105 foot and two 85 foot deck plate girders, the total length of structure being 720 feet and height 60 feet above low water. In the construction of this last bridge, 3,500 cubic yards of concrete were employed, and 1,007,600 tons of steel. A glance at the view of the Lower Maitland bridge will enable the reader to judge of the substantial character of the work.

The entire road is laid with 80 pound rails and excellent ballast was easily procured at convenient intervals along the line.

The station buildings and terminals are also in conformity with the character of the work already described. The railway was formally opened for traffic to Goderich on September 12, 1907, three years from the date of the turning of the first sod, and, although this appears to be an unusually long time in which to build 80 miles of line, the permanent character of the work must be taken into account, together with the severe winter and the heavy work at the Goderich end, across the valley of the Maitland River. This last mile alone consisted of 10,450 cubic yards of concrete in bridges and retaining walls, and 265,000 cubic yards of excavation.

The whole work was carried out under the direction of Mr. P. A. Peterson as chief engineer, Mr. J. W. Leonard being president of the company. The organization of the engineering staff consisted of an assistant or office engineer at headquarters, one division engineer and two residencies for each 20 miles of line.

Forms For Concrete Construction*

By SANFORD E. THOMSON, M. AM. S. C. E.

Recent failures in reinforced concrete construction cannot be cast to one side and forgotten with the passing comment so frequently heard that the accident was due merely to poor construction or too early removal of forms. The reasons for every failure should be thoroughly investigated by experts to prevent recurrence of similar accidents.

"Forms," although frequently guilty, are by no means the only culprits. In fact they are frequently blamed when the designer is at fault. Just so long as men who know nothing of the first principles of mechanics are permitted to design concrete structures and just so long as irresponsible contractors are engaged to erect them, the list of accidents will increase in startling numbers. In every case it is the men, not the inanimate lumber and materials, who are to blame. However, granting its danger under ignorant hands, reinforced concrete as a whole must not be condemned for failures due to improper conditions any more than brick should be rejected as a building material for apartment houses because of the collapse of several unfinished buildings in New York City two years ago through disregard of frost action upon the mortar.

Failures in concrete buildings may be attributed to:

1. Imperfect design; especially through neglect of essential details in locating the reinforced metal, and through the adoption of too low a factor of safety.
2. Poor materials; such as cement which does not properly set up, or sand which is too fine or which has an excess of clay, loam or other impurities.
3. Faulty construction; from improper proportioning, mixing or placing, or too early removal of forms.
4. Weak forms.

A disregard of such important principles is frequently criminal negligence, and yet in at least one case under my observation an examination of the structure and the materials, after a collapse in which a number of

lives were lost, showed the design, materials and construction all faulty, so that it was impossible to decide positively which of the four causes named above was the primary reason for the failure.

In this paper it is proposed to treat only of the design, construction and removal of forms.

KIND OF LUMBER.

The selection of the lumber must be governed by the character of the work and the local market. Although white pine is best for fine face work and quite essential for ornamental construction cast in wooden forms, for ordinary work, even for the panels, white pine is apt to be too expensive, and spruce, fir, Norway pine or the softer qualities of southern pine, especially North Carolina pine, must be substituted for it. Some of these woods are more liable to warp than white pine, but they are generally stiffer and thus better adapted for struts and braces.

Kiln dried lumber is not suitable for form construction because of its tendency to swell when the wet concrete touches it. Very green lumber, on the other hand, especially southern pine, which does not close up quickly when wet, may give trouble by joints springing. Therefore the middle ground, or, in other words, partially dried stuff is usually best.

FINISH AND THICKNESS OF LUMBER.

Either tongued and grooved or bevel edged stuff will give good results for floor and wall panel forms, and is preferable to square edged stuff. A smoother surface may be attained at first with the tongued and grooved stock, and there is less trouble with opening joints, but it is more expensive than bevel edge because of the waste in dressing, and if the forms are used many times there is greater tendency to wear at the joints. Even for rough forms, plank planed on one side may be economical to cheapen the cost of cleaning. Studs should always be planed on one side to bring to size.

The thickness of lumber varies with different contractors, some using one

*From proceedings of the National Cement Users' Association.

inch, others one and a half inch, while a few employ two inch stuff even for panels. (These are commercial thicknesses measured before planing.) For ordinary walls one and one-half inch stuff is good, although for heavy construction, where derricks are used, two inch is preferable. For floor panels, one inch boards are most common, although if the building is eight storeys high or over, one inch stuff

the concrete, at least one prominent contractor provides a door at the bottom of each of them.

In building construction the forms must be designed so that the column moulds and also the bottom of beam moulds are all independent of the slabs. The forms may thus be left a longer time upon members subjected to the greater stress.

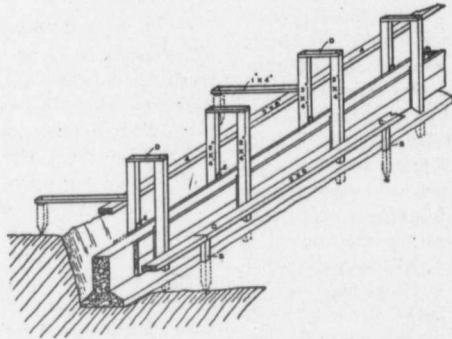
The sides of the beam moulds

10 inches, with frequent shores rather than to use lumber which is heavier to handle.

If forms are to be used but once or must be taken apart when removed, it is sometimes practicable to use only a few partially driven nails, so that they can be withdrawn without injury to the lumber. It is very difficult to convince house carpenters that the pressure of the concrete will hold temporary panel boards in place with scarcely any nailing.

Alignment is another item of importance, since it is here that a great deal of time may be wasted by inexperienced or incompetent carpenters. Such workmen may err either on the side of poor alignment or more careful alignment than the structure requires. Mr. W. J. Douglas suggests as a general rule the allowance of "three-eighths inch departure from established lines on finished work and two inches on unfinished work."

In removing forms the green concrete must not be disturbed by prying against it. This seems so obvious as to need no emphasis, but I have known a first-class house carpenter to actually attempt to straighten a wall which was an inch out of line the day after the concrete was laid by prying the forms over. The wall was straightened, but by a different pro-



FORM FOR CELLAR WALL.

is likely to be pretty well worn out before the top of the building is reached and the under surface of the concrete may show the wear badly. For sides of girders, either one inch or one and one-half inch is sufficient, while two inch is preferable for the bottoms of girders. Column forms are generally made of two inch plank.

