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The Canadian Engineer

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Awakening Recognition of the Engineer

Address Delivered November 15th Before the Ottawa Branch of the Canadian Society of Civil Engineers—A Plea for Greater Recognition of the Engineer and His Work

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ANY discussion regarding the awakening recognition of the engineering profession must consider to what extent the awakening has occurred and what must be done to make the recognition complete.

The awakening has already taken place in the profession itself, and the extent to which recognition may grow on the part of those outside the profession depends entirely on how far that awakening has occurred within ourselves, and to what extent we are prepared to arouse those outside to a similar sense of awakening.

The recognition from within is a forerunner of the recognition from without, and must be by it inspired.

Let us glory in the fact that we have become alive to a sense of our position and our possibilities, but let us not deceive ourselves as to the headway that has been made. We have awakened, it is true, but are very much in the position of one aroused from a long sleep. We are yet blinking and rubbing our eyes and wondering just what we should do, because the full light of what might be and what should be has come to us, and finds us lacking somewhat in the initiative. During the past decades the engineering profession has been the fountain source of material advancement and has been a mighty modernizing and civilizing force down to the present minute, yet as far as real recognition of the achievements of the profession and its elevation to its real status in society is concerned, we have advanced little beyond the glacial age of tradition; so that fierce fires of enthusiasm will be needed to melt the ice-bound barriers of precedent with which we have to contend.

You all know that for some years past there has been a general feeling of unrest on the part of engineers in Canada, the United States and Great Britain. This has given rise to a general searching and questioning as to why the engineer is not occupying the position to which his ability, education and accomplishments justly entitle him.

In our own Society this unrest, which has been, in truth, a feeling of dissatisfaction based on a certain anxiety towards improved conditions, has resulted in the appointment of a Committee on Society Affairs. But, after all, is not this the result of a professional consciousness which has arisen and demands expression in activity?

At the last meeting of Council, held on October 30th, the report of the Committee on Society Affairs was accepted and approved. Its recommendations regarding changes of by-laws owe much to the Ottawa members of that committee. The report as approved by the Council is now in the hands of the printers and will be issued to our corporate members of the Society within the next few weeks. A vote is to be taken, returnable in time for the annual meeting to determine if these recommendations meet with the full approval of the membership at large. Not even the members of the committee believe that the proposed by-laws are at present perfect, but if adopted, will mean a long step in advance, and will pave the way for any future improvements that may be proposed.

The extent to which the individual member realizes the suggested changes, and personally sets about to carry into effect the program as contained in the report of this committee, will determine how much the Society and the profession have awakened to a realization of a proper perspective of what is required by the profession in its relations with the outside world.

The distinctive feature of this report is the increased sense of responsibility of our Society, which means the profession, in its relation to the individual member, and of greater importance still, in its relation to its service to the public at large. We have, therefore, apparently reached a point where we know that our former objects were limited and our activities circumscribed, and it is now possible, with that knowledge, to go further, believing that the future of the profession lies largely in how far it is willing to assist the individual member and to what extent he may co-operate with the profession in dealing with all public matters, whereby our interests are affected, using this newly awakened sense in making our combined influence felt outside of the Society. It would then appear that (and let me emphasize) **the awakening of the engineering profession involves, in the first instance, the increased recognition of the profession's responsibility to the individual, and the individual's responsibility to the profession, and in the second place their collective responsibility to the public, and in turn an acknowledgment from the public of the engineer's real place in national affairs, which includes status, remuneration and opportunity of service.**

Recognition from Without

You will find, generally speaking, that the recognition engineers have received has been as individuals rather than as a profession. Fifty years ago the engineer was a skilled laborer, and his status was such. During that time he has become a man, highly educated, highly trained, and so successful in his application of knowledge to material things, that his work has wrought untold benefit to humanity. The great achievement of the engineer in revolutionizing the material welfare of mankind has fitted him to shoulder greater burdens and responsibilities.

The gradual evolution of the status of the engineer has forced him to take account of other laws and forces than those of mathematics and science, so that to-day he is compelled (almost without realizing it) to consider economic and social problems, and particularly those arising out of a proper appraisal of equity between man and man. The latter includes a study of the complex problems of tax valuations as between individuals and corporations, advice as to financing of public works, and advice in arriving at just and equitable rates for service rendered by public utilities. The engineer is thus becoming not only one who directs the great sources of power in nature for the use and convenience of man in the most economical manner possible, but he is fast becoming an economist and an arbiter in industrial problems.

When a committee was appointed in 1915 by the President of the United States from the national engineering societies to constitute a Naval Consulting Board and Committee of Industrial Preparedness, the profession received its highest recognition. This, in fact, is an epoch in the relation of engineers to national affairs. Of this action on the part of the President, Thos. A. Edison said: "This marks almost dramatically the entrance of the trained non-partisan doing his work on the sole basis of efficiency and integrity, into the affairs of the government." The men who are thus chosen have an opportunity of not only making a name for themselves, but of adding much to the prestige of the profession, and there is no doubt whatsoever that they will do so.

Why Engineers Should Have Recognition

It cannot be said, however, we have made any considerable headway towards being recognized in Canada.

In his message to the people of Canada on the 50th anniversary of Confederation, Sir Robert Borden reviewed the development of production, commerce and wealth; the immense increase in transportation facilities; the conspicuous rise in the standards of living, and the great improvement in the general conditions of life throughout the Dominion. He pointed with pride to all this, yet he failed to remark that each and every one of these indications of advancement owes its present state directly to engineering skill, and to engineering progress. In the past, we have not, as a Society, recognized, and consequently are not in a position to enthuse others with the fact, that all material advancement in the history of the world's existence has had its foundation on engineering in some one or other of its branches. It is, therefore, not to be wondered at that members of governments, politicians and the man on the street are ignorant of this fact and fail to give credit where credit is due.

It is only recently that the government of this country has come to the point of recognizing, even in the most limited sense, that the training of the engineer eminently fits him for any special position of executive responsibility. When the premier appointed Mr. C. A. Magrath, M.Can. Soc.C.E., to the chairmanship of the International Joint Commission he felt called upon to apologize for appointing an engineer, because it has been generally understood that positions of this kind were the special domain of the lawyer. As you know, Mr. Magrath, since his appointment, has more than justified it in every sense of the term, and later, as fuel controller, has handled the fuel situation of Canada, although his problem was a most difficult one, in a manner that commands the admiration and respect of all.

The government of the United States appointed as food controller Herbert Hoover, M.Am.Soc.C.E. Canada appointed a lawyer for this office. Note the difference. The engineer went about his work with the idea foremost in his mind of carrying out and securing the desired result for which a food controller was needed, namely, to conserve food resources, assure reasonable prices, eliminate profiteering and assist the Allies to secure supplies. The work of the engineer food controller in the United States has resulted in the prices of food products steadily decreasing, while in Canada during the same period, they have increased by leaps and bounds.

Here we have a practical, definite illustration of the difference of what is to be expected from the appointment of an engineer when something definite was to be done in contrast to a lawyer. This is possibly the first time we have had an opportunity of comparing the methods of the two, and we owe it to ourselves to educate the public to this fundamental difference of attitude of mind and directness of purpose between the methods of the engineer and the politician. The significance of this example cannot be too strongly emphasized and cannot be too firmly impressed upon the minds of the citizens of this country.

Our own president, Col. John S. Dennis, was appointed by the British government some months ago to take charge of the British recruiting mission at Chicago, and the record he has established as recruiting officer stands without a parallel for achievement on this continent. During the time he has been actively engaged over twelve thousand volunteers have been recruited,—more than were enlisted in the whole of Canada during that time. After one speech he made in Providence, R.I., 76 men applied for admission to the Canadian army. Last month Col. Dennis, who is sixty years old, in the course of his work, travelled by rail nearly five thousand miles, marched three hundred miles on foot, visited thirty-two places and made sixty-seven speeches. This illustrates again the inbred sense of responsibility and joy in accomplishment, without practical thought of reward, that characterizes the engineer.

If the striking manner in which engineers carry out special work assigned to them is not sufficient to give the whole profession added prestige, then the part played by our gallant men in connection with the great war should surely have some affect. We have nearly 30 per cent. of our entire membership actively participating in the war. They have performed deeds of bravery and endurance that would put to shame the heroes of history or mythology. They have made it possible to conduct the great campaigns by providing transportation, water and sanitary facilities, while exposed, for the most part, to the fire of the enemy, and the war will be won largely by the superior engineering skill of the Allies in comparison with the Germans, whose whole history has been one of stolen ideas.

It would be well perhaps if we considered the engineering profession in the light of conquerors. The title "Conquerors" was given to a special publication of the Cleveland Engineering Society, which described notable engineering achievements. The more one dwells upon the thought the more fitting becomes the simile of applying the term "conquerors" to the profession, for the engineers have been conquerors in the highest and best and noblest sense of the word, as it is the engineer who has succeeded in overcoming the turbulence of nature, eliminating distance, conquering space, and making the earth, the sea, and the air subservient to the welfare of mankind.

Unity and Co-operation

To accomplish any near approach to our possibilities, greater unity and co-operation will be necessary. These to some extent might become our watchwords.

Events in the world of engineering activities show clearly and unmistakably that a new era is dawning for the profession. The insularity of the engineer is slowly but surely giving way to a fraternity of spirit that has been almost entirely lacking in the past. The former idea of specializing in various groups has been transformed to a broader vision with a tendency towards union of all branches of the profession.

You have seen recently for the first time in the history of the profession a national engineering board appointed by the United States from the parent engineering societies, whose whole tendency seems to be towards closer union and greater co-operation. To some extent we are in a more advantageous position in Canada, as we have now made it possible to unite all the engineering professions in one great national body instead of starting a number of organizations, as was done in the United States. It will mean that the members of our organizations will have to work as a unit and co-operate in the closest possible manner. The situation affords a great opportunity to the engineering profession, an opportunity in which every individual may take an active part, a chance to advance the interests of the profession in one great body of such strength of sufficiently high standard and at the same time broad enough to make it the goal of every man in this country who aims or claims to be a member of this high calling.

We have been criticized in the past, not only because we were accused of being narrow in our objects; but also it was stated we were collectively without a soul or heart. Be that as it may, if the heart of the profession were a composite heart of the individuals therein it would leave nothing to be desired, but, we must admit there has been some coldness and to some extent indifference, and we should therefore to the greatest possible extent cultivate a fraternal spirit that will develop a heart in our organization, a pulsating, personal heart throbbing with human emotions, and cause that heart to beat warmly and sympathetically not only for our own members, but in our relations with the outside world.

It is in developing this spirit that the branches will play a great and ever-increasing part. While we have a headquarters and a council to give general direction to affairs, the branches are the active energizing agents of the profession, and it is to them that we must look for the greatest personal activities. You know, gentlemen, of the opportunities that may arise whereby a branch may take an active part in local affairs for the benefit of the whole profession. We have an instance of this in the part played by the Calgary branch, when they stood behind the city engineer who was being severely criticized in the building of the Centre Street bridge, and were enabled to prove to the public that his critics were unjust. From this affair both the city engineer and the branch emerged with added respect and prestige.

It is possible for a branch to include in its discussions public matters of local interest, even where the branch is not directly concerned. In fact, as a profession we will make greater strides if we give fuller discussion to public questions and less to technical subjects than we have in the past. The branch should be more than a mere unit of the local members of the profession. It should be a fraternal organization meeting in a spirit of good-fellowship. It should encourage the younger members in every way and give them an opportunity of learning public speaking, as well as absorbing the ideas of the older men in the profession. It should be ever and always on the lookout for opportunities for service. The branch should be the technical centre in any community and could possibly take an active part in the technical education of the district, or at least give advice thereon.

The big opportunity for service is coming in connection with the vocational training for returned soldiers, and in this the branches could play a leading part. No more worthy object can be thought of than this, and there is no other body of men similarly capable of giving assistance in this respect. In the United States the local engineering bodies study political questions to keep an active tab on the doings of local legislatures where the welfare of the profession is concerned, act as advisory boards to municipal councils, they suggest legislation and in numerous other ways make their voices heard and influence felt. It is, therefore, to the branches that we must look for the full flower of development of the profession.

The proposed changes in the by-laws, as well as the change in name, will to some extent increase the prestige and standing of our various branches. Each branch will elect its own councillors and will consequently be more directly represented at the headquarters of the Society than at present. It is intended to hold an annual meeting of the Society once a year in every province. This meeting will be directed by Council, will have representatives present from headquarters, and the official report of the meeting will be published in the annual report. These changes are based on the admitted necessity of greater fraternity and closer co-operation, and will enable the individual member to come to a better appreciation of his fellow members, together with a personal responsibility to the Society and to the profession. The object of our organization in the future will be of a broad enough nature to enable the Society both at headquarters and from its branches to engage in useful public service.

Earning Capacity and Reward

Some of you may have asked yourselves the question, where does all this lead to and how does it affect our earning capacity? Two definite factors in increased earning capacity are—additional usefulness and added recognition. The usefulness must come from within, and we may take it as an established fact that the engineer has already proven his usefulness over and beyond his monetary reward. Recognition will come from corporate usefulness and educating the public to a better appreciation of what the engineer is really doing. One of the technical journals in discussing the question as to when engineers will be better paid, says: "The inevitable conclusion of any careful study of this question is that engineers will continue to draw low salaries as long as they will work for them. Meanwhile, discussion of the question is not wholly without value as men can talk themselves up to the point of making even a bayonet charge. Perhaps after some more years of discussion engineers will begin to ask themselves: 'What are we going to do about it?' After some more discussion somebody will suggest that engineers must demand better pay. Again, after still further discussion, the suggestion will be adopted. Then, and not until then, will the engineer become a permanently well-paid professional man."

Let me ask you, what position would the government of Canada be in to-day in carrying out the nation's work without the services of the men in the engineering profession. The majority of the departments of the government would be unable to operate without our help. Do the political members of the government realize that this is true? It is certain that they do not. Why? Because we of the engineering profession have in the past taken no corporate action to insure that they should. Instead we have to some extent acted like dumb driven creatures, accepting the crumbs that have fallen by the wayside, content to sell superior qualities of mind and training for a mess of pottage; for despite your capacity, such in general is your reward in comparison with your true worth. As individuals, it may not be possible to force the recognition needed, but as a body we are a mighty power capable of securing any reward within reason upon which we set our minds and hearts. It is not only in the government service that engineers receive inadequate reward, but throughout the entire profession, and particularly those employed at railway work.

There is one active full member of our Society who is a resident engineer on one of the transcontinental railways and his salary is $100 a month. He has a wife and family. Whose fault is it that such is true? Yours and mine. How much longer is the engineering profession going to continue to be underpaid? Just as long as we permit it, gentlemen, and no longer. We have it in our hands to bring about a different state of affairs, but action is required, not words. We have talked in the past a great deal about inadequate rewards and we may continue to talk, but nothing will be accomplished until we secure a higher standard of reward, and we shall find the accomplishment so easy that the wonder will be why we had not thought of doing so sooner. We are to-day exactly in the position of the man staying out all night on his own doorstep because he thought he could not get in, only to find out in the morning that he had the key in his pocket.

The government and railway officials and the general public have only a vague conception of what they owe to the engineering profession for their material welfare, and they will continue in ignorance until we have educated them. In the meantime, gentlemen, it is we who are culpable, not they.

The newspapers in this country are the great moulders of public opinion, and it is to them we must look, to some extent at least, for co-operation and assistance. For, once we have convinced the editors that in doing this they are assisting in the public weal, the natural patriotism that characterizes the editorial body would prompt them to act and give their hearty support.

The lawyer and the politician have admittedly failed to solve the industrial relations of man to man and the relations between capital and labor. The very qualifications of mind and training that have enabled the engineer to so successfully grasp and solve any problem set before him will be called upon and required to solve and to deal with what will be, after the war, the greatest problem which we have to face.

We find already many of the executives of large industrial concerns being chosen from our own profession and more and more will the men who have received a thorough training in technical matters be called to the high positions in industrial affairs. This will mean the opening up of a scope for the profession, giving rise to a future that will place the technical man in control of the industrial life of the nation. Coincident with that is arriving a condition whereby the engineer must, besides drawing plans and specifications, give his advice in connection with financing of any industrial or engineering undertaking, so that the time is coming, and very soon, that the engineer instead of receiving the reward that capital is willing to offer will walk hand in hand with the capitalist, on an equal footing, and will share in the rewards that the other has heretofore enjoyed.

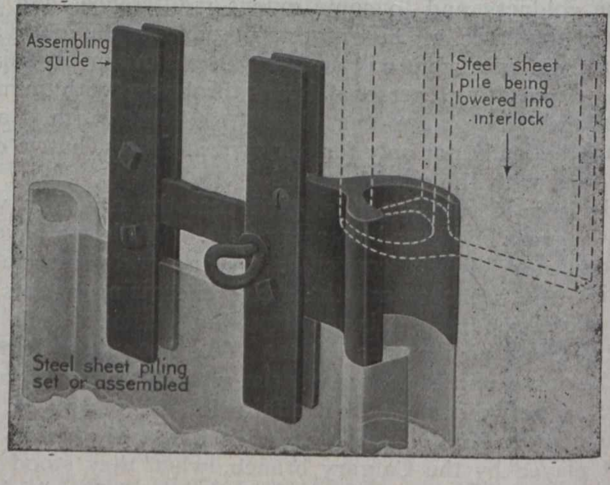
In view of such enticing prospects and possibilities for the individual, what limit is there to our development as a profession by acting in unison? Here we are, a powerful legion with all the potential attributes of mind, heart and soul to carry us to undreamed-of heights of eminence, and how far we shall rise as a profession is only limited by the minimum amount of effort which each and every one of us is prepared to give in conjunction with his fellows to make what is reasonably possible a living reality.

And speaking from knowledge, gained by experience in my relations with you, gentlemen of the Ottawa branch, you who have been leaders in the affairs of the Society in the past, I know full well that in the forward movement leading to the exaltation of the profession, you are certain to play a very important and a very prominent part.

HELPFUL DEVICE FOR HANDLING STEEL SHEET PILING

The assembling of long lengths of Lackawanna steel sheet piling where the tops of those piling sections which have been assembled or placed remain at a considerable distance from the ground or water level has in the past been subject to one notable annoyance. On windy days, or when the handling line was swung from a barge affected by swells or wave motion, the sway of the piling section being handled has made trouble in steering the interlock of the free piling section into entrance and sliding contact with the interlock of the last piling section placed.

To save time and labor and make the attendant's work safer in this operation. the assembling guide shown was developed by Mr. F. E. Cudworth and very successfully



used in placing the 50 to 70-foot Lackawanna sheet piling sections used in the 46th Street Pier cofferdam, New York City.

This guide sets upon the last piling section placed, is held there by the light, flat jaw pieces on each side, is reversible to handle either position of interlock and is provided with a swivel eye and safety line that prevent the guide from falling out of reach or getting lost in water.

The guide proper is trimmed from a Lackawanna sheet piling section, is about 5 inches long and has part of the thumb of the interlock cut away.

The workman draws the free piling section sidewise into and against the guide as the piling section descends, and as the interlocks are in this way aligned perfectly and slide together on the first trial, the entire equipment and crew can proceed without delay.

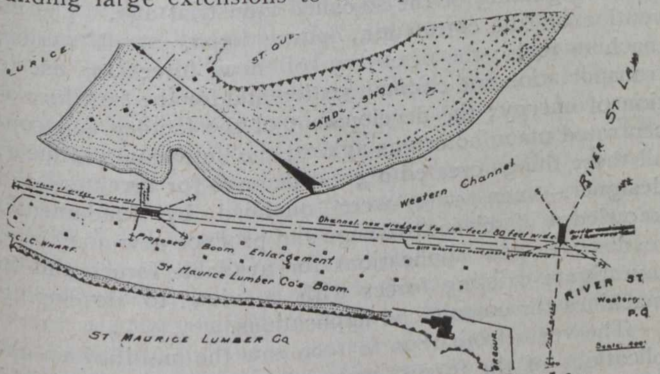
It was found in the 46th Street cofferdam that an operator skilled in handling a lighter could easily lower a sheet piling section within the range of the guide and that the guide then enabled the section to be placed with less labor than by any other method attempted.

IMPROVEMENTS AT THE ST. MAURICE RIVER OUTLET—WESTERN BRANCH

By Romeo Morrissette
Assistant District Engineer, Department of Public Works, Three Rivers, Que.

THREE RIVERS is midway between Quebec and Montreal on the St. Lawrence River and takes its name from the three channels forming the outlet of the St. Maurice River flowing a distance of 367 miles across the Laurentide Mountains.

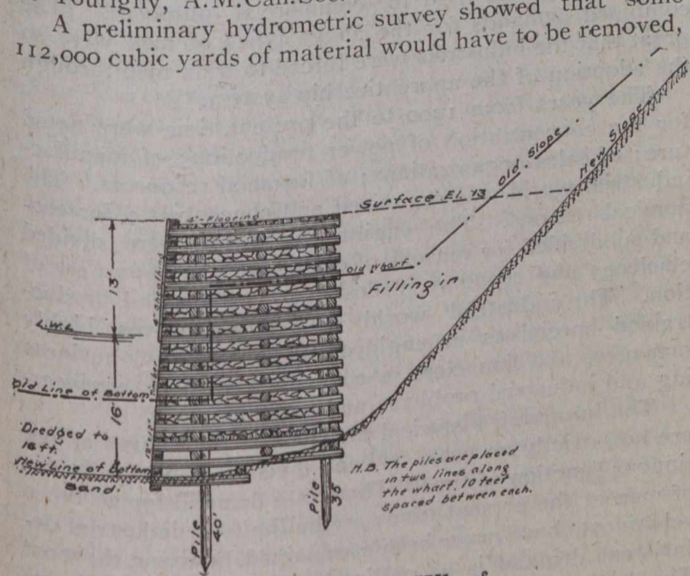
At the outlet of the St. Maurice dredging has been undertaken at various times to remove sand bars which were real impediments to navigation. Furthermore, the industrial need was increasing every year and by recently building large extensions to their plant the Canada Iron



Plan Showing Field of Operation of Dredge

Corporation was confronted with the necessity of getting an easier approach and more ample accommodation for their raw material which comes by Great Lakes steamers from both American and Canadian points. In order to do this, the company undertook the construction of a landing pier and asked for the deepening of the western branch from 6 feet to 14 feet in the main channel. The dredging was carried out by the Department of Public Works, under the direction of the district engineer. H. B. Tourigny, A.M.Can.Soc.C.E.

A preliminary hydrometric survey showed that some 112,000 cubic yards of material would have to be removed,



Cross-section of Wharf

principally sand and clay. A contract was entered into with La Compagnie Generale d'Entreprises Publiques, of Levis, Que., at 9 cents per cubic yard. The work started during the end of October, 1916, but was discontinued during November on account of weather conditions, 45,365 cubic yards having been removed by the elevator dredge "New Welland" in the proposed basin and at the outlet. Work was resumed in August of this year.

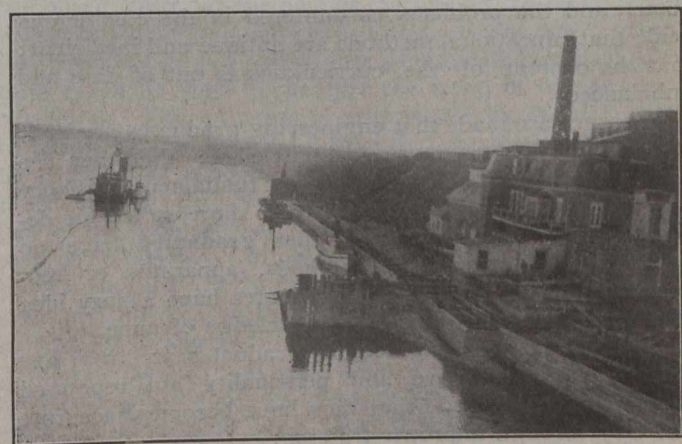
The great problem in such dredging is the filling in and the alluvial sand movement every spring. New soundings having been taken during August, 1917, showed that 88,000 cubic yards remained to be dredged

Detail of Crib Work, Page's Wharf

this season, leaving approximately 20,000 cubic yards which can be considered as the result of the filling in during the last freshets.

At the point where the St. Maurice and the St. Lawrence rivers join a large deposit of wood paste was found. This was 6 feet deep by 100 feet long. It is assumed that the paste was driven by the freshets from Shawinigan Falls and Grand Mere, a distance of 25 miles, where there are large paper mills.

As shown on the plan, the dredge has to follow two methods of work. When inside of the river she advances on the full length of wire on her front anchor, but when



Page's Wharf

working in the St. Lawrence River only 80 feet of wire were used on each cut, the guide anchors having to draw the dredge for a distance of 160 feet. It is expected that the work will be completed this fall.

The Canada Iron Corporation, of Three Rivers, has awarded the contract to Mr. Charles Pagé for the building of a crib 260 feet long 22 feet wide with a batter of 1:12 sixteen feet below the low-water mark and thirteen feet above.

The contractor had to remove an old slab quay and prepare the berth to elevation minus 18. That work was sub-let to Captain F. C. Burns, to carry out which he used a dipper dredge and was paid at the rate of 25 cents per cubic yard. Sixteen thousand cubic yards of material were taken out. Owing to the difficult setting of the slope, the bank being elevated and of quick sand, this scheme had to be abandoned at elevation minus 16 as the company's buildings were endangered. After a survey of the river bed the contractor decided to start the crib by steps, as shown on the accompanying cross-section. Owing to the pressure on the back of crib and to the live load added by a travelling 16-ton crane to take materials from the boats to the warehouse, 40-foot and 35-foot piles were driven spaced each 10 feet.

The crib contains 5,865 cubic yards and is estimated to have cost $5.20 per cubic yard, summarized as follows:

Timber and bolting	$1.21 per cubic yard
Stone filling	2.25 per cubic yard
Labor	1.24 per cubic yard
Contingencies	.50 per cubic yard

Piles cost 75 cents per lineal foot sunk and fifty-two were placed.

ENGINEERING GRADUATES AND INDUSTRIAL DEMANDS*

By L. W. W. Morrow
Associate Professor and Acting Director, Dept. of Electrical Engineering, University of Oklahoma.

THE current technical press has contained several articles regarding the capabilities of engineering graduates in the industrial world. At the meetings of the various technical societies there have been frequent criticisms of present educational methods and engineering curriculums.

It is alleged that the present curriculums are unsuited for modern industrial conditions; that educators are too academic and are not in touch with the progress of industry and the problems encountered in the commercial field; that educational methods are antique and inefficient; that the content of the curriculums is out of date and unbalanced.

Charges are made that engineering graduates are lacking in thorough training and knowledge; that they use bad English; that their knowledge of fundamentals is very hazy; that their training makes them more suited for designers than anything else; that graduates have no knowledge of commercial methods, apparatus or economics; that as a whole the graduates have a hazy idea of several things but accurate knowledge of none.

It is stated that engineering graduates are from one pattern; that initiative and personality are repressed rather than cultivated; that they have become inaccurate and lazy through improper training.

Other criticisms are made but, in general, the foregoing statements express the sentiments of those advocating reform in curriculums and educational methods. The men who make the criticisms are industrial engineers; men who judge engineering schools by their product and its fitness for their requirements; men who demand efficient employees; men whose viewpoint is necessarily that due to their environment.

The criticisms may be just in some respects; there may have been too great a tendency to remodel and change engineering educational methods and curriculums from a purely academic point of view. From an analysis of the criticisms it may be possible to consider more specifically industrial demands. At all events the criticisms should be considered with a view to eliminating them through educational campaigns or through educational changes.

A consideration of the points alleged leads inevitably to a historical sketch of the growth of engineering and changes in industrial conditions; the growth of the engineering school and finally the changes in the relations between the schools and the industrial world.

Historically, engineering may be divided into three eras, each era being determined by the chief industrial demand. These eras are as follows in point of time: the era of the designer and inventor; the era of the operator and constructor, and finally the era of the specialist and executive.