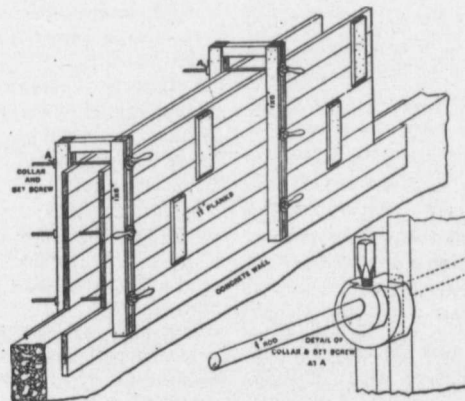
DETAILS OF FORM CONSTRUCTION.

Certain general rules are applicable to all kinds of forms. Strength, simplicity and symmetry are three fundamental principles of design. The necessity for strength is obvious, while economy in concrete construction consists in quickly erecting and moving the forms and in using them over and over again.

The design of the concrete member should recognize the forms. A slight excess of concrete sometimes may be contributed to save carpenter work. Frequently beams may be designed of such widths as to use dimension widths of lumber without splitting.

Columns may be of dimensions to avoid frequent re-making. Panel recesses in walls may be made the thickness of a board or a plank. To permit ready cleaning of dirt and chips from the column forms before laying

should be held tightly together by wedges or clamps, to prevent the pressure of the concrete springing them away from the bottom boards. At top or bottom of each strut hardwood wedges are useful when setting and removing it and also permit testing to make sure that there is no de-



MOVEABLE WALL FORM.

flexion of the beam or slab. For this purpose some contractors loosen the wedges twenty-four hours in advance of the struts. In general, it is preferable to use comparatively light joists, such as 2 by 8 inches or 2 by

cess from that proposed by the carpenter—the concrete was relaid.

Forms for facework should be tightly put together, it being advisable in some cases to close the joints and holes by mortar, putty, plaster

of paris, sheathing paper or thin metal. This is not, as is commonly supposed, to prevent loss of strength by the cement which flows out with the water, but rather to prevent the formation of voids or stone pockets in the finished surface.

Crude oil is one of the best materials to prevent adhesion of the concrete to the forms, though linseed oil,

mensions and spacing of the supporting lumber must be actually computed from the weight or the pressure against the sheathing. For columns and for walls where a considerable height of wet concrete is to be placed at once the pressure may be calculated as a liquid. Mr. W. J. Douglas assumes that the concrete is a liquid of half its own weight, of 75 pounds

an allowable deflection than upon strength, in order to give sufficient stiffness to prevent partial rupture of the concrete or sagging beams.

In calculating, we must add to the weight of the concrete itself, *i. e.*, to the dead load, a construction live load which may be assumed as liable to come upon the concrete while setting. Definite units of stress must also be assumed in the lumber.

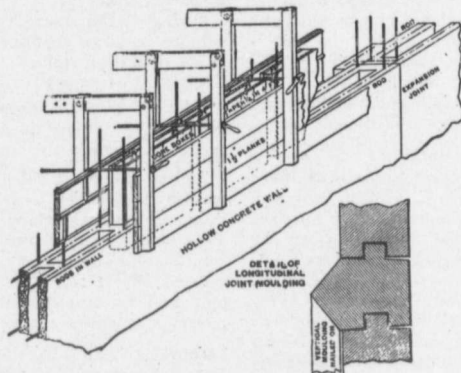
Bracing both ways will of course reduce the length of a long strut.

If the concrete floor is comparatively green, the load must be distributed by blocking, preferably of hard wood. At the top of the strut provision must be made against crushing of the wood of the plank or cross-piece. Ordinary soft wood will stand, without crushing, only about 700 pounds per square inch across the grain, so if the compression approaches that figure, brackets must be inserted or hard wood cleats used.

TIME TO MOVE AFTER PLACING

The best contractors have definite rules for the minimum time which the forms must be left in ordinary weather, and then these times are lengthened for changes in conditions according to the judgment of the foreman.

Correspondence with a number of prominent contractors in various



FORM FOR HOLLOW WALL.

soft soap and various other greasy substances are also employed for this purpose. The oil or grease should be thin enough to flow and fill the grain of the wood.

If the forms are to be left until the concrete is hard, there is little danger of the concrete sticking to them if instead of being greased they are wet thoroughly with water before the concrete is laid. In any case, if concrete adheres to the forms it should be thoroughly cleaned off before re-setting; even then it is apt to stick again in the same place.

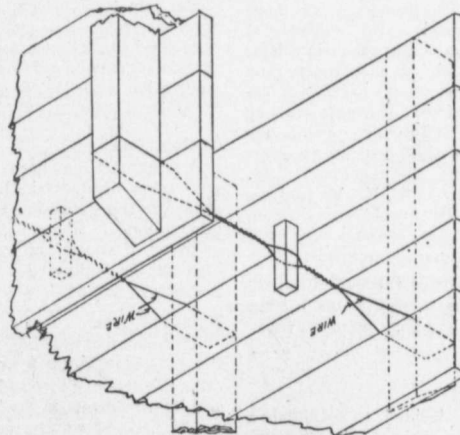
DESIGN OF FORMS.

"Rule of thumb" layout of forms in the field is being superseded by design in the drawing room. In building construction where the forms form a large percentage of the cost of the building, and where a failure in the forms may cause loss of life, it is especially necessary to treat this question from an engineering standpoint, and many of the best concrete contractors now design their forms as carefully as the dimensions of the concrete members.

If a minimum quantity of lumber is to be used consistent with the deformation allowed, it follows that the di-

per cubic foot.

In ordinary walls where the concrete is placed in layers computation is not usually necessary, since general experience has shown that maximum spacing for 1 inch boards is 2 feet, for 1 1-2 inch plank is 4 feet, and for 2 inch plank is 5 feet. Studding gen-



FORM FOR HEAVY WALL.

erally varies from 3 by 4 inches to 4 by 6 inches, according to the character of the work and the distance between the horizontal braces or waling. Floor forms are better based upon

parts of the country, including the Aberthaw Construction Company, Boston; the Expanded Metal and Corrugated Bar Company, St. Louis; the

(Continued on Page 22)

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies.

CONTRACTS OPEN.

Brandon, Man.

At a meeting of the city council held last week it was decided to proceed at once with the erection of a large bridge over the Assiniboine river and instructions are to be given for the immediate removal of the old bridge. The cost of the proposed new structure has been placed at \$100,000. It has not yet been decided whether to employ steel or reinforced concrete in the building of the new bridge. The material will be chosen after by the council.

The city council are considering the remodeling of the police cells as recommended by city engineer Shillinglaw at a cost of \$1,050.

Bridgewater, N. S.

The Micmac Gold Mining Company are said to be planning the installation of a power plant for their mines. It is understood that the plant will be built on a tributary of the La Have river, nine miles from the mines, where it is intended to build a dam 200 feet long and 15 feet high. 400 horse power will be developed now and provision will be made for considerable extensions later. The company will need two water-wheels, two generators, motors, turbine pumps, electric hoists, drills, tools, mining machinery, nine miles of wire and about 500 cedar poles. It is estimated that the cost will be from \$45,000 to \$50,000. Work will be started on this project at once. The consulting engineer is P. H. Moore, of New York, N. Y., and the secretary, W. B. Arnold, of Boston, Mass.

Calgary, Alta.

At a meeting of the exhibition directors held last week plans for the proposed new buildings were approved and passed forward to the building committee.

Carlyle, Sask.

It has been decided to establish a creamery here and the Carlyle Creamery and Packing Company are applying for incorporation in this connection. John Frier, of Sussex, N. B., is the prime mover in the enterprise.

Coverdale, N.B.

Tenders will be received by C. H. LaBillois, Chief Commissioner, De-

partment of Public Works, Fredericton, up to March 23rd for building the Mill Creek bridge. Plans and specifications may be seen at J. T. Ryan's store, Moncton, at office of C. J. Osman, M.P.P., Hillsboro, and at the Department.

Fort William, Ont.

A special investigation was made last week by A. C. Killam, chairman of the railway commission, to hear the evidence in the application of the McKay and Kakabeka Railway Company for crossings over the C.P.R., C.N.R. and G.T.P. tracks at West Fort and the C.P.R. at this town. The railways were unanimous in asking that the street railway construct overhead bridges or subways, preferably the latter, at the West Fort crossing and the three transcontinental roads. It was suggested by Mr. Killam that the interested parties share the cost of building the subways.

A report has been adopted by the school board calling for considerable extensions to the school buildings.

Grantham Township, Ont.

L. S. Bessey, township clerk, wants tenders up to February 15th for the purchase of \$20,000 4½ per cent nine year good roads debentures. Further particulars may be obtained upon communication with Mr. Bessey, Box 25, St. Catharines, Ont.

Guelph, Ont.

A delegation has been appointed to wait upon the Ontario Legislature in regard to the extension of the winter fair building. The general opinion is in favor of steam and cement buildings at an estimated cost of from \$20,000 to \$30,000.

Hamilton, Ont.

At the annual meeting of St. John's Presbyterian church it was decided to raise the sum of \$2,500 for alterations and improvements to the buildings.

The fire and water committee have decided to take fresh tenders for the new electric pumps owing to a misunderstanding in the recent bids.

Geo. W. Holcombe, of Pittsburg, Pa., interested in the Lakeside Amusement Park, was recently in the city and gave assurance of the early construction of the park buildings.

Hastings, Ont.

Owing to the discovery of iron and sulphur in large deposits at the Sulphide Ontario mine, the Canada Chemical Company have decided to remove their factory from London, Ont., to this town.

Howe Sound, B.C.

Arrangements are being hurried forward by the British Canadian Wood, Pulp and Paper Company, Limited, of Vancouver, in their project for the erection of a large plant on their property at this place. As soon as the pulp mill is completed work on the paper plant will be commenced.

Lethbridge, Alta.

At a joint meeting of the city council and board of trade held recently it was decided to recommend the Knox church property as the most suitable site for the proposed courthouse.

London, Ont.

The McClary Manufacturing Company will carry out considerable extensions this season. It has been decided to convert the new five storey warehouse into a factory, equipping it with a full line of machinery, and work is to commence in the spring on new foundries.

Negotiations are in progress between the Y.M.C.A. and G.T.R. with a view to the erection of a new institute in the east end of the city for the railroad men.

The city council have turned down for the present year the proposal to erect public swimming baths at a cost of \$6,000. A bylaw is to be submitted at the municipal elections next year.

Medicine Hat, Alta.

Tenders will be received by Fred Gelinis, Secretary, Department of Public Works, Ottawa, up to February 7th for the installation of hot water heating at the municipal buildings. Specifications may be obtained at office of W. T. Williams, clerk of works, this town, and at the Department.

Moncton, N.B.

D. Pottinger, General Manager, Intercolonial Railway, wants tenders up to February 5th for the construction of the Renous bridge and for masonry

work on the Pine Tree bridge. Specifications at offices of station master at Indiantown, N.B., and New Glasgow, N.S., and at the chief engineers' office, this city.

Moose, Jaw, Sask.

The C.P.R. will enlarge their round house to the extent of six additional stalls.

Morrisburg, Ont.

The Canada Tin Plate and Sheet Metal Company will at once rebuild their large factory destroyed by fire last Monday.

Neelin, Man.

William Easton, secretary-treasurer, wants tenders up to February 20th for a brick veneer school house. Specifications and further particulars on application.

Nelson, B.C.

W. E. Wasson, City Clerk, will receive tenders up to March 2nd for \$60,000 five per cent 20-year school debentures.

New Westminster, B. C.

E. P. Moss, consulting engineer, has been authorized by the City Council to make the borings necessary for foundations for the Lulu Island steel bridge.

Ottawa, Ont.

The anti-tuberculosis association have received from Mrs. J. W. Pugsley the offer of a free site on the Sparks estate off Fourth Avenue West for the proposed hospital for consumptives. As the only condition is that the city maintain the hospital when built it is likely that the offer will be accepted.

There is some talk of a refinery building being added to the Royal Mint. While nothing definite has been decided in this respect, the need of such a building is obvious. The cost of such refinery and plant has been placed at \$25,000.

A company to be known as the Holden Murray Company, Limited, has been organized to manufacture lumbermen's and railroaders' supplies. The capital of the concern is \$200,000 and a charter will be applied for at once. Amongst those interested are S. S. Holden, G. C. Murray, J. Henry and E. J. Brown, of this city, and R. McLennan, of Winnipeg.

Assistance will be given by the Finance Committee to the Board of Health in their scheme for building a \$5,000 smallpox hospital.

Peterborough, Ont.

Improvements and alterations are contemplated by the management of the Grand Opera House.