The demand for inventors and designers was greatest at the beginning of the so-called industrial age. The invention of the cotton gin, power loom, steam engine, machine tools; the discovery of new forces for use in transportation and communication and for the transformation of energy; the development of the factory and concentrated manufacture as against the individual producer, all these things created a great demand for inventors and designers—men who were qualified by fundamental knowledge of science to design and produce new machines, to discover new applications for available forces and to investigate existing forces with a view to developing machines for commercial applications.

The years from 1890 to 1900 saw the multifarious applications of the forces, materials and ideas developed during the previous era. The railway, the telephone, the power plant, the steam engine, the electric motor and generator, the turbine and water wheel, the machines for the manufacture of diversified products—all these were developed and applied with great rapidity.

The great development in commercial applications of engineering machines created a demand for skilled operators and constructors. Men were desired who were capable of constructing machines from design drawings; men were wanted in the drafting rooms to make the drawings; men were wanted to operate the engines, machines and power plants used for commercial purposes. The combined demands for the above types of men were so great that the industries were forced to train men through the adoption of the apprenticeship system.

The years from 1900 to the present time were noted for the concentration of power production; of manufacture; of sales organizations; of financial resources. The industrial world was organized and concentrated for economical reasons. The engineering fields were divided and subdivided for reasons of efficiency. It was an era of efficiency and economy in design, operation and production. The industrial world desired executives, highly trained specialists in engineering, organizers, business managers and financiers in connection with its engineering and industrial problems and conditions.

The foregoing historical divisions of the industrial age are not strictly accurate as each division is not a discontinuous function of time. There is a demand for all types of men at the present time; as the limits in industrial developments have never been ascertained, however, the most insistent demand is as outlined, and the supply is least. The demand for designers, operators and constructors has been greatly lessened by the increased supply of such men developed by the industries and the technical schools. The gauge of the peak demand for men is found in the salaries. At this time few designers, operators or constructors receive $10,000 per year, yet many executives, specialist engineers, sales engineers, consulting engineers

*Abstracted from Bulletin of the Society for the Promotion of Engineering Education.

and efficiency engineers receive that figure. $50,000 would be a better comparative figure as regards the number of men receiving such salaries in the two classes.

The engineering school is a product of the industrial age and is a result of industrial demands. It was born in the inventive era and was a direct result of the desire for men who had fundamental training in science sufficient for them intelligently to use the newly discovered machines, forces, materials and processes. The engineering school grew gradually from a school of pure science to one of applied science because of the insistent demands of industries. The growth and evolution of curriculums were slow processes and lagged far behind industrial demands as regards time.

The era of application and operation gave an impetus to engineering schools that has existed almost to this time. The demands for skilled operators, draftsmen and mechanics were so great that industrial organizations were forced to supply some of the men through apprenticeship systems. The engineering schools were insufficient in number to fill the demand for their products. New engineering schools were founded in great numbers. The field of pure and applied science was sharply divided and defined in this era. The engineering curriculums were changed in order to train students in the use of industrial apparatus in wood and machine shops and in testing laboratories for steam and electric machines. The schools devoted a great amount of time to design and drafting and also taught the fundamentals of engineering as contained in the pure sciences. This was the golden age for engineering schools—their products were in great demand and excited no criticism; the engineering profession was very popular and caused the schools to receive private and state support as well as a great increase in the number of students.

The era from 1900 to date, with the resulting changes in industrial conditions and demands, has greatly changed the working conditions for engineering schools and caused some dissatisfaction with their products. The popularity of engineering as a profession created in the previous era caused a large increase in enrollments for several years and in the number of engineering schools. These conditions existed long after the initial industrial impetus had ceased. The schools still kept in view the training of designers and operators although the demand for such men was decreasing yearly. Engineering schools continued to add large and expensive shops and laboratories to their equipment; some even attempted to manufacture commercial products in order to train students in commercial methods. The apex of this condition as regards the engineering schools was reached long after industrial demands had changed. The time lag between school curriculums and industrial conditions is very great and can only be shortened by more intense co-operation between the schools and the industries through faculty associations with industrial pursuits.

The engineering schools awoke to existing conditions in industrial pursuits only a few years ago—the prime source of awakening being a decrease in engineering enrollment. This was explained in part by the growth in popularity of agriculture at this period, but this alone could not be sufficient reason for the decrease in the popularity of engineering as a profession. Upon investigation, the schools found that the industrial conditions and demands had changed. Industry now desired specialist engineers—a man who was not only an electrical engineer but also a specialist in one branch of electrical engineering, such as railways, telephony, illumination, transmission, etc. The engineering problems were largely problems in economics and no longer those of design or operation. The industrial world also desired executives and business managers and could not obtain a sufficient number. Industry was looking to the engineering schools for their supply and found it unfitted for the existing conditions.

The schools found it advisable to conform to industrial demands as their salvation and life depended upon their products obtaining larger salaries than were being given them. In a haphazard way and at different times the schools began to change their curriculums to conform to the new conditions. In this revision of curriculums, instead of omitting previous courses and replacing them by others of the desired type, they simply added to the existing curriculum specialized courses in engineering, economics, business law and business management and made no attempt to increase the time allotted for an engineering degree. Civil engineering students, for instance, were not only given the previous content of the curriculum but were also given specialized courses in concrete construction, hydraulic engineering, structural engineering, railroad and highway engineering, economics, English, business management and business law. The same conditions held true in electrical and mechanical engineering.

During the elapsed time the knowledge of fundamental laws and their applications had increased and so required more time for their assimilation with the same degree of thoroughness.

What was the result? The schools found they had attempted the impossible; they found that it was impossible to have such curriculums in a four-year course. They found their graduates were not thoroughly trained even in fundamentals; that their reputations were on the wane; that their enrollments were decreasing as a consequence; that criticisms were severe; that radical steps must be taken to avert disaster. The realization of this condition was a slow process and was marked by no organized effort, on the part of the schools, to revise their educational methods and curriculums. Even now a great many schools do not realize that such conditions exist and have taken no steps to analyze the trend of engineering education. The situation is aggravated by the demands of industries for the type of men that cannot be furnished by engineering schools in a four-year course; the industries do not realize the conditions engineering educators face or the problem they have to solve—industry demands results irrespective of conditions. The schools have proven through costly experimentation that the type of men demanded is an impossibility, yet some schools are still trying to supply the demand.

The industrial engineers desire men trained in fundamentals, operation, design and construction and specialized engineers along one line; they desire men trained in economics, business organizations and executive duties. They criticize the schools because they do not furnish such men in a four-year course.

The schools should admit without question that they fail to supply the demand; that they cannot do so under present conditions in a four-year course. It is impossible to train a high-school graduate in four years so that he will possess all the qualifications demanded by industries. The schools should admit these facts and submit their brief to industrial engineers.

Engineering schools are facing a crisis. Industry demands results that are not forthcoming. The lives of engineering schools depend upon their supplying the demands of industry. The problem must be solved and will only be solved by the efforts of engineering educators for they are the ones vitally interested. An educational campaign is the first step in the solution of the problem. Industry and industrial engineers must be made to realize that they are demanding the impossible. That engineering schools have attempted to supply such men and found it impossible with the result that the schools have been criticized because their products are inaccurate, hazy and ill-trained in many respects.

What is the solution of the problem? How can industrial demands be satisfied?

A six-year course has been offered as a panacea. The objection to the six-year course is the time required. Industries have offered no inducements to cause men to take six-year courses. Curriculums for six-year courses are very immature at the present time. Such a course requires a strong graduate faculty as the time has not arrived for abolishing the four-year course. The criticisms that curriculums are faulty, that all students are given the same training; that initiative is not developed; that there are no facilities for training in commercial operation, methods, processes and executive duties—all these conditions cannot be changed by simply spreading out the present curriculums over two more years.

Six years is required to give accurate and thorough training in the fundamentals of engineering and some specialized training in a main division of engineering such as civil, electrical or mechanical. The engineering schools are equipped to give such training as to faculty and apparatus. It is feasible to balance curriculum content and to allow for the natural aptitude and personality of students. From the above considerations it would seem that the addition of two years would not help to supply the commercial demand except by removing the criticism as to inaccuracy in fundamentals. It would merely give the student a proper foundation.

Commercial methods in manufacture, operation and construction can only be obtained through academic and commercial co-operation. It is impossible for the schools to have up-to-date equipment on a commercial scale. This criticism could be readily removed, however, through co-operative effort. Students could be required to work in the industrial world at least two summers before a degree is granted. The type of work, pay, etc., could readily be worked out in specific cases. This field offers a splendid opportunity for development and should be considered by engineering educators.

Fundamental training in engineering is the best foundation for executives and organizers. It is not possible to give more than this foundation in a four-year course, so the only way this demand can be filled is through the graduate school. There is no place for such special training in the four-year course and students will not take graduate work unless there is some inducement for such work. This condition holds true for specialists in one line of engineering. The schools should remove all specialization from their four-year courses. They should develop strong graduate schools, they should obtain the co-operation of industries and offer inducements to proper men to pursue the graduate courses.

Taking up the chief criticisms, it is found that in many cases engineering graduates of recent years have lacked thorough and accurate training in engineering. This was due to faults in the curriculums and methods of teaching and also due to the attempt of industrial engineers to get the impossible. This condition and the above criticisms can be removed through removal of specialization, balancing the fundamental curriculum content and educating the industrial engineers.

The supply of specialists and executives demanded by industrial engineers can only be obtained through strong graduate schools. The graduate schools can only be developed through co-operative effort.

The knowledge of commercial apparatus and methods demanded by industry can be obtained through required commercial summer work, provided industries co-operate with the schools to offer some inducement for such work.

The schools should bear in mind the fact that their function is to furnish industrial engineers and should not be too academic in their aims and curriculums. The present curriculums of engineering schools show a startling difference in content. There is no uniformity in curriculum content, time allotted the different courses or methods of presentation. It seems feasible to have a better agreement among engineering schools as to the above points.

The industrial world should be made aware of educational conditions through an educational propaganda; should be taught what to expect of four-year engineering graduates; should be strongly urged to co-operate with the schools as to summer work and, finally, should offer inducements to students to pursue graduate work so as to cause the development of strong graduate schools.

Some of the criticisms are well founded and can only be removed by conscientious effort of engineering educators, other criticisms are not logical and are made through ignorance of the conditions and results possible in engineering education.

CANADIAN SOCIETY OF CIVIL ENGINEERS

The third meeting of the 1917-18 session will be held on Thursday, November the 22nd, at 8.15 p.m., at headquarters, 176 Mansfield Street, Montreal, when Lieut.-Col. C. N. Monsarrat, M.Can.Soc.C.E., chairman Quebec Bridge Commission, will deliver an address on "The Quebec Bridge." The address will be illustrated by slides and motion pictures and will be the first of a series on this subject to be presented to the society.

CANADIAN SOCIETY OF CIVIL ENGINEERS, MANITOBA BRANCH

In order to encourage the interest of all society members and associates, and of branch associates of all sections in the meetings of the branch, and in the subjects from time to time under study and discussion, it has been decided by the Manitoba Branch of the Canadian Society of Civil Engineers to discontinue until further notice, the holding of separate meetings of the electrical and mechanical sections. In place of these section meetings, which had been held monthly during recent winters, the executive has arranged fortnightly meetings of the branch. The subjects treated will include electrical and mechanical as well as civil and structural topics. All society and branch members and associates are urged to attend all meetings, and are welcome and urged to take part in all discussions.

The export of wolfram ore from Tavoy, Burma, in May last, was 248 tons, compared with 164 tons for the corresponding month of last year. No tin ore was exported in May of this year, and only 5 cwt. in May, 1916. The exports of tin ore from Mergui to the Straits Settlements during April, 1917, amounted to 56 cwt.

TESTS ON NAILED JOINTS IN FIR AND HEMLOCK TIMBERS

Mr. Henry F. Blood, engineer of the Bureau of Buildings, Portland, Ore., has recently been conducting some tests on nailed joints using Douglas fir and western hemlock—two timbers most used on the Pacific Coast.

Report has now been made on these tests covering 110 joints, 87 of which were of Douglas fir and 23 of western hemlock, the tests all being designed to show the strength of nailed joints with wire nails used in single shear.

The tests were divided into two series, depending on the style of the joint. In the first, two sidepieces, each with the grain of wood vertical, were nailed to a centrepiece with the grain of wood horizontal. In the second, two sidepieces, each with the grain of the wood vertical, were nailed to a centrepiece with the grain of the wood also vertical. In both series both Douglas fir and western hemlock were tested, but in the second series only Douglas fir was used. The sizes of the sidepieces varied from 1 x 6 ins. to 3 x 8 ins., and those of the centrepieces from 4 x 6 ins. to 6 x 10 ins., the dimensions indicating commercial sizes which vary from 3/8 in. to 1/4 in. less than dimensions given. The nails were common wire nails ranging from 10d. to 60d. in size, and the number of nails used in each sidepiece varied from two to five. The sizes of the pieces were such that the nails had a penetration in the centrepiece of 30% to 80% of the length of the nail, but the nails were used in single shear, in no case passing through the centrepiece. All timbers were surfaced, so that contact in the joints was between planned surfaces only.

Tests were made by placing the blocks in a testing machine and forcing the sidepieces down and alongside of the centrepiece. Measurements were taken on the relative movement of the pieces by means of a scale screwed to the blocks. An effort was made to measure the elastic limit of the joints, but this could not be determined so it was not recorded. The ultimate loads carried in the series were as follow:

Results of Tests on Wood Joints to Determine Holding Power of Nails

	No. of tests.	Size of nail.	Ultimate load carried per nail, lb. per sq. in.
Series 1—Douglas Fir	14	10d.	525
	9	16d.	600
	10	20d.	749
	10	30d.	922
	5	40d.	1,183
	1	60d.	1,800
Series 2—Douglas Fir	5	10d.	407
	9	16d.	628
	12	20d.	751
	6	30d.	992
	4	40d.	1,023
	1	60d.	873
Series 2—Western Hemlock.	6	10d.	519
	4	16d.	588
	7	20d.	695
	6	30d.	979

This tabulation shows the irregularity and apparent unreliability of the single test made on the 50d. and 60d. nail joints.

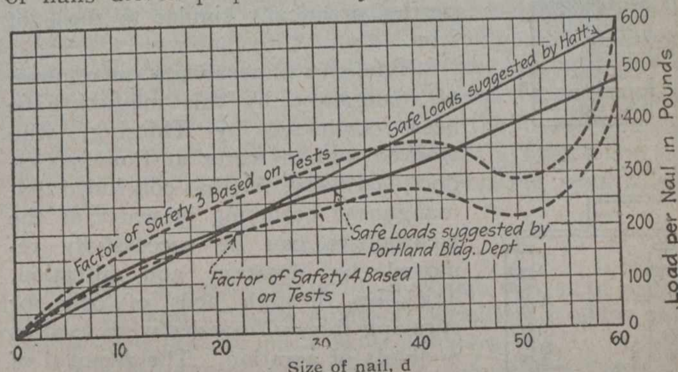
On the basis of these tests the department established safe values for nails driven in perpendicularly to the grain in either Douglas fir or western hemlock, with the load perpendicular to the length of the nail, as follow:

Penny nail.	Load value per nail, lb.	Penny nail.	Load value per nail, lb.
10	120	30	270
12	120	40	320
16	160	50	400
20	200	60	480

From the accompanying diagram of the loads based on two factors of safety and the suggested safe load, it will be seen that the suggested safe load is about according to the formula $W = 7d + 50$, where W is the safe working load, per nail in pounds and d is the penny designation of the nail. It is interesting to compare this value with the value suggested by previous experimenters of $9.6\,d$, the figure given by Prof. W. K. Hatt, of Purdue University, in a paper in the 1900 "Proceedings" of the Indiana Engineering Society.

For nails driven parallel with the grain of the wood the figures above should be reduced 25%. All of these values should be reduced if the penetration of the nail in the holding piece is less than 50% of its length.

Other conclusions in the report are that the resistance of nails driven perpendicularly in the timber with the



Safe Loads for Nailed Joints of Oregon Fir and Western Hemlock

Nails driven perpendicular to grain. Load perpendicular to length of nail.

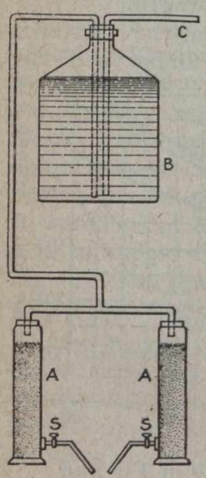
grain of the wood parallel to the load is but little more than for nails driven similarly with the grain of the wood perpendicular to the load. It is also indicated that the standard nail heads are of proper proportions, there being no difficulty with the nail head pulling through the outside timber. The strength of the joint seems to be affected but little by the penetration of the nail in the centrepiece if that penetration is 40% or more of the length of the nail, but with less penetration the loads were reduced, and for a penetration of 30% the strength reduction amounted to about 25%. The examination showed that each nail in a joint seemed to support an equal proportion of the load.

Two principal factors involved in the strength of nail joints are the resistance of timber to crushing and the nail to bending. The investigator reports that the resistance of the nailed joint, if depending solely on the resistance of the wood to crushing, varies with the diameter of the nail, other things being unchanged. On the other hand, the resistance of the joint, if depending solely on the resistance of the nail to bending, varies as the cube of the diameter of the nail. As the resistance of the joint depends on the combination of these two, various sized nails give varying degrees of resistance, but it is found that the variation of the resistance corresponds quite closely with the square of the diameter of the nail.

REMOVAL OF MANGANESE FROM WATER SUPPLIES*

By H. P. Carson
Illinois Water Survey.

THREE practical methods for the removal of manganese from water have been developed—aeration and filtration through sand, filtration through permutit, and filtration through pyrolusite. The problem of removing manganese has been attacked by most workers in a manner similar to that of removing iron. The usual method for the removal of iron from water is by aeration followed by filtration through sand, and it is generally and successfully used in many plants in the United States and Europe. Iron occurs in most ground waters in the ferrous condition. When the water is aerated the iron is oxidized to the ferric condition and separates as the hydroxide. This combination of oxidation, hydrolysis, and precipitation is the basic principle of the method though the presence of other substances somewhat affects the results. The occurrence of manganese with iron in many waters and its separation as the hydrated dioxide under certain conditions have led to the assumption that the element in water has chemical properties practically similar to those of iron.



Experimental Sand Filters for the Removal of Manganese

Extensive experiments on removal of manganese by this method have been conducted by Thiesing, who worked with a water at Pommerensdorf, Germany. He has concluded that manganese occurring in water as the bicarbonate can be successfully removed by aeration and filtration. Trickling through beds of coke or spraying through nozzles were used as methods of aeration. The removal of carbon dioxide as well as solution of oxygen was found to be important in the process of aeration. Subsequent filtration through sand gave an effluent containing very little manganese; sedimentation effected little removal.

In the United States extensive experiments along similar lines have been conducted by R. S. Weston with several waters containing iron and manganese in Massachusetts. Mr. Weston's problems have dealt chiefly with the removal of iron. A well water containing 0.73 part per million of iron and 0.23 part per million of manganese was treated at Cohasset by being sprayed through nozzles followed by passage through a coke trickling filter and mechanical filters. Satisfactory results were obtained in the experiments and arrangements have been made for construction of a large plant. In experiments at Brookline sprinkling through nozzles followed by passage through a coke trickling filter and slow sand filters decreased the content of iron from 0.6 to 0.2 part per million. The content of manganese of the untreated water was 0.26 part per million; though Weston published no figures concerning the efficiency of the removal of manganese he stated that he found it roughly proportional to that of the removal of iron. A plant for removal of iron and manganese, which has been installed at Middleboro, treats 335,000 gallons of water a day. The water, after it has been sprayed over a coke trickling filter 10 feet deep, flows into a settling basin and through slow sand filters operating at a rate of 10,000,000 gallons per acre per day. The content of iron was decreased from 1.5 to 0.2 part per million and the content of manganese from 0.67 to 0.27 part per million during the first run from September 26th, 1913, to January 12th, 1914. The efficiency of the removal of manganese increased as the plant was operated longer, and the effluent on January 22nd contained 0.10 part per million of manganese.

Barbour performed a similar series of experiments on the well water supply of Lowell, Mass. The waters of the wells differ in content of manganese, the strongest containing 2.0 parts per million. Aeration. sedimentation and sand filtration were tried on an experimental scale. The efficiency of the plant was at first rather erratic, but it finally bcame possible to reduce the content of manganese to 0.01 part per million. A dark coloration due to precipitated oxides of manganese was observed in the sand bed, and this extended in diminishing amounts to the bottom of the bed. On the basis of this study a plant was erected at a cost of $180,000 for the removal of manganese and iron.

Practically all students of removal of manganese by aeration and filtration have concluded that manganese is much more difficult to remove than iron. The details of the process, such as the amount of aeration and the rate of filtration, differ with the character of the water.

Manganese permutit consists of a zeolite with which a layer of manganese dioxide is incorporated. When a manganese-bearing water is filtered through this medium the manganese is removed from the water by the formation of a lower oxide of manganese by reaction between the manganese in the water and the manganese dioxide in the permutit. At the same time the alkali or alkaline-earth of the silicate is replaced by the manganous compound of the water. The replacement is of minor importance, and the slight extent to which it takes place is dependent on the concentration of manganese in the water. Manganese is added to the permutit not only when manganese permutit is regenerated by potassium permanganate but also when manganese is removed from water by the regenerated permutit; therefore, the content of manganese dioxide increases and the filter medium approaches in composition pure manganese dioxide with each successive regeneration and reduction. As the zeolite can not increase in amount with successive reductions and regenerations the replacement effect must become less and less as the substance is used. These conclusions are in entire accord with that reached independently by Tillmans—that the action of manganese permutit is really the action of manganese dioxide.

Some preliminary experiments made by filtering an aerated artificially prepared manganese-bearing water through a small sand filter showed that no removal of manganese was effected. A mechanical filtration plant has been installed at Mount Vernon, Ill., however, for the purpose of removing manganese as well as effecting hygienic purification of a surface water, and analyses of the water some months after installation of the mechanical filters showed that manganese was being removed by this plant. Manganese is also removed in a filter plant at Anna. Ill., designed for hygienic purification of a surface-water supply. These results seemed contradictory to the negative results obtained on a small scale. Yet, as manganese dioxide had been used successfully for removal of

*Abstract from thesis presented in partial fulfilment of requirements for the degree of Doctor of Philosophy at the University of Illinois.

manganese and as this compound is the basic part of manganese permutit it was concluded that manganese dioxide was the principal factor in the removal of manganese in successful sand filtration.

Two filters were therefore prepared for experimental use. The apparatus (see Fig. 1) consisted of two gas-washing cylinders (A, A) connected at their tops by a siphon to a large carboy (B) holding the water to be treated. The rate of filtration could be so adjusted by two stopcocks (S, S) that both filters would deliver their effluents at the same rate. A glass tube (C) extending to the bottom of the carboy provided means for admitting compressed air for aeration.

Each filter was filled with one litre of clean high-grade filter sand, having an effective size of 0.50 millimetre and a uniformity coefficient of 1.32. One filter was treated successively with solutions of manganous sulphate, sodium hydroxide, and potassium permanganate. After two or three treatments a thin film of black oxide of manganese had formed on the grains of sand. The filter was then washed with water until an effluent free from manganese was obtained. The other filter was used without such treatment. The apparatus consisted, therefore, of two filters working in parallel, one containing sand only, and the other containing sand which had been slightly coated with manganese dioxide. As the depth of sand in each was 35 centimetres the filtering area of each was 28 square centimetres.

The removal of manganese in a manganese-removal filter, depends on the contact of the manganous compound with manganese dioxide; consequently, the rate of filtration should be expressed in terms of volume of water filtered per volume of filter medium and not per area of filter surface. The rate varied slightly in these experiments, but it was so adjusted that a volume of water equal to the volume of the filter medium was filtered in twenty minutes.

Filtration through sand removed iron, but did not detectibly decrease manganese. The content of dissolved oxygen was decreased throughout more than one part per million by passage through the filters, even in the experiment in which no removal of manganese apparently took place. Filtration through sand coated with manganese dioxide removed all manganese and iron, decreased alkalinity 14 parts per million, and decreased dissolved oxygen about the same extent to which it was decreased in the sand filter.

In order to determine the effect of adding a coagulant, 2 grains per gallon of alum was added, the water was then aerated, and allowed to settle one hour as in the other series. The results obtained indicate that little change is caused by addition of the coagulant. Complete removal of manganese was obtained by filtration through sand coated with manganese dioxide but practically no removal by filtration through sand alone.

The action in presence of both iron and manganese was studied by treating a water in which 10 parts per million of manganese as $MnSO_4.4H_2O$ and 10 parts per million of iron as $FeSO_4.(NH_4)_2SO_4 6H_2O$ had been dissolved. After this water had been aerated it had a high reddish-brown turbidity caused by precipitated ferric hydroxide. Treatment of this solution by filtration through sand alone resulted in complete removal of iron but no removal of manganese. Treatment of it by filtration through sand coated with manganese dioxide, however, completely removed manganese and iron. The alkalinity was not decreased by passage through either filter; this is not in accordance with the theory as the removal should have decreased the alkalinity by an amount equivalent to the manganese removed. This apparent discrepancy might be accounted for either by the presence of small amounts of substances capable of neutralizing free acid in the sand, or by oxidation of the manganous compound to a marked degree in the aeration and yet to a degree insufficient to form an insoluble compound.

Though no removal of manganese by filtration through sand could be detected by analysis the upper part of the sand became discolored by a slight deposit of manganese dioxide after the filter had been used for some time. This shows that there must have been some slight but continual removal of manganese by aeration and filtration. This slight deposit would rapidly aid in removal of more and more manganese until sufficient manganese dioxide would have been deposited to remove completely the manganese from water filtered through it; the process might be erroneously considered to be simply one of aeration and filtration through sand when in reality it is a catalysis by manganese dioxide.

Manganese is efficiently removed from surface-water supplies by filtration through sand coated with manganese dioxide at two plants in Illinois. One of these filter plants was installed for removal of manganese as well as for hygienic purification of the water, and the other was installed for hygienic purification only, the presence of manganese in the water not being suspected. There was evidence of unsatisfactory removal of manganese for some time after the installation of these plants, but efficient removal resulted after a period had elapsed for the deposition of sufficient manganese dioxide in the filters. As no similar observations have been reported a description of these two plants with some of the operating results are presented.

Summary

Manganese occurs normally in certain classes of water in Illinois, and amounts sufficient seriously to affect the quality have been found in several waters.

Little manganese is present in water from Potsdam sandstone, St. Peter sandstone, the overlying limestones, Lake Michigan, and the large rivers.

Manganese is usually present and often in very large amounts in coal-mine drainage.

Manganese is present in water from some impounding reservoirs on small streams in southern Illinois, and from some wells entering unconsolidated deposits near rivers.

No apparent relation exists between the content of manganese of a water and any of the other mineral constituents.

The persulphate method is the most convenient and accurate method for the colorimetric determination of manganese in water. Chloride does not interfere. Five-thousandths of a milligram of manganese in a volume of 50 cubic centimeters, equivalent to 0.1 part per million can be detected.

The standardized bismuthate method is accurate and reliable. The presence of chloride in amounts less than 5 milligrams does not interfere with this determination. By this method 0.01 milligram of manganese in a volume of 50 cubic centimetres, equivalent to 0.2 part per million can be detected.

The principle underlying all processes for the removal of manganese from water supplies, except those of direct chemical precipitation. is the reaction between manganous compounds and manganese dioxide to form a lower oxide.

The removal of manganese by the permutit process takes place according to this reaction, as the state of oxidation of manganese in the substance is not greater than that in manganese dioxide. No evidence of the existence of oxides higher than MnO_2 in this substance was found.

No appreciable removal of manganese was obtained on an experimental scale by aeration and sand filtration. When an artificial coating of manganese dioxide was prepared on the grains of sand, however, complete removal of manganese was obtained. Manganese is efficiently removed from water supplies at Anna and Mount Vernon, Illinois, by this process, a coating of manganese dioxide having formed on the sand. If the water contains dissolved oxygen regeneration of the filter is unnecessary, and the process may be considerd catalytic.