T. A. S. Hay, City Engineer, wants to purchase about 600 cords of field stone.

Port Royal, N.S.

Tenders are invited by Fred Gelinis, Secretary, Department of Public Works, Ottawa, up to February 14th for the construction of a wharf at this place, according to specifications at offices of C.E.W. Dodwell, resident engineer, Halifax, and E.G. Millidge, resident engineer, Antigonish, with the local postmaster and at the Department.

Prince Rupert, B.C.

It is the intention of the Grand Trunk Pacific to make a model city of Prince Rupert, and with this in view two Boston landscape architects, Franklin Brett and George D. Hall, are now on their way here. They will go over the site and make suggestions as to the means to be employed and will probably be later empowered to make plans for same.

It is reported that the Grand Trunk Pacific are arranging preliminaries for the construction of the proposed \$250,000 hotel.

Russell, Man.

The Secretary Treasurer here is calling for tenders for the supply of 40,000 feet of 3-inch tamarac, to be delivered by April 1st.

St. Catharines, Ont.

The Superintending Engineer of the Welland Canal will receive tenders up to February 10th for supply and delivery of timber, hardware, castings, etc., for use on the Welland Canal during the coming season. Specifications and further particulars at office of Superintending Engineer, this city.

Stanley, N.B.

C. H. LaBillois, Chief Commissioner, Department of Public Works, Fredericton, invites tenders up to February 10th for the construction of the Ryan Brook bridge over the Nasbwaak river. Specifications may be seen and further particulars obtained at the Department.

Tillsonburg, Ont.

A. Crawford will commence the erection of a big packing plant here in the spring.

Toronto, Ont.

The old Molsons Bank building, corner of King and Bay streets, owned by the Canada Life Assurance Company, will shortly be renovated preparatory to its occupancy by the Sterling Bank.

No less a sum than \$400,000 will be expended in the erection of the new Knox College building and an ac-

tive campaign for funds has already started, and is receiving encouraging support. The new building will be situated on the campus, extending to St. George street.

Kenilworth Avenue Baptists are planning the erection of a new edifice, corner of Waverly road and Queen street, to cost \$21,000.

The George A. Case Company have just sold a lot on St. George street, below Bernard avenue, upon which a fine residence is to be erected.

A. E. Dewar will carry out considerable improvements on his property, 786 and 788 King street West, recently acquired for manufacturing purposes.

The Imperial Trusts Company of Canada will erect a fine office building on Richmond street West at an approximate cost of \$40,000.

It is anticipated that City Engineer Rust will be instructed to prepare plans for a street railway bridge over the western gap at Queen's wharf at a probable cost of \$60,000.

There is now under consideration a proposal to erect a building as a training college for novitiates for the Christian brotherhood.

Recent building permits include: National Trust Company, Limited, repairs, Richmond street west, \$2,000; F. Martham, 3 attached 2-storey brick dwellings, Belmont street, \$6,000; A. MacGregor, alterations to dwellings, St. Clarens avenue, \$2,000; Morris Reid, 2½-storey brick dwelling, Queen street, \$3,000; Chas. A. Welsman, alterations to store, Queen street East, \$1,000; Geo. Aldridge, 2-storey brick dwelling, College street, \$3,000; Chas. J. Foster, 2-storey brick dwelling, Kippendance avenue, \$1,800; J. Edison, 2-storey brick veneered store and dwelling, corner Yarmouth road and miles lane, \$2,000; A. E. Peglar, pair 2-storey brick veneered front and rough cast dwellings, Smith street, \$2,400; G. R. Houghton, 2-storey rough cast dwelling, Clinton street, \$1,200.

Upper Sumas, B.C.

O. Bowman, postmaster of this town, has purchased a timber limit from E. Thornton, of Promontory Flats, and will put in a portable mill at an early date.

Vancouver, B.C.

Providing the B.C. Electric Railway Company give assurance of the construction of a tram line on Fourth avenue, City Engineer Clement will recommend to the board of works that this street be opened up to the city boundary. An interim appropriation of \$40,000 for the work of his Department will also be asked for by the City Engineer.

H. P. Potter, of Chicago, was recently in the city negotiating for the purchase of extensive timber limits on behalf of an American syndicate. He stated that he was returning to the east to lay before his firm a proposition involving \$2,000,000.

City Engineer Clement has instructed J. A. Waddell, of Kansas City, Mo., to prepare plans for the construction of bridges over False Creek.

G. W. Grant is calling for tenders for a four storey brick and stone block on the site of the Widewake Furniture store on Hastings street.

Recent building permits include: R. F. Miller, frame dwelling, Lakewood street, \$1,000; Mah Chung, frame addition, Barnard street, \$2,000; T. B. Hynman, frame apartment house, Robson street, \$4,000; Sentaia Uchida, frame rooming house, Powell street, \$2,000; F. E. Robertson, frame dwelling, Sixth avenue, \$1,900; T. A. Allan, frame tenement, Pender street, \$4,000; John McRae, frame dwelling, Sixth avenue, \$1,800; Wm Acorn, frame dwelling, Semlin drive, \$1,500; Cook & Holmes, frame dwelling, Thirteenth street, \$2,500; Artistic Furniture Manufacturing company, frame shop, Pandora street, \$3,000; Thos. Ke neen, addition to dwelling, Fiith avenue \$3,000.

Victoria, B.C.

Robert Howe, C.E., municipal engineer of the Canadian Fire Underwriters' Association, has just completed for the council a report upon the city's fire fighting system in which the available appliances are shown to be totally inadequate. Mr. Howe's services were called in owing to the action of the insurance companies in advancing the rates in the business section thirty per cent.

Welland, Ont.

The Government have purchased sites from the town for the erection of a new post office and customs house to cost \$30,000 and it is expected that construction will be under way by the spring.

Windsor, Ont.

The American Concrete Company, Chicago, have decided to establish a branch in this city.

Winnipeg, Man.

R. J. McKenzie has offered the exhibition directors a site of one hundred and thirty acres on the north side of Portage avenue adjoining St. Charles and a committee has been appointed to consider the proposition.

Hooper & Walker, architects, this city, want tenders for the removal of the Alexandra hotel, Winnipeg Beach, to a site 300 feet north of the C.P.R. station.

It is rumored that the old wooden block on the northwest corner of Portage and Longside will be pulled down and a modern block erected in the spring.