The assumption that manganese may be removed by the same process which removes iron is incorrect.

The formation of incrustations of manganese in water pipes, where manganese-secreting bacteria are not present, is explainable by the catalytic action of manganese dioxide.

PUBLIC UTILITY RATES*

By H. S. Cooper

Secretary, Southwestern Electrical and Gas Association.

TO the untechnical outsider, "the ultimate consumer," the charges for the "product" of a public utility: the "rates" for water, gas, or electric current (especially the last) are mysteries, open to the suspicion of having been made and maintained as such for the express purpose of deluding the user of the product. This suspicion has been fostered by two opposite forces—the utilities themselves and those opposed to them. The utilities have strengthened it by having rates which could not be justified or could not be logically explained, or else by refusing or neglecting to explain their rates even when they were perfectly just and explainable. The opponents and enemies of public utilities, privately owned and operated, have not only seized on any and every case of negligence, carelessness, irregularity, inequity, or discrimination in the rates and made public capital of them, but in many cases have taken advantage of the ignorance of the general public on these matters to make positively untrue and entirely misleading statements with the evident intention of making capital with the public in favor of themselves. This latter condition has been made worse by the fact that a majority of the utilities have refused, or neglected, to enlighten the public fully and intelligently upon the subject of their rates or the reason for those rates, even after such biased or untruthful charges have been made.

Therefore, between these two parties, there is little wonder that the general public is not correctly conversant with either the general operating mechanism of its public utilities or the basing of their rates. If this miscomprehension went no further than a misunderstanding, even then the result would be unsatisfactory; but this ignorance, incited by misinformation, paves the way for suspicion of all the acts and motives of the utilities, and incites reprisal for so-called wrongs and inequities which have been either greatly exaggerated or have been entirely imaginary.

Added to this, as a factor of misunderstanding, is the great and, by the public, unrecognized difference between the public utility and any other class of business. As a rule, the public understands, thinks it understands or takes on trust every other kind of business, manufacturing or distributive, or both. It believes that the principles which it sees underlying all these private businesses are of universal application, and it is rendered still more suspicious of the utilities and their methods when the fact is forced on it that, in certain things, the utility business operates in ways apparently opposite to the ordinary commercial businesses with which they are familiar.

Moreover, the public has so much more business to transact with the average private commercial establishments than it has with the utilities that it conceives that the methods of the private enterprises are the only correct ones, and that any business the methods of which vary greatly from these must be wrong in its principles. No full and concerted effort has ever been made to explain clearly and practically that the difference between the operating mechanism of a public utility and that of a private commercial enterprise is one of form only and that the eternal axioms of all commercial life, the basic principles of all permanently successful businesses, rule the public utility plant as well as the department store, the hardware shop, or the livery stable.

To further complicate the matter, the product of the more important utility, electricity, is an intangible substance; it is in all its uses merely a "form of service." The public has been familiar with dealing in commodities, in tangible goods, in an actual physical and personal service. However, the electric "unit of rates," the kilowatt-hour, is fundamentally an entirely different unit from that of any other business with which the public deals and it is, consequently, suspicious of that unit and all its combinations in rate schedules. No full and concerted effort has ever been made to explain clearly to the public that the "product" is not a quantity or a bulk or a measure, but that it is actually a service expressed in terms of quantity and time as a "kilowatt-hour"—the supply of a certain amount of a certain kind of electrical service for a certain length of time. Thus explained and illustrated by the concrete example of a service of light, heat, or power, there is immediately laid a basis for explanation of the equity of varying rates for the same product—the great stumbling-block and trouble-breeder with the public.

The ordinary retail commercial organization, such as a department store, conducts its selling and prices on a system of averages by which the profitable customers pay for the unprofitable ones. The charge customers, no matter how slow in paying they may be, obtain their goods at the same price for the same quantity as do the customers who pay spot cash; the one who requires a spool of cotton delivered in a remote suburb pays no more for it than does the one who carries it away. The service which, to a greater or lesser extent, must necessarily accompany all retail merchandizing is averaged over all customers, as are all other costs or expenses (including bad debts and, often, poor buying of goods). The whole commercial teaching of the retail purchaser at private commercial establishments is on the one-price principle. It is the same as that impossible "single-rate" ideal of certain rate faddists. This method of average charging is, at the present time, perfectly legal in a private manufacturing or distributing business, but the instant any business is, or becomes, a public business (a "Public Service Corporation" or a "Public Utility") the manner of selling its goods or product or service to the public is legally changed.

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*Abstract from General Electric Review.

The private enterprise has entire control of the price it may demand for its goods or services. If the cost of its operation, its material, or its labor increases, it is at perfect liberty to instantly increase its price or "rates" to its customers, and the only limit to such raise of price is what the customers will stand. This course is not open to the utility, its rates are generally contractually fixed at a maximum for a long term period, and it cannot raise those rates without the consent of the public no matter how much its loss or loss of profit may be under the existing rates. Also, the private concern may legally practice any discrimination it may desire among its patrons. It may charge one price to one customer and another price to another; it may, simply as a matter of like or dislike, give credit to one and refuse it to another; it may sell to one and refuse to sell to another, and there is no legal recourse against it or its practices. This the utility cannot do; its price for the same service must be identical to all; and it may refuse service to no customer or prospective customer who complies or agrees to comply with the reasonable rules and regulations approved by the public and put in force by the utility. It must serve friend and foe alike, no sentiment must enter into its business relations with its customers; its most bitter enemy and detractor must have the same service and courtesy as its best friend.

The profit of the private concern is legally unlimited. Without regard to the cost to it of any article or service it sells, it may set any price it may desire on that article or service and the public must pay that price, go elsewhere to get it, or failing to do the latter must go without it or use a substitute.

This is not the case with the utility. Its product or service must be sold to each consumer at as near the particular cost of the product or service demanded by such consumer as is commercially possible, plus a certain legally fixed, agreed, permitted, or passively allowed profit.

The public actually makes a "demand" of the public utility in regard to its service; it orders the public utility to serve it in such and such a manner and to such and such a degree, and the public utility is legally compelled to fulfil each and every such demand if the public pays it cost plus profit to do so. It is this ability of the public to compel the fulfilling of a demand which is one of the principal factors in the difference of price-making between the public utility and the private commercial concern. If the public went to its grocer and said, "I want a pound of sugar, send it up at the most convenient time for you," the price of that sugar would be at its minimum per pound. But if the customer said, "Send me, at your very busiest time, ten pounds of sugar in one-pound packages, a package every ten minutes," that grocer would soon advance the price of sugar to that customer or find some method of avoiding filling any more such freak orders. But the utility is not only compelled to fill such freak orders as long as it is paid cost plus profit to do so, but it must stand prepared to fill, at any minute, night or day, Sundays or week-days, any and all of the freak orders or demands of every one of its connected customers. It cannot store or reservoir its product—electric current—so it must have a reserve of machinery and apparatus ready at any time to generate, translate, and distribute electric service in quantity and kind the very instant it is demanded; in other words, must have it "on tap" so fully and completely that any customer who, at any time, throws in a switch gets instantaneously the electric service he pays for.

If the grocer gets out of sugar the customer may be dissatisfied, may even transfer his patronage to another grocery, but there is no legal obligation on the part of the grocer to maintain, as far as is humanly in his power, a stock of sugar which will fill any sudden demand from his customer, nor it there any liability for damages against the grocer because he allows his regular customers to fail to receive their supply from him. But the public utility is legally compelled to do this or forfeit the right to do business in that community. Now, to be so able to fulfil any such demand at any time, to have a reserve of capacity to accomplish this, adds greatly to the costs and consequently to the rates, and it especially adds to the rates of those customers whose demands are responsible for this condition of affairs. The simple and correct commercial reason is "that he who dances must pay the fiddler"; in public utility rates "he who demands must pay for his demand." In other words, the customers, or class or group of customers, whose ordinary demand for the most of their electric service is in the evening only but who, at the same time, demand that this service shall be on tap the whole twenty-four hours whether they use it or not, because they may want to use it, these and such as these must not only pay for the electric service which they use but, in equity, they must pay the expense of keeping it on tap ready for their use the whole twenty-four hours because, by their actions and by their installation, they demand that this shall be done.

As has been shown, the public utility does not merely sell its product—gas, water, or electric current. If it sold merely the product, the customer would be compelled to come or send to the gas works, water reservoir, or station switchboard and carry away its needs of gas, water, or electricity, if such a procedure were possible. But because such procedure is nearly impossible practically, and absolutly so commercially, the public utility delivers its product in every case and in that delivery lies the difference in rates, because that delivery is always in accordance with the demand of the customer, and, as stated, the demand of the customer may be exceedingly varied but in all cases it must be fulfilled by the utility as long as that customer pays the utility sufficient to reimburse it for the cost of its raw product, for the cost of the specific service demanded and, in addition, the profit legally due the utility on the transaction. It will be seen, therefore, that actually the basis of rates or the "prices" of the public utility are not only figured very similarly to those of the private commercial concern but that, as a matter of fact, they are more strictly and impartially equitable than are those of the private business. The private price method is simpler and easier to understand because it is a one-price method; the same price to every one for the same quantity and without regard to the cost of the varying demand made by the different customers. This, as can be easily seen, is so inequitable that it actually amounts to discrimination because discrimination is, in one of its phases, "the charging of an equal tariff for unequal service." The public has, however, in its modern retail dealings with its private suppliers become so accustomed to this average or one-price method of charging that it not only has not been able to recognize the inherent equity and reasonableness of the public utility price-methods, but it has actually viewed these methods with grave suspicion as being an endeavor on the part of the "wicked corporations" to "put one over on the public"!

Outside the fact that this matter has not been fully explained to the public lies the further fact that the utility has never explained to them that its price methods, or rate-bases and rate-schedules, are now and have been for a long time fixed on it by legal enactment, and that even if the utility desired to return to the slipshod and inequitable price-fixing methods of the private merchandizing concerns, neither the public nor its representatives would allow them to do so upon full consideration of the matter. While the public "kicks" at the amount or the comparative amount of its public utility bills, while it hoots at "kilowatt hours" and affects inability to comprehend "demand," there are among it and representing it in the council-chamber, commission-room, legislative-hall, or on the judicial-bench those whose understanding or training enables them to see the defects of the private commercial price-making methods, especially when applied to public or quasi-public supply by a virtual local monopoly. Left to the untechnical public, the price-fixing of public utility product or service would be "a thing fearfully and wonderfully done," and the utilities should be thankful that, in many cases, those outside of the utility business have been more industrious in forming true rates on a proper rate-basis than have many of the utilities themselves.

In order to comprehend and appreciate fully the equity of a proper public-utility rate schedule, it is necessary that the public should be preinformed as to what has been aptly termed "the operating mechanism" of a public utility, the peculiar conditions which differentiate its method of doing business from the methods of the private commercial business. Mention has been made of the fact that the utility may not select its customers: it cannot refuse its service or product to any person within its franchised territory who desires that service or product, providing that the one so desiring shall indubitably pay the cost plus profit. Mention has also been made of the fact that the profit, or the percentage of profit, made by the utility is a matter fixed in some public manner and that its prices, or rates, are not allowed to fluctuate with fluctuating costs but are generally fixed by the public, or their maximum is fixed by the public for greater or less periods in the future.

The cost of having the utility product on tap is entirely a separate matter from the cost of manufacturing and distributing the product. It goes on, as one of the most authoritative state public-utility commissions declared, "whether the consumers use much, little, or none of the product," and its actual cost to each customer should be paid by that customer in addition to what he pays for the actual product which he uses. In fact the "fixed-service charge," or, as it is often miscalled, "the minimum charge," is really something which is paid the utility by the consumer for his privilege of having the product or service continuously on tap.

Japan's total production of copper is now 12,000 tons a month—twice as much as before the war. Of this amount 2,000 tons, on an average, are obtained by melting Chinese copper coins. The largest exports of copper from Japan go to Russia at present; France, England and Italy secure all they can obtain. The price of the metal in Japan is $39 per 100 pounds.

On account of the great difficulties in obtaining coal for heating purposes and the enormous prices of this commodity at present, the Norwegian peat-fuel industry is making rapid progress. Nearly 200 new peat-fuel machines are being installed in different parts of the country, and it is reported that all that they can produce is already contracted for. It is hoped that it will be possible to produce in the neighborhood of 100,000 tons of peat-fuel during the year. The Norwegian Peat Fuel Association disposes alone about 50 machines, which are rented out to the members on very reasonable terms.

TESTS OF CONCRETE ROAD AGGREGATES*

By J. P. Nash
Testing Engineer, University of Texas.

WITH the increasing mileage of concrete roads constructed each year comes the pertinent question as to the most desirable materials to use in their construction, and also the proper methods of mixing, laying and curing the concrete. The effects of the latter variables, namely, the mixing, laying and curing, are fairly well known; but the wearing qualities under continued traffic for a period of years have not been fully demonstrated, as few concrete roads have been in existence as long as ten years. Most of the properties which a concrete for road construction should possess are the same as it should have for any other purpose, with one additional property—it must resist the abrasive action of traffic. The tensile strength also plays an important function in a concrete road, as it is that property which largely determines the number of cracks.

The resistance to abrasion is determined by the tenacity of the aggregates to hold together under impact and friction, and also by the resistance to wear of the separate aggregates. The resistance of the aggregates to separation is a function of the cement and the cleanness and grading of the aggregates, while the resistance of the aggregates to wear is an inherent property of the aggregates themselves. By far the greater proportion of cracks in a concrete road are contraction cracks. When the material contracts tensile stresses are set up due to the friction of the concrete on the sub-base. The road cracks when this friction is greater than the tensile strength of the concrete slab. Other things being equal, the concrete having the highest tensile strength will have fewest cracks.

The object of the tests described in this paper was to determine the resistance to abrasion and the tensile strength of concrete made with various aggregates. In these tests the chief variable was the coarse aggregate. The sand used in most of the tests was a well-graded Colorado River sand, passing a ¼-in. sieve. However, where the coarse aggregate was graded to ⅛ in. a finer sand was used. The Colorado River sand is composed of rather angular fragments of flint, quartz, and a small proportion of limestone. With the exception of a slag from Birmingham, Ala., and a sample of gravel from New Orleans, all the materials used were from Texas.

Making the Specimens.—The amount of material on hand to make the tests was meagre. The samples were sent to the laboratory by producers, who in no case furnished the full amount requested. The number of test specimens made, consequently, had to be limited in number to one for the abrasion test, one for the tension test, and, in most cases, only two for the compression test.

The concrete was mixed on the floor, with shovels, to a medium consistency and tamped in the molds with a ⅝-in. round steel bar. After 24 hours the specimens were removed from the molds and placed in wet sand for 6 days, when they were removed and stored in the laboratory without further moistening, until tested at the end of 28 days.

The molds used for these tests were made of No. 16 galvanized sheet iron. Later cast iron molds were procured.

*Abstract of paper presented at the 20th annual meeting of the American Society for Testing Materials.

The compression specimens were 6 ins. in diameter and 12 ins. high, made on plate glass so that a plane surface was secured on one end, the other being bedded in plaster of Paris when tested.

The tension specimens were similar in shape to the standard cement briquettes, having a sectional area at the centre of 25 sq. ins. The specimen was 5 ins. deep and at the narrowest part was 5 ins. wide, while the length was 12 ins. With a specimen of this type the concrete may be placed in the mold in the same way in which it is placed on the road. The line of stress is also the same in both cases.

The abrasion specimens consisted of a large concrete ring 20 ins. in inside diameter, 28 ins. in outside diameter, and 8 ins. deep. The 4-in. thickness of concrete was reinforced with two steel rods to prevent cracking from unequal stresses in the rattler. The specimen was molded between two concentric metal forms held in place by metal spacers. This specimen can be handled by one man without the assistance of any apparatus, the average weight being about 200 lbs.

Testing the Specimens.—In testing the compression and tension specimens a 100,000-lb. Olsen testing machine was used, the load in both cases being applied at a speed of 0.05 in. per minute. One end of each compression specimen was bedded in plaster. In testing, the spherical bearing block was placed at the top. Grips were devised for the tension specimens so that when the load was applied the specimen would adjust itself to a direct pull and the pressure of the grips would be distributed equally on the specimen at all points.

The apparatus was designed to test any specimen up to the capacity of the machine, and it was found that it was somewhat unwieldy. A lighter apparatus was designed later. This will test specimens up to 20,000 lbs. total load, which is ample for any concrete that it is possible to make. The direct tension is assured with the apparatus by a welded eye from which the clip hanger allows a limited universal motion.

In order to determine what variation might be expected in the results of the tension tests four independent series of tests were made, each series consisting of three specimens made on different days. Exceptions to this were the three tests made on the Ottawa sand briquettes, which were all made from the same batch. A different mix was used for each series. The results obtained from these series are given in Table I. From these results it is reasonable to assume that a single tension test would fall within 10 per cent. of the average. Results on other tests, not included here, indicate that the probable error on concrete specimens is much smaller, being closer to 5

Table I.—Results of an Independent Series of Tension Tests

Mix.	Tensile strength lb. per sq. in.	Maximum variation from avg., %
1 Cement: 3 Ottawa sand	202, 220, 216..Average 213	5.2
1 Cement: 3 Colorado River sand	264, 263, 294..Average 274	7.3
1 Cement: 2 Colorado River sand: 4 Colorado River gravel	275, 274, 275..Average 275	0.4
1 Cement: 1½ Colorado River sand: 3 Colorado River gravel	288, 304, 280..Average 291	4.0

than 10 per cent. The specimens were tested at the rate of 40 lbs. per square inch per minute.

In order to determine how closely the large 5-in. briquettes could be expected to check with the smaller 1-in. standard briquettes some 1:3 Ottawa sand mortar was made into briquettes of both sizes at the same time. The speed of the small tension testing machine was regulated to that of the large machine so that the rate per square inch of load would be the same. It was found that the smaller briquettes tested 12.4 per cent. higher than the larger briquettes when tested with the old apparatus, and 2.1 per cent. higher when the large briquettes were tested with the new apparatus. It is believed, however, that this difference is due to the variations that might enter in making and curing the specimens rather than in the apparatus. For instance, the mortar tested with the old apparatus was mixed with shovels on the floor, while that tested with the new apparatus was kneaded by hand, according to standard methods.

The abrasion test on the concrete rings was made in the standard brick rattler, having alternate staves removed. This was done in order to lighten the load on the pulley. The axis of the specimen was aligned with the axis of the barrel by driving wooden wedges between the staves and the specimen. After the shot were placed in the ring the moving head of the barrel was brought in contact with the specimen, holding it in place. The rattler revolved at the rate of 30 r.p.m., which was sufficient to cause the shot to ride up the specimen while it revolved. This permitted some of the shot to slide upon the concrete while others dropped from the top of the pile with a certain amount of impact. The charge used consisted of 139 cast-iron cubes measuring 1½ ins., with rounded edges. In addition there were six rectangular shot, 2⅝ x 2⅝ x 4½ ins., which brought the total weight of the charge up to 158 lbs.

Table II.—Abrasion Tests of Three Specimens

1 Part Cement : 2 Parts Colorado River Sand : 4 Parts Colorado River Gravel. Age, 28 Days.

First specimen lost	3.81%	by weight in 1,000 revolutions
Second specimen lost	3.70%	" " " " "
Third specimen lost	2.88%	" " " " "
Average	3.45%	" " " " "

After each 500 revolutions the specimen was cleaned of all dust and weighed in order to determine what effect the number of revolutions would have on wear. It was found that the specimen lost approximately the same amount each 500 revolutions. The specimen was tested for 2,000 revolutions, but the percentage loss was calculated for 1,000 revolutions. The character of the surface of the specimens was carefully noted after each test. These observations furnish some of the most important features of these tests.

In the abrasion tests individual results show considerable variation from the average, as is apparent from the results of testing three specimens made of the same materials at different dates, given in Table II. The maximum variation from the average is 16.8 per cent. While this variation may seem excessive, it should be kept in mind that the chances for variation with a gravel specimen are larger than with crushed stone. This is due to the fact that a different number and size of the stones are knocked out of the surface of the gravel concrete in each of the specimens, while concrete made of ordinary crushed stone shows no such loss.

Abrasion Tests.—If the relation between the number of revolutions of the specimen and the traffic were known it would be possible from the test to determine how long a concrete road could be expected to be satisfactory. It does not seem unreasonable to suppose that the effect of one revolution of the specimen is equivalent to that of ten steel-tired vehicles. Certainly the tests show this in a relative sense, which is quite satisfactory.

One of the most important factors in road construction is to procure a surface that is uniform and will wear uniformly. Especially is this true with a rigid road such as concrete makes. It should be smooth enough to allow the vehicles to roll over the surface without appreciable impact, and yet rough enough to afford a horse good footing, especially in wet weather and upon steep grades. It is, therefore, just as important to know the character of the surface of the concrete after the test as it is to know the numerical loss.

The Gravel Aggregate.—The surface of most of the gravel concrete specimens was rough. Such gravel specimens as No. 2930-A and No. 2732, containing pebbles of varying hardness, produce a surface in which the hard flints wear but little, while the softer limestones wear equally with the mortar. In many cases these flints protrude as much as ½ in. above the surrounding surface. Other gravels, such as No. 2765, are composed of pebbles of equal hardness. However, they are so much harder than the surrounding mortar that the latter wears much faster than the stones, causing a somewhat uniform, but extremely rough, surface. The hard stones are knocked out, causing more than normal pitting and loss in the specimen. An exception to the general run of the gravels is one such as No. 2872, composed of limestone and sandstone pebbles only, which have approximately the same hardness. In this case the pebbles themselves were but little, if any, harder than the mortar, and consequently the specimen wore surprisingly uniformly. In this particular instance it should be noted that the gravel contained no pebbles over 1¼ ins. in size, which undoubtedly influenced the satisfactory condition of the surface.

Crushed Stone Aggregates.—Where crushed limestone was used as the coarse aggregate the surface as a rule was smooth and uniform. The limestones tested were all comparatively soft and they wore equally with the mortar. In specimens where the aggregate contained some large stones (No. 2830) the surface became somewhat wavy, due to the fact that the larger stones did not wear as fast as the smaller ones. In those specimens in which the aggregate was below 1½ ins. in size the surfaces were very satisfactory. In one or two of the specimens that contained some very soft stones there was a tendency for these stones to be pitted. This, however, does not seem to be any serious disadvantage.

With the crushed trap rock specimens the results are interesting. The stone is a basalt, having high resistance to abrasion in the Deval machine, and very tough. Trap rock from the same quarry was used in all the tests. In the 1:2:4 concrete specimens the mortar wore faster than the stone, giving the surface a distinctly mosaic appearance. This was more noticeable with the larger sized aggregates.

In the 1:1½:3 concrete specimens the mosaic appearance of the surface was still apparent with the larger sized aggregate; but with that graded only to 1 in. the surface was very satisfactory, having but few protruding stones. This latter specimen also had a high resistance to abrasion.

The specimen in which slag was used for the coarse aggregate (No. 2889) had a rather high resistance to abrasion and a fairly uniform surface. It is believed that if this aggregate were limited in size to about 1¼ ins. the surface would be very smooth. The surface appeared rather porous when enough of the slag fragments had been worn away to expose their interior. From this apparent porosity of the specimen it would seem that it should make a satisfactory surface for a treatment of asphalt or tar.

Tension Tests.—From the results obtained it is apparent that no relation exists between the compressive and tensile strengths of any given concrete. When the limestone concrete fails in tension practically all of the stones are broken, but with gravel there is always quite a number of stones that are pulled out rather than broken. The number broken depends upon the smoothness of the stones, but even with the very smooth stones a good proportion of them break.

It is preferable that the tensile strength of concrete for road construction shall be obtained by using superior aggregates rather than additional cement, because the contraction due to setting of the concrete increases with the amount of cement, which tends to nullify the extra strength obtained.

CHRISTMAS CARDS AND TOBACCO TO MEMBERS OF THE CANADIAN SOCIETY OF CIVIL ENGINEERS ON ACTIVE SERVICE

The Canadian Society of Civil Engineers has over 800 of its members in khaki, over fifty of whom have been killed. The society is sending to each of the men whose addresses ar available to the number of 600, a parcel of tobacco and cigarettes, each package to be accompanied by a neatly printed Christmas card. The message on the card is addressed to "The Men on Our Honor Roll," and reads as follows:

> ***The Council and Members of the Canadian Society of Civil Engineers desire to express to you their heartiest greetings and best wishes for your good health and well-being.***
>
> ***Your fellow members at home have a very definite appreciation of the good work you are doing, both for the profession and for the Empire. You have sacrificed much, risked much and done much to make us all proud of you. Your name has been inscribed on the Honor Roll, to hang for all time on the wall at the headquarters of the Society, as evidence of the fact that you have done your share in fighting for the Empire and for civilization.***
>
> ***It gives me much pleasure to convey this message to you, as well as the parcel herewith, which expresses in a very slight degree our high regard and the esteem in which you are held.***

The card is signed on behalf of the society by the secretary, Fraser S. Keith.

The port of Antofagasta, Chile, is to be improved by the government at a cost of $8,273,000.

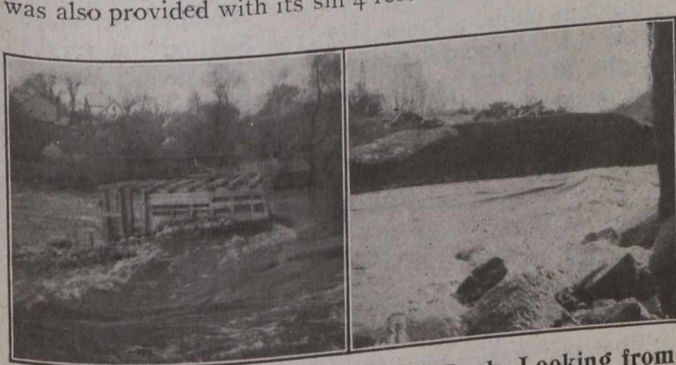
DAM OF "HOME-MADE" DESIGN FAILS IN NOVA SCOTIA

By K. H. Smith, A.M.Can.Soc.C.E.
Resident Engineer, Dominion Water Power Branch,
Halifax, N.S.

ON Monday, October 22nd, a freshet occurred in the Annapolis Valley which is said to have been the largest for many years. Higher water has been experienced at certain places along the Annapolis River, due to ice blockades in the spring time, but such high water throughout the whole course of the river due to rainfall entirely was certainly very unusual, particularly at this season of the year. As a general rule, the highest stages of streams in Nova Scotia occur during the month of April and arise from a combination of melting snow and ice and rainfall.

In the present instance, the freshet was due to excessively heavy rains over Friday, Saturday and Sunday preceding the high water of Monday. Detailed information as to the actual amount and duration of the rainfall in various parts of the valley is not yet to hand, although a heavy rainfall was general at that time over most parts of the province. It seems that the crest of the flood was soon passed and the excessively high water was of short duration. However, during this short period, parts of the Dominion Atlantic Railway were washed out, some live stock was lost and several hundred barrels of apples are said to have gone down the river.

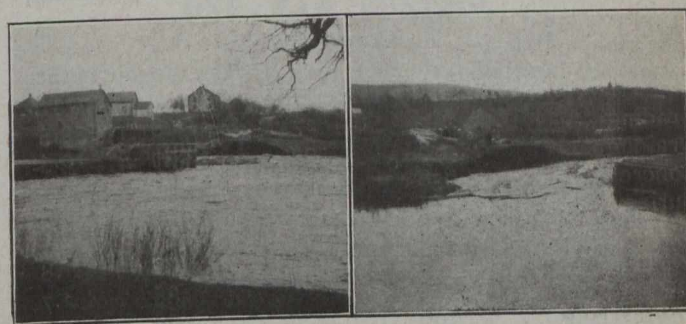
Probably the most extensive damage was in connection with a small dam and power development in course of construction for the village of Lawrencetown. This small development is situated on the Annapolis River in the centre of the village. The dam itself was practically completed, the flume built and the wheels installed. The small power-house was not completed nor the electrical machinery installed. As built, it was a rock-filled crib structure about 200 feet in total length, including the flume and power-house which was integral with the dam, and having a maximum height above the stream bed of about 14 feet. A rollway 86 feet long was provided of which 34 feet was 7.5 feet above the stream bed and the remainder 8 feet above the stream bed. A sluice gate was also provided with its sill 4 feet above the stream bed.