The Pioneer Sand and Navigation Company and others have petitioned the city to move the swing pier of the Redwood bridge closer to the east side of the river and the city engineer has been asked to report on the matter.

Smith and Bruce, architects, have prepared plans for the proposed enlargement of St. Stephen's church. The seating capacity would be nearly doubled and the cost would be in the neighborhood of \$30,000. A committee will report upon the scheme later.

FIRES.

Flour and planing mills of Lakefield Milling Company and F. J. Moore & Son, Lakefield, Ont.; total loss \$35,000.

Factory buildings of Canada Tin Plate and Street Metal Company, Harrisburg, Ont.; loss not estimated.

Hotel of Scott McCain, Florenceville, N.B.; loss not ascertained.

Building of Dominion School Supply Company, Toronto, Ont.; loss \$1,000.

Factory of Castle & Son, Montreal, Que.; loss \$5,000.

Annex of Togo House, Winnipeg, Man.; loss \$2,000.

C. N. R. station, North Battleford, Sask.; loss \$5,000.

BIDS.

Kamloops, B.C.

Five tenders have been received by the government for the new law courts buildings to be erected in this city. The lowest was from a Seattle firm whose figure was \$56,400. McClay, of Vancouver, put in a tender for \$61,667, and Johnston & Company one for \$72,900. The other two were still higher. No decision has as yet been announced by the government, but it is not thought likely that the work will be given to any contractors outside the province.

Hamilton, Ont.

Several firms tendered for the supply of electric pumps and motors for the Beach pumping plant. Engineer Sothman, of the Hydro-Electric Commission, recommended for the 25 cycle proposition the tender of the General Electric Company for motors at \$12,800 and the tender of the Buffalo Steam Pump Company for pumps at \$7,600, total of \$20,400. Mr. Sothman next recommended the tender of the Canadian Westinghouse Company for motors at \$15,945, which with the

Buffalo Steam Pump Company's tender would bring the total up to \$23,545. For the 66 cycle proposition for induction motors Mr. Sothman recommended the offer of the Swedish General Electric Company for motors at \$9,800 and the Buffalo Steam Pump Company for pumps at \$8,500, a total of \$18,300. It was decided to leave these tenders open and to call for fresh tenders for pumps.

Winnipeg, Man.

The board of control are considering tenders for the supply of fifteen miles of water pipe and specials, and it is understood that the tender of the Canadian Iron & Foundry Co., of Fort William, will be recommended for acceptance. The contract price is seventy-five thousand dollars.

NEW COMPANIES.

George Belanger Company, Limited, Montreal Que., incorporated to manufacture agricultural implements and machinery, capital \$45,000. Incorporators, D. Demars, of LaPrairie, Que., George Belanger, F. Basilières and J. A. Daoust, all of Montreal, and others.

Terrano Flooring Company of Canada, Limited, Montreal, Que., incorporated, capital \$100,000. Incorporators, H. E. B. Smith, K. F. Lockhart, W. L. Bond, J. J. Meagher and J. E. Goulin, all of Montreal.

Benallack Lithographing and Engraving Company, Montreal, Que., incorporated, capital \$400,000. Incorporators, W. J. Benallack, A. D. Dickson, of Westmont, Que., Thomas Allan, Lachine, Que., and William Marler and A. R. Oughtred, both of Montreal.

Canadian Resort & Development Company, Limited, Montreal, Que., incorporated, capital, \$49,000. Incorporators, G. I. Goodard, H. K. Martin, Charles Neville, A. Wainwright and D. B. Smith, all of Montreal.

Lake Manitou Land Corporation, Limited, Winnipeg, Man., incorporated, capital \$200,000. Incorporators, J. C. Green-Armytage, T. Beattie, T. B. Campbell, William Ramage and others, all of Winnipeg.

St. David's Hall Company, Limited, St. Davids, Ont., incorporated to erect and maintain amusement houses, capital \$10,000. Incorporators, J. M. Crysler, W. S. Walkers, John Irwin, Frank Woodruff, W. O. Burgess, all of Niagara Township, and others.

Dineen Manufacturing Company, Limited, Toronto, Ont., incorporated to manufacture fur clothing, capital \$75,000. Incorporators, William Dineen, W. F. Dineen, C. J. Hohl, F. B. Dineen and C. M. Dineen, all of Toronto.

Standard Brass Manufacturing Company, Limited, Sarnia, Ont., incorporated, capital \$20,000. Incorporators, W. and L. Brabant, of Detroit, Mich., F. X. Brabant, of Chatham, Ont., and others.

Imperial Gold Mines, Limited, Toronto, Ont., incorporated, capital \$4,000,000. Incorporators, J. G. Shaw, J. Montgomery, W. R. Williams and others, all of Toronto.

BUSINESS NOTES.

Aubertin & Bonin, plumbers, Montreal, Que., have dissolved partnership.

The Dominion Securities Corporation, Limited, have purchased \$40,000 4½ per cent twenty year debentures and \$29,500 4 per cent twenty-year debentures from the town of Owen Sound, Ont.

A special general meeting of the shareholders of the Fort William Terminal Railway and Bridge Company has been called for February 10th.

The United Counties of Prescott and Russell, Ontario, are reported to have disposed of \$15,000 5 per cent 15 year bridge bonds.

Morin & Lebel, sash and door manufacturers, Montreal, Que., have assigned and the meeting of creditors will take place on February 3rd.

Barbeau & Dufort, contractors, Montreal, Que., are reported to have dissolved.

A. & E. Mallette & Company, a new firm of electricians at Montreal, have registered.

The assets of D. Larivee, contractor, St. Lambert, Que., will be sold on February 26th.

The city of Peterborough, Ont., received tenders up to the 21st inst. for \$61,000 debentures, of which \$40,000 bear interest at 5 per cent., and \$21,000 at 4¾ per cent. The debentures were awarded to Wood, Gundy & Co., of Toronto, who have also closed a deal with Portage la Prairie, Man., for \$62,500 five per cent debentures due at the end of forty years. For the latter bonds an average figure of 95.86 is understood to have been obtained.

Advice from Regina, Sask., states that the city's debentures, aggregating over half a million dollars, have been awarded to Aemilius Jarvis & Company, Toronto, the highest tenderers.

The city council of St. John, N.B., have accepted the tender of J. M. Robinson & Sons, private bankers, for the whole issue of ten year bonds, to the extent of \$325,000, at one-quarter of one per cent. premium. The loan is being made to pay for harbor improvements and other works being carried on by the city.

CITY AUDITOR WANTED.