View from Top of Eroded Bank to Flume and Dam — **Eroded Bank, Looking from Existing Timber Flume**

On the left bank of the stream, the dam abutted against a high bank of reddish sand and clay soil. The large flume in which the wheels were installed was built practically at the foot of this bank while a small section of crib-work and planking connected the top of the flume with the slope of the bank. Behind this part of the dam, a certain amount of excavation had been carried out to provide foundations for the power house. This was to be built immediately adjoining the flume so that the shaft from the pair of horizontal wheels installed would project through the side of the flume and into the lower section of the power house, enabling a belt connection to be made to the generator placed on the main floor of the power-house.

At the period of highest water, the whole structure was submerged at least two feet, so that the water going over that section of the dam just mentioned washed out the bank, probably beginning where it had already been disturbed and continued to cut into the bank until a channel from 60 to 75 feet had been formed which carried almost the entire flow of the river. The bank at the other end seems to have been saved by the mass of willow roots which it contained. The present condition of the dam is



Looking Upstream, Showing Existing Condition of Dam and Break in Bank — **View Looking Downstream, Showing Break in Bank**

shown in the accompanying illustrations. The greater portion of it remains intact and in good condition, while the stream is flowing in a new channel cut around the end of the dam. In brief, the dam failed due to water going over the top of a bulkhead section caused by the fact that sufficient discharging capacity was not provided by the existing rollway and sluice gate.

Now, the failure in connection with this comparatively small structure would hardly warrant the attention given to it herein, did it not present the opportunity of pointing out the danger of building structures of this kind without competent engineering advice. The whole situation was further complicated by the fact that no adequate surveys had been made to determine the lands likely to be flooded; in fact, no proper computations seem to have been made as to floods likely to occur, the discharging capacity of the dam or backwater from the dam. It is roughly estimated that the maximum discharge at the dam was about 7,000 sec.-ft., and while no gaugings have been made of the river in this immediate vicinity, records available in various parts of the province for the past two years would indicate that such a discharge or considerably larger might be expected from the drainage area involved, about 415 square miles

The party who designed and built the structure appears to have been a good workman so far as his knowledge went, and it seems reasonable to suppose that if he had built a structure properly designed to pass the floods which might reasonably have been expected from information readily available, no trouble would have occurred.

It is unfortunate that the necessity for competent engineering advice in matters of this kind is not yet fully recognized in certain localities and that conditions are such that a structure such as described above can be built in the heart of a village on one of the largest rivers of the province without engineering supervision. It is hoped that such conditions will soon be remedied. In this case the failure is to be attributed not to bad engineering practice but to a lack of engineering practice at all.

COST DATA ON ROADWAYS OF QUEEN VICTORIA NIAGARA FALLS PARK SYSTEM

THE following cost data covering the construction and maintenance of roadways under the jurisdiction of the Queen Victoria Niagara Falls Park Commission are taken from the 31st annual report of that body:—

Concrete Pavement

Section No. 5A—Bridgeburg: Area of concrete surface, 10,430 sq. yds.; width of concrete surface, 18 ft.; thickness of concrete, sides, 6 ins., middle, 8 ins.; area of cross-section, 11.125 sq. ft.; subgrade, flat; concrete mixture, 1:2:3; cost per square yard concrete surface, $2.13.

Costs

	Labor.	Material.	Total.	Cts. per sq. yd.
Grading	$ 3,361	$ 27	$ 3,388	32.5
Drainage	576	503	1,079	10.3
Concrete	4,058	9,410	13,468	129.3
Curing, etc. ..	471	....	471	4.5
Shoulders	674	1,009	1,683	16.1
Cement tests .	88	....	88	.8
Inspection ...	288	....	288	2.7
Engineering .	560	....	560	5.4
Incidentals ...	803	357	1,160	11.1
	$10,879	$11,306	$22,185	212.7

Reinforcement: 1,577 square yards of pavement reinforced with expanded metal cost $295 = 19c. per square yard.

Shore Protection: 1,000 lineal feet of riprap placed at a cost of $1.17 per lineal foot.

Macadam Roadway: 600 square yards of macadam, 18 feet wide put down for $588 = 98c. per square yard.

Excavation: Amount of earth secured from cutting, 1,162 cubic yards; amount of earth borrowed, 2,512 cubic yards. Total amount of fill used, 3,674 cubic yards.

Section No. 5B—Fort Erie: Area of concrete surface, 7,129 sq. yds.; width of concrete surface, 18 ft.; thickness of concrete, sides, 6 ins., middle, 8 ins.; area of cross-section, 11.125 sq. ft.; subgrade, flat; concrete mixture, 1:2:3; cost per square yard of concrete surface, $2.11.

Costs

	Labor.	Material.	Total.	Cts. per sq. yd.
Grading	$1,637	....	$ 1,637	23.0
Drainage	362	$ 366	728	10.2
Concrete	3,001	7,779	10,780	151.2
Curing, etc. ...	197	....	197	2.8
Shoulders	355	284	639	9.0
Cement tests ..	51	....	51	.7
Inspection	170	....	170	2.4
Engineering ...	317	....	317	4.4
Incidentals	270	232	502	7.0
	$6,360	$8,661	$15,021	210.7

Reinforcement: 1,434 square yards of pavement reinforced with expanded metal cost $278 = 19¼c. per square yard.

Shore Protection: 106 lineal feet of riprap placed at a cost of $1.17 per lineal foot.

Excavation: Amount of earth secured from cutting, 916 cubic yards; amount of fill required, 862 cubic yards. Amount of earth available for Section 5A fill, 54 cubic yards.

Section 5 Complete; from Bowen Road, Bridgeburg, to Ferry Landing, Fort Erie: Area of concrete surface, 17,559 sq. yds.; width of concrete surface, 18 ft.; thickness of concrete, sides, 6 ins., middle, 8 ins.; area of cross-section, 11.125 sq. ft.; subgrade, flat; concrete mixture, 1:2:3; cost per square yard of concrete surface, $2.12.

Costs

	Labor.	Material.	Total.	Cts. per sq. yd.
Grading	$ 4,998	$ 27	$ 5,025	28.6
Drainage	938	869	1,807	10.3
Concrete	7,059	17,189	24,248	138.1
Curing, etc. ..	668	....	668	3.8
Shoulders ...	1,029	1,293	2,322	13.2
Cement tests ..	139	....	139	.8
Inspection ...	458	....	458	2.6
Engineering ..	877	....	877	5.0
Incidentals ...	1,073	589	1,662	9.5
	$17,239	$19,967	$37,206	211.9

Reinforcement: 2,991 square yards of pavement reinforced with expanded metal, cost $573 = 19.2c. per square yard.

Shore Protection: 1,106 lineal feet of riprap cost $1,291 = $1.17 per lineal foot.

Maintenance of Roadways—Niagara River Boulevard

Tarvia "A" Treatment: Time, September, 1916; location, station 660 to 800 (shipyard to Bridgeburg); average haul, 1½ miles; surface treated, 18 feet wide, 14,000 feet long (28,000 square yards.).

Labor

	Total.	Per sq. yd.
Teaming ½ in. stone	$192.20	.69
Loading and spreading stone	157.50	.56
Sweeping and brushing roadway ..	29.30	.10
Heating Tarvia	112.90	.40
Distributing and rolling	27.10	.10
Miscellaneous	24.00	.09
	$543.00	1.94c.

Materials

	Total.	Per sq. yd.
½ in. stone chips, 348 tons at $1.10	$383.00	1.37
Tarvia "A", 6,500 gals. at 10c. ..	650.00	2.32
Freight, $115, car service, $19 ...	134.00	.48
Coal, 19.7 tons at $7	138.00	.49
	$1,305.00	4.66c.

Summary

	Total.	Per sq. yd.
Labor	$ 543.00	1.94
Materials	1,305.00	4.66
	$1,848.00	6.60c.

Cost per square yard, 6.6c.; cost per mile (18 feet wide), $700; distribution of Tarvia, 23 gals. per square yard; distribution of stone chips, 1 cubic yard on 97 square yards.

Wage Rates: Teams, 45c. per hour; laborers, 20c. per hour; foremen, 30c. per hour.

The Bethlehem Steel Corporation has received orders from the United States Government for over 150 torpedo boats, to cost about $1,500,000 each. This would make the total value of the order approximately $225,000,000, which is the largest contract awarded by the Government since war was declared.

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PRINCIPAL CONTENTS OF THIS ISSUE

RECOGNITION OF THE ENGINEER

The leading article in *The Canadian Engineer* for this week is an address delivered by Fraser S. Keith, secretary of the Canadian Society of Civil Engineers, at Ottawa, in which an earnest plea is made calling upon all members of the profession, no matter how small a place they may fill, to do what they can to assure that so far as the future is concerned the engineer will bulk more largely than he has in the past, and be awarded a greater share of recognition. Slowly but surely it is beginning to dawn upon many that the present age belongs to the engineer.

During the past few years, and particularly since the outbreak of war, the real value of the engineer and his work has come to be recognized more distinctly and more intelligently than ever. The part he has played in the war has doubtless tended to throw the engineer and his work more prominently into the limelight.

More and more the engineer must assert himself and secure the measure of public appreciation which he rightly deserves. As a public servant, he is by reason of his habit of mind and his training, fully qualified to lead and direct public opinion.

One has only to consider at how many points the engineer touches the life of the community to get a fair conception of how important his position is. Think of the part he plays in the safeguarding of the public health by the design, construction and operation of sewage disposal plants, water purification plants; his relation to the matter of production, transportation, and many other blessings.

His standing, or lack of standing, in the public mind is, in some measure at least, due to his own modesty. Is it not time that this condition was changed and the engineer, as an integral part of the community, assert himself and get the facts concerning his part in human development before the public by the use of the school, the press, the platform and literature?

ONE MAN CONTROL

There exists a latent danger due to abnormal efficiency when this distinguishes a chief, in that his staff are starved of opportunity. It is possible to discover firms solvent in business, where both initiative and decision rest absolutely with one man, who by assuming such autocratic prerogative, sets a bad example. Not that his staff has nothing to do, but that its efficiency is impaired because the chief is too able.

The best chiefs are those who contrive to build up an organization which, while their finger is always on the pulse of the undertaking, yet refrain from active interference in its more detailed routine. Even so, enough troubles and difficulties will come forward for solution to exercise the mentality of the responsible head.

Where the boss is the hardest worked man in the organization, it may safely be assumed that his overloaded day detracts from efficient control; he literally has no time, and he is often busy beyond reason upon the more trivial matters best delegated elsewhere.

Every man holding an executive post, however minor in character, has a right to some freedom of movement. His orbit may be very limited but it should be reasonably independent. His powers may be far from absolute, but to deprive him of responsibility by uncalled-for interference with detail, minimizes his value, undermines his power and authority, and saps his resource.

A safe rule is to set limits in a clear and definite manner, leaving detail to the subordinate on the understanding that failure involves penalty. It is under such conditions that first-class men do their best work, retain personal interest, and throw their entire mentality into the task in hand.

A good man likes to be consulted, and it is safe enough to assume that if afforded opportunity he will, when occasion arises, consult his chief. Yet, it is very difficult to put up with contradiction for its own sake and suffer revision upon minor matters. Too often, however, the man representing management is ill-advised enough deliberately to cause annoyance by such action.

It must be remembered that minor executives have a greater trouble to maintain their position than men higher up, and action which sacrifices their dignity may also sacrifice discipline. There are methods of finding fault which need not impair the position of the man one step only in rank.

It takes a big man to face big issues, and it takes the same type to refrain from unwarranted interference and petty criticism which cause resentment without furthering any good end.

PERSONALS

C. B. MUTCHLER has been appointed assistant to the general superintendent, Grand Trunk Pacific Railway, at Winnipeg.

R. W. GIFFORD, head of the shell department of the Massey-Harris Co., Toronto, has been appointed superintendent of the Toronto plant.

J. IRWIN, superintendent of the Canadian Northern Railway Co., at Rosedale, Ont., has been appointed superintendent of the third division, western district, with headquarters at Edmonton, Alta.

H. J. FULLER, president of the Canadian Fairbanks-Morse Co., has been appointed to represent the Imperial Munitions Board in New York in connection with munitions and marine equipment contracts.

Sir HENRY DRAYTON, chairman of the Board of Railway Commissioners, Dominion Government, has been appointed controller of the production and distribution of electrical energy by companies generating or distributing electrical energy in the province of Ontario.

J. E. DOBSON, late Scottish representative of Bruce Peebles & Co., Limited, Edinburgh, has been appointed London office manager of the company in place of the late R. W. Gauntlett, and has now taken up his new duties at Hastings House, Norfolk Street, Strand.

Lieut. R. V. MACAULEY, Toronto, was wounded during the fighting of November 6th. He went overseas as a gunner and qualified in England for a commission. He is a graduate of the School of Practical Science, and was employed as an engineer by the Bell Telephone Company in Montreal.

ERNEST LEVY, for a number of years manager of the Josie group of mines in Rossland camp, British Columbia, owned by the Le Roi No. 2, Limited, of London, Eng., has taken over the mining engineering practice of Mr. J. V. Richards, of Spokane, Washington, who has volunteered for service in the United States army.

Sapper D. E. CRAIGIE, of Toronto, a student at the School of Applied Science, class 1918, is returning to Canada. He enlisted with the Div. Signal Co., Canadian Engineers, with whom he went overseas. Subsequently he crossed to France with the C. B. Cable Section, B.E.F., and was reported dangerously wounded on May 23rd last.