There is a vacancy at Edmonton, Alta., for a City Auditor, and F.M.C. Crosskill, Secretary Treasurer, invites applications for the position up to February 15th.

PERSONAL.

S. H. Reynolds, Assistant City Engineer, of Winnipeg, has resigned his position and will shortly remove to Victoria, B. C.

Norman Richards Cole, of Ottawa, has been appointed Special Electrical Mechanician to the Electrical Branch of the Department of Inland Revenue.

Thomas Izzard, of Toronto, Ont., and A. J. Greeves, of Winnipeg, Man., have been elected vice-presidents of the Bricklayers and Masons' International Union of America.

CONTRACT AWARDED.

Toronto, Ont.

The Barber Asphalt Company, and California Asphaltum Sales Agency, of Chicago, have received the contract for the supply of asphalt to the city, the former at \$24.90 per ton and the latter as \$24.00 per ton, these tenders being for Trinidad Pitch Lake asphalt.

BUILDING NEWS.

That Vancouver is not hampered much by the alleged stringency of the money market is evidenced by the fact that building operations for the first half of the present month nearly double the figures for the corresponding period last year.

A lumber glut is reported from British Columbia. The stock of logs in water and lumber on hand is fourteen million feet in excess of the entire lumber output of the coast last year. There are now in stock on the coast two hundred and sixty million feet of logs and lumber. With the exception of two, which are cutting for export trade, all the coast mills are closed down, as are also the mountain mills. Lumbermen declare it will be impossible for them to reduce prices in order to dispose of their stock.

1907 was a good year for the building trade at Fernie, B. C., and the activity of the second half of the year easily made up for the slackness of the first. Buildings to the value of upwards of \$300,000 were erected during the season.

In carrying out the harbour improvements at St. John, N.B., the dominion government, after receiving a conveyance of the site for the proposed extension, will extend the southerly face of the 600-foot wharf between 400 and 500 feet to the harbor line. Facing the harbor the extension will run a distance of 200 feet and will then turn

westward to be joined to the northerly side of the 600-foot wharf, a distance of about 830 feet. Provision will thus be made for two additional berths. On the southerly side facing Sand Point the total length in a straight line from the angle of No. 5 will be nearly 1,100 feet, which will give another new berth in addition to the one the city is now building, and accommodation will be provided for two steamers of about 550 feet each. On the northerly side the berth will be 630 feet long, ending at an angle, the remaining 200 feet connecting with No. 5. The estimated cost of these improvements exceeds a quarter of a million dollars. As we have already informed our readers, tenders are expected to be called for this work at a fairly early date.

James A. Macdonnell, of the western contracting firm of Macdonnell, Gzowski and Company, has recently been in the east upon business connected with the big tunnelling contract in the Rockies recently obtained from the C.P.R. This work from an engineering point of view is a very important one and is attracting the attention of engineers all over the country. When the project is finished the length of the stretch will be increased from four miles to eight, but the grade will be greatly reduced. The contract includes the construction of two spiral tunnels, one 3,200 feet, and the other 2,800 feet in length, on opposite sides of the Kicking Horse river. In both tunnels there will be a ten degree curve and in both the trains will turn completely round. These will be the first tunnels of the kind in America, although there are said to be three under the Alps. The dimensions of the tunnels will be seventeen feet wide and twenty-five feet high.

It is now stated that the Grand Trunk Pacific will not invite tenders for the hundred miles of the road from Prince Rupert eastward before Spring. This portion of the road will it is estimated cost about seven million dollars, and it is not expected that the work of construction will be begun before next May.

The Queen City made a good showing in the building list of American cities last year by obtaining eighth place. In advance of Toronto from the highest down were New York, Manhattan and the Bronx, Brooklyn, Chicago, Philadelphia, St. Louis, Cleveland and Detroit, the last named of which was but a thousand dollars or so better than her Canadian rival. Toronto's gain was eight per cent.

The assessment of Vancouver has increased \$6,833,895. Last year the total assessment was \$54,035,010; this year it is \$61,768,905. The population has increased 8,000.

TENDERS AND FOR SALE DEPARTMENT



Department of Railways and Canals, Canada

TRENT CANAL.

ONTARIO-RICE LAKE DIVISION.
SECTION No. 3.

NOTICE TO CONTRACTORS.

SEALED TENDERS addressed to the undersigned and endorsed "Tender for Trent Canal" will be received until 10 o'clock on Thursday, 12th March, 1908, for the works connected with the construction of Section No. 3, Ontario-Rice Lake Division of the Canal.

Plans and specifications of the work can be seen on and after the 1st February 1908, at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa, at the office of the Superintending Engineer, Trent Canal, Peterboro, Ont., and at the office of Mr. J. B. Brophy, Division Engineer, Trenton, Ont., at which places forms of tender may be obtained.

The lowest or any tender not necessarily accepted.

By order,

L. K. JONES,
Secretary.

Department of Railways and Canals.
Ottawa, January 16th, 1908.

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

FORMS FOR CONCRETE CONSTRUCTION.

(Continued from Page 17.)

Ferro-Concrete Construction Company, Cincinnati; the Trussed Concrete Steel Company, Detroit, and the Turner Construction Company, New York, indicate substantial agreement in the minimum time to leave forms. As a guide to practice, the following rules are suggested, these following in the main the requirements of the Abertshaw Construction Company:

Walls in mass work: one to three days, or until the concrete will bear pressure of the thumb without indentation.

Thin walls: in summer, two days, in cold weather, five days.

Slabs up to 6 feet span: in summer, six days; in cold weather, two weeks.

Beams and girders and long span slabs: in summer, ten days or two weeks; in cold weather, three weeks to one month. If the shores are left without disturbing them, the time of removal of the sheeting in summer may be reduced to one week.

TENDERS

Office Commissioner, Public Works and Mines

Department Technical Education,
Halifax, Nova Scotia.

Sealed tenders, marked "Tenders for Technical College" will be received at office of undersigned up to noon on MONDAY, FEBRUARY 17, 1908, for the erection of the

Nova Scotia Technical College,
in the city of Halifax.

Plans and Specifications can be seen at the office of Herbert E. Gates, Architect, Roy Building, Halifax, N.S. Each Tender must be accompanied by a Certified Cheque for 10% of the total amount of the Tender, as security for the performance of any contract entered into with the Department.

The Commissioner is not bound to accept any Tender.

C. P. CHISHOLM,
Commissioner Public Works & Mines.

TO ENGINEERS AND SURVEYORS.

FOR SALE

The instruments (consisting of Theodolite, level, chains, tapes, drawing instruments, etc.) maps, plans, fields-notes, engineering library, and practice of the late Augustine McDonell, Civil Engineer of Chatham, Ont. An exceptionally good opening for a surveyor or engineer. Address: - F. J. A. McDonell,
P. O. Box 282 Chatham, Ont.



WELLAND CANAL.

TENDERS FOR SUPPLIES FOR THE YEAR 1908.

SEALED TENDERS for Supplies addressed to the Superintending Engineer, Welland Canal, St. Catharines, will be received until 16 o'clock on Monday, the 10th February, 1908, for the supply and delivery of various articles of Timber, Hardware, Castings, Fuel, Paints, Oils, etc., for use on the Welland Canal and its branches for the year 1908.

Specifications, forms of tender and other information may be obtained at the Superintending Engineer's Office, St. Catharines on and after Tuesday, 21st January, 1908. The lowest or any tender not necessarily accepted.

By Order,

L. K. JONES,

Secretary.

Department of Railways and Canals,
Ottawa, January 17th, 1908.

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

Notice to Contractors

Tenders will be received until noon, the 7th day of February, 1908, for building a brick schoolhouse at Fairbank. Plans and specifications at Fairbank postoffice. Wm. Brimacombe secretary, Wychwood Park.

Column forms: in summer, two days; in cold weather, four days, provided girders are shored to prevent appreciable weight reaching columns.

Conduits: two to three days, provided there is not a heavy fill upon them.

Arches: of small size, one week; for large arches with heavy dead load, one month.

All of these times are, of course, simply approximate, the exact time varying with the temperature and moisture of the air, and the character of the construction. Even in summer during a damp, cloudy period, wall forms sometimes cannot be removed inside of five days, with other members in proportion. Occasionally, too, load is proportionately larger and batches of concrete will set abnormally slow either because of slow setting cement of impurities of the sand, and the foreman and inspector must watch very carefully to see that the forms are not removed too soon. Trial with a pick may assist in reaching a decision.

Beams and arches of long span must be supported for a longer time than short spans because the dead therefore the compression in the concrete is large even before the live load comes upon it.

The general uncertainty and the this item emphasize the necessity for some more definite plan for insuring safety. The suggestion has been made that two or three times a day a sample of concrete be taken from the mixer and allowed to set on from the mixer and allowed to set on the ground under the same conditions as the construction until the date when the forms should be removed. These sample specimens may be then put in a testing machine to determine whether the actual strength of the concrete is sufficient to carry the dead and construction loads. Even this plan does not provide for the possibility of an occasional poor batch of concrete, so that watchfulness and good judgment must also be exercised.

DRIVING SPIKES UNDER WATER.

Contractors may not often have to drive spikes under water, but the knowledge of how this usually difficult operation may be done with comparative ease may not come amiss. For this purpose a piece of iron pipe, large enough to hold the spike loosely and small enough to keep it upright, is used, says the "Electrical World." A steel drift slightly longer than the pipe is placed in the pipe and used to transmit the hammer blows to the spike. By means of this expedient spikes can be driven in several feet of water and at any angle desired, as the spike will necessarily go at the angle at which the pipe is held.

WIRELESS TO MONTREAL.

Marconi states that the wireless telegraph service between London and Montreal will be opened to the public on February 1st or 2nd at sixpence per word.

COMPARATIVE BUILDING.

A Brooklyn builder has just made a somewhat novel test to get at the relative cost of houses built with different available material. A set of plans was produced and three houses were built from the same plans, one of wood, one of concrete with wood floors, and the third hollow tile blocks and concrete. The building of wood cost \$6,000, the one of concrete \$7,900, and the one of tile and concrete \$6,500, and the decision was in favor of the latter structure, for obvious reasons—low cost, small future outlay for repairs, and immunity from possible destruction by fire. This would seem to relegate lumber to the "also ran" class.—National Builder.

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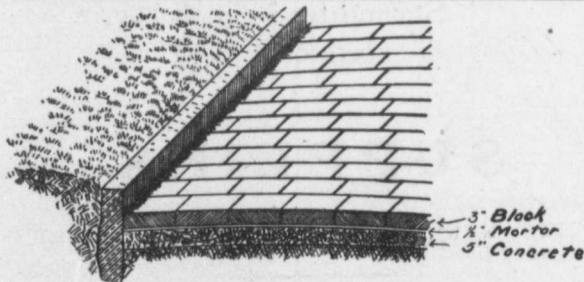
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SHEET PILING AND EARTH PRESSURE.

There are some puzzling questions which arise in connection with sheet piling as used for both small and large excavations, especially when the latter are of considerable depth, says "The Engineering Record." As a matter of fact, the bracing generally employed to hold the sheeting or sheet piling in place is designed more as a matter of judgment than of exact computation. The ordinary rational theory of earth pressure is based upon an assumed perfectly dry material composed of small grains, possessing no coherence among themselves. The

standard quality of earth on which is based the usual theories of earth pressure is that of a fine granular mass, whose particles are free to move over each other except for friction, these particles assuming an exterior surface slope, under normal conditions, whose tangent to a horizontal line represents the co-efficient of friction. This theory results in an intensity of pressure for a mass of dry earth which increases directly with the depth as does water pressure, but at a different rate. There are few structures whose design involves the use of formulas for earth pressure which have not been proportioned upon this theory if their treatment has been of

a rational character; in fact, Rankine's and other similar theories have come to be standard for this entire field of construction. Although these earth pressure theories have been criticized for various alleged defects of more or less serious nature, the latest is probably one of the most interesting attacks of this kind.

In a recent number of the "Proceedings" of the American Society of Civil Engineers, Mr. J. C. Meem has presented a paper on "The Bracing of Trenches and Tunnels, with Practical Formulas for Earth Pressure." In this paper the author has set forth certain views as to earth pressure which are based on his observations in sheeted or sheet-piled



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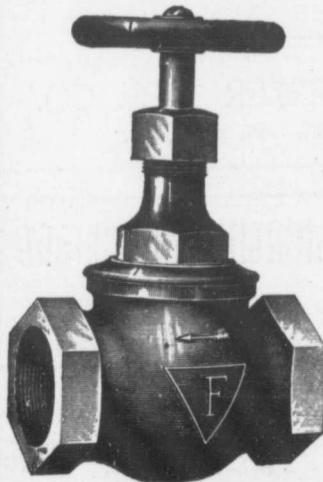
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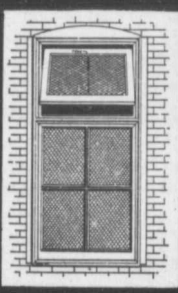
Montreal, Toronto, Winnipeg, Vancouver.

trenches. He has observed that in many new excavations both the bottom and the bottom portions of the vertical sides remain stable in place even when not supported, while in the upper parts of the same trenches the material has exhibited such a tendency to motion as to produce heavy pressures against the sustaining sheeting with its braces, the excavated material not being dry sand. He assumes, therefore, in treating the laws of pressure thus disclosed, that the greatest earth pressures are near the top of the excavation, from which place they decrease to the bottom, where they are either actually or essentially zero. This obviously is fundamentally at variance with the ordinarily accepted law of earth pressure, which makes the intensity of that pressure zero at the surface and a maximum at the bottom of an excavation, with a uniform rate of variation between.

The difference between these laws is radical, as is recognized by Mr.

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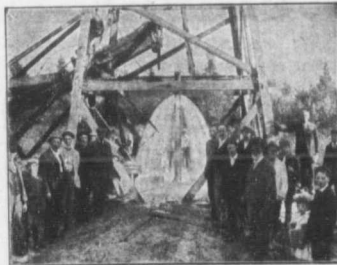
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Meem himself. If his views are cor-
rect, practically the whole body of
present and past practice in connec-
tion with earth pressures is altogether
wrong, except in the case of dry, sandy
material, for which he would em-
ploy the generally accepted theory of
earth pressure, the law of whose vari-
ation with the depth below the sur-
face is similar to that of liquid pres-
sure, i. e., the intensity varies directly
as the depth.

Probably every experienced engi-
neer who has had much to do with the
design and construction of structures
to resist earth pressure, has recogniz-
ed the familiar fact that the stand-
ard theories of earth pressure are not
supposed to be more than approxi-
mately correct for other materials
than dry sand. There are, however,
with equal probability, very few who
would be willing to postulate with
emphasis that the intensity of pres-
sure against sheet piling and its brac-
ing decreases with the depth of excava-
tion, becoming zero at the bottom
of the latter, and acquiring a maxi-
mum value in its upper part. It is
true that in almost any excavation
other than in dry sand, the material
in its bottom stands stiff and undis-
turbed for a greater or less period of
time after the excavation is complet-
ed. There is nothing uncommon
about that; it is a matter of frequent
observation. A damp clayey or loamy
material holding considerable moist-
ure assumes under the heavy pressure
of the superposed material a stiff,
dense and firm condition, which dis-
appears only after weathering, and
much weathering in some cases.

If a trench or other excavation is
to be quickly completed and refilled,
insufficient time may elapse for such
material to lose its moisture, and so
to become friable or granular behind
the sheeting and produce intensities
of pressure of relatively high values.
This is precisely what takes place in
many excavations of magnitude. Ma-
terial is frequently found capable of
maintaining a vertical face for a con-
siderable time even without the sup-
port of sheeting, but the instances are
rare where such faces will not soon
become dry enough to lose coherence
and granulate to a marked degree,

and slough off or fall away if unsupported, like any dry granular material in which the maximum intensity of pressure is found at or near the bottom of the excavation. Under such circumstances it certainly would not be prudent or safe to rely upon the temporary tenacity thus disclosed to hold long in position the sides of such excavations. It is a matter of common experience to observe the weakening by dessication of vertical earth faces, nor is it so very infrequent to experience the failure of sheeting with its bracing from this kind of cause. The matter prac-



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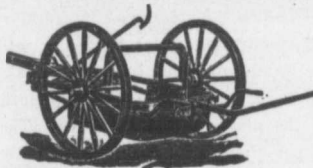
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tically reduces itself to taking chances with these excavated faces and hazard reaching the refill before the material with its reduced moisture has an opportunity to assert its capacity for lateral pressure.

More than one instance of this character has resulted in failure. Experience with excavations in general has taught the important lesson that, except in comparatively few cases of unusually tenacious material, it is safer to assume that the relatively dry granular condition may prevail sooner than anticipated, and that in general it is prudent to accept the indications of the standard theories of earth pressure, if there is much at stake. In the more difficult and dangerous saturated or semi-saturated, materials, it takes but little experience to confirm the accepted laws of earth pressure and to realize that such earth pressure theories as that of Rankine are among the valuable technical assets possessed by the engineer.

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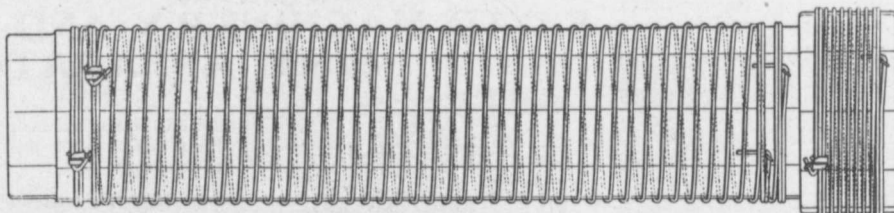
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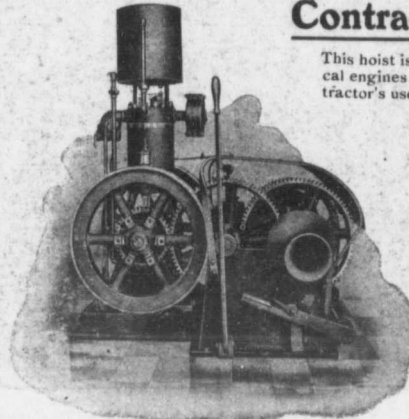
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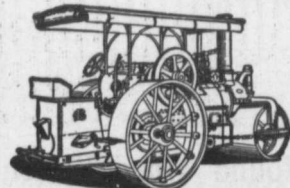
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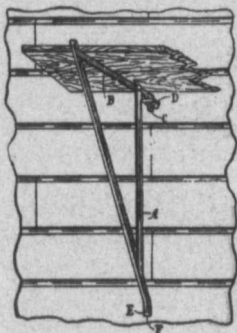
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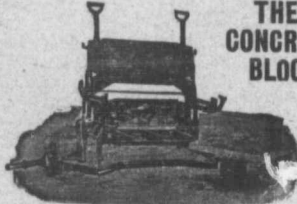
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