Capt. W. E. V. SHAW, B.A.Sc., 1908, mechanical engineering, Toronto University, has been wounded in action. He is a native of Sydney, New South Wales. After graduating he followed his profession in Milwaukee, Wis. He went to England with the Canadian Field Artillery and afterwards transferred to a Howitzer Battery, with which he was serving in France when wounded.

Lieut. C. C. THOMPSON, a student of the School of Applied Science, Toronto, class of 1917, has been wounded in the shoulder by shrapnel. Lieut. Thompson, who enlisted with the 124th Batt., has spent considerable time in the hospital since going overseas, being seriously ill last winter with gas poisoning and pneumonia. He recovered sufficiently to cross to France this summer. He is a son of Mr. Christopher Thompson, 24 Crescent Road, Toronto.

Flight-Lieut. W. H. JONES (B.C.E., Man.) has been missing since November 1st. In a letter written October 23rd Lieut. Jones tells of his engine stalling and the plane dropping to within 500 ft. of German soil while 75 miles behind their lines. He was, however, able to hobble home on five cylinders, and it may be that through a similar occurrence he is now a prisoner. Lieut. Jones was formerly engineer for Rockwood Municipality, Stonewall, Manitoba.

Flight-Lieut. GORDON A. COCKBURN, son of Mr. W. A. Cockburn, 324 Spadina Road, Toronto, is reported missing. When he enlisted he was a third year student at the School of Practical Science. After a course at the artillery school at Kingston, Ont., he was attached to the 34th Battery and finally to the 43rd Battery. He was wounded a year later and rejoined his unit. After the fighting at Vimy Ridge he secured a transfer to the Royal Flying Corps.

Lieut. JACK NEWCOMBE, of Toronto, a graduate of the School of Applied Science, class of 1916, is returning to Canada. He went to England in August, 1916, with a draft from the C.O.T.C. to qualify for an Imperial commission. He took a course of training at the School of Military Engineering, passing the examinations with high honors. Early in February last he crossed to France with the 12th Field Company, Royal Engineers, with whom he has served.

WALTER C. TEAGLE, of Toronto, has been elected president of the Standard Oil Company of New Jersey. Mr. Teagle was born in Cleveland, Ohio, on May 1st, 1878. He graduated from Cornell University with the degree of Bachelor of Science. In 1900 he was elected vice-president of the Republic Oil Company. He remained the active manager of the Republic for about three years, when he accepted a position in the Standard Oil Company's export department in New York. In 1910 he was elected director of the New Jersey Company, and later became one of its vice-presidents, resigning this position in 1913 to accept the presidency of the Imperial Oil Company. He also has been president of the International Petroleum Company since its formation in 1915.

OBITUARIES

MICHAEL MCAULIFFE, one of the pioneer dredging contractors of Canada, died at Welland, Ont., on November 11th, aged 73. He was at one time a member of the Weddell Dredging Co., and in more recent years the Manly Dredging Co.; his contracts extended from Chicago along the lakes to the Lower St. Lawrence.

GEORGE T. HOLLOWAY, of the firm of George T. Holloway & Co., Limited, London, England, passed away on October 24th. He was an eminent metallurgist, with long experience in the investigation of the properties of metals. Mr. Holloway was the nominee of the British government on the Royal Ontario Nickel Commission and was appointed chairman of that body. The work of the commission occupied a year and a half, from September, 1915, to March, 1917, and after its completion Mr. Holloway returned to England. He was then in poor health, and grew steadily weaker until the end. He was an associate of the Royal College of Science, London, vice-president of the Institution of Mining and Metallurgy, and was also connected with the Institute of Metals, and a member of the Mineral Resources Committee of the Imperial Institute.

The National Congress of Peru, at its last session, passed a highway by-law having as its purpose the encouragement of road construction throughout the country. The new law distributes the cost of new construction between the local and the national governments and provides both for new revenues for this purpose and for the payment of a road tax either in money or labor.

Coast to Coast

Edmonton, Alta.—Twice as much building in Edmonton so far this year as for the same period last year is the way the building situation looks now. The sum total is already double that of 1916, and anything further from now to the end of the year will be clear gain over even that decided improvement. One of the largest projects is the utility and recreation building at the Swift Canadian plant, for which a $40,000 permit has been issued.

Grand Forks, B.C.—The Imperial Oil Co. has completed the erection of a 14,000-gallon gasoline tank here.

Manitoba, Province of—The past year has shown a wonderful improvement in the road system of the province of Manitoba, due principally to the increased advantage which has been taken in regard to government aid to good roads and the formation of dragging districts. At the western end of the province, in the municipality of Wallace, there is probably the most extensive system that has at present been carried out. Adjoining municipalities which watched the results of the good roads movement in Wallace municipality have now made application to come under the Good Roads Act, and the province is benefiting materially from the improved conditions of the highways. In the poorer municipalities where it is felt that the time is not ripe to put a good roads system into effect, a government grant of $3.25 per mile per season is given towards the cost of keeping the roads dragged with split log or other types of drag. Most of these schemes are the direct result of the activities of the Manitoba Good Roads Association.

Orillia, Ont.—The Ragged Rapids dam, on the Severn River, was blown up on November 10th. Four tons of dynamite was used in the operation, which fully met all expectations. More than two-thirds of the structure was entirely demolished. The remainder will be dealt with later. More than a thousand yards of concrete were sent into the air. The dam was completed about ten years ago, and was the third which Orillia had constructed for her power plant, the first one having given way and the second one proving unsatisfactory. It cost about $65,000. It has now been blown up as a part of the plan for canalizing the Severn River as part of the Trent Canal waterway, and a splendid new dam and power house has been built by the Department of Railways and Canals at the Swift Rapids about a mile further down the river. In this power-house Orillia has installed a new hydraulic and electrical machinery and equipment with a capacity of 6,000 horse-power, which will give her abundance of power for her industries at a cost of over $150,000. The whole work at the Swift Rapids, including the lock, which will raise and lower vessels 47 feet at one lift, will cost three-quarters of a million dollars, and is being carried out by the Inland Construction Company. The greater part of the work has been completed, but considerable remains to be done to the lock. Orillia has for the past year been purchasing over 2,000 horsepower from the Hydro-Electric Commission, in addition to what was got from the old plant at the Ragged Rapids, and this power will now be released for the use of the towns on the Hydro's Simcoe system. The blowing up of the dam, which was an operation of more than usual magnitude, was carried out by the Canadian Explosives Co., Mr. R. Y. Russell superintending the loading of the 8,000 pounds of dynamite and throwing in the switch which sent off the charge. Mr. A. J. Grant, superintending engineer of the Trent Canal, was present to see the work carried out, together with several other officials.

Ottawa, Ont.—The Government has placed an embargo on the shipment of iron and steel from Canada save in exceptional cases, in which licenses may be granted by the Customs Department. This action is due to the great shortage of these commodities for munitions, shipbuilding and other operations.

Regina, Man.—Plans are being completed for the holding of a large joint meeting of members of the Manitoba, Saskatchewan and Alberta motor leagues in this city on December 11th. It is proposed to draft an appeal to present to the Government, asking that legislation be granted whereby the improvements on main highways be taken out of the hands of the municipalities and turned over to the Government. Under the present Good Roads Act the Government cannot make a move to improve a road until the municipality has moved in the matter and requested their co-operation.

St. John, N.B.—D. A. Saker and Co., who acquired the Warner property on the Strait Shore, are making preparations for the building of a number of wooden sailing craft. This firm anticipates taking up steel shipbuilding when the time is opportune.

St. John, N.B.—Grant and Horne, Courtenay Bay, have laid the keel for a large wooden steamer with a carrying capacity of 3,000 tons, and about 200 men are rushing the work of construction. The keel, composed of British Columbia fir, is 250 feet long. Native timber will be largely used in the building of this steamer A second steamer will be put on the stocks immediately upon the completion of the present ship. This yard is now well equipped with building plant.

St. John, N.B.—The grain elevator being built by the Fegles-Bellowes Co. for the Canadian Government Railways is approaching completion. The concrete substructure is practically complete, and the workmen are now employed on the steel superstructure, which will be 100 feet in height. The capacity of the first unit of this elevator will be 500,000 bushels. The rebuilding of No. 5 warehouse on the western side of the harbor is being proceeded with by Kane and Ring, contractors.

St. John, N.B.—The New Brunswick Power Co. expect to put their new pumping station into operation very shortly.

St. John, N.B.—The St. John Shipbuilding Co., of which Thomas Nagle is manager, and which numbers among its directors some of the wealthiest men of Eastern Canada, have negotiated for a yard site on Courtenay Bay, adjacent to the Grant and Horne yard, and are now having it surveyed by marine engineers. This company propose building ships of both wood and steel.

Trail, B.C.—A. L. McCulloch, of Nelson, engineer in charge of the extensive waterworks and sewerage improvements, recently furnished the following statement to the City Council of the condition of the work which has been in hand by the contractors for several months past: Up to November 1st there has been laid 1,514½ lineal feet of 12-inch and 15-inch sewers, 9,637 lineal feet of 8-inch sewers, and 21 manholes have been built. There remains yet to construct 8,992 lineal feet of 8-inch sewers and 51 manholes to build. There has, therefore, been completed 55 per cent. of the pipe-laying and 33 per cent. of the manholes. The pipe-laying on the Cambridge Creek conduit pipe line is completed. The pipe-laying on the distribution system is practically completed. All the hydrants to the number of 34 have been set. These, with 10 of the old hydrants retained, make 44 fire hydrants in use on the distribution system. Cambridge Creek water was turned into the city mains on October 1st, and has been in use since then. Work on the distribution reservoir was started in July, but on account of the difficulty of getting water for use in the construction, work was stopped until the Cambridge Creek water was available. This work is now under way, and 80 per cent. of the reservoir embankment has been completed. After the embankment is completed there still remains to be done the reservoir lining. Work on the Violin Lake conduit pipe line is progressing favorably, about 70 per cent. of the pipe now being laid, and the work will be completed in about two weeks. When tenders were called for recently for the construction of the dam at Violin Lake and for clearing the land that will be flooded when the dam is completed, no tenders were received. Violin Lake storage will not, therefore, be available for some time, as the dam cannot now be constructed until next summer.

Toronto, Ont.—The contractors on the double-track improvements on the Canadian Pacific Railway east of Yonge St., are making rapid headway with the two bridges over the reservoir ravine and the belt line ravine. The reinforced concrete piers are some of them finished and the foundations of the remaining well begun. The large concrete monoliths, weighing over 50 tons each to carry the tracks, are nearly all cast and once the piers are completed will be lifted into position in short time.

Toronto, Ont.—The Toronto Harbor Commission have arranged to lease a large site on the waterfront within the harbor, between Spadina Avenue and the old Queen's Wharf, to the Dominion Shipbuilding Co. The site will contain about 15½ acres, upon which the company will erect buildings, slips and drydocks costing many thousands of dollars. Preliminary work is to be commenced at an early date.

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 or projected, contracts awarded, changes in staffs, etc.

▲—Denotes an item regarding work advertised in *The Canadian Engineer.*
+—Denotes contract awarded. The names of successful contractors are printed in CAPITALS.

ADDITIONAL TENDERS PENDING

Not Including Those Reported in This Issue

Further information may be had from the issues of *The Canadian Engineer* to which reference is made.

PLACE OF WORK	TENDERS CLOSE	ISSUE OF	PAGE
Port Arthur, Ont., construction of a temporary pile protection breakwater	Nov. 26.	Nov. 8.	50
Winnipeg, Man., cast-iron gate valves, air valves and sluice gates	Nov. 26.	Nov. 1.	50
Winnipeg, Man., construction of pipe line	Dec. 3.	Nov. 1.	50
Winnipeg, Man., construction of pressure pipe line; manufacture and supply of 48-inch pre-moulded reinforced concrete pressure pipe, and supply of cast-iron pipe and specials	Dec. 3.	Nov. 8.	50
Winnipeg, Man., construction of tunnel shafts and well; supply of cast-iron gate valves, air valves and sluice gates, and construction of gate house and intake	Nov. 26.	Nov. 8.	50
Winnipeg, Man., pipe line material	Dec. 3.	Nov. 1.	50
York Tp., Ont., trenching and laying of water mains	Nov. 26.	Nov. 15.	52

FACTORIES AND LARGE BUILDINGS

Athabasca Landing, Alta.—The erection of a hospital is contemplated.

Aylmer, Ont.—Town Council contemplates the erection of market buildings. Engineer, W. E. Stewart.

+—**Bashaw, Alta.**—Contract let to the WHITE CONSTRUCTION CO. for erection of telephone building for the Department of Public Works, Provincial Government, Edmonton.

Belleville, Ont.—City has donated a site to Albert College on which to erect new buildings costing not less than $200,000. Work will start at close of war.

Chauvin, Alta.—Public School Board plans erection of school.

Cobourg, Ont.—The public school building was totally destroyed by fire.

Cranbrook, B.C.—Factory owned by the Cranbrook Sash and Door Co., Ltd., destroyed by fire. Loss, $40,000.

+—**Dartmouth, N.S.**—RHODES CURRY CO., LTD., Windsor St., Halifax, have the general contract for one story brick plant for the Canadian Carbonate Co., Ltd., 132 Hollis St., Halifax.

+—**Halifax, N.S.**—Contract let to the NOVA SCOTIA CONSTRUCTION CO., Upper Water St., for erection of a freight shed for the Department of Railways and Canals, Dominion Government.

Hamilton, Ont.—Mitchnik and Sitleman, 60 Florence St., will erect a $10,000 bath house.

Lougheed, Alta.—Offices, etc., owned by the Atlas Lumber Company, warehouse and machinery owned by J. L. Morrison, destroyed by fire. Total loss, $23,000.

Magrath, Alta.—The Department of Agriculture, Provincial Government, contemplates the erection of an agricultural college. Address, Secretary, D. P. Woodruffe, Magrath.

Moncton, N.B.—The Victoria Garage and Motor Co., Ltd., Victoria St., contemplate the erection of a plant and addition to old building.

+—**Mont Laurier, Que.**—Samuel Ouellette has the general contract for the erection of a $60,000 Cathedral for the Corporation Episcopale du Diocese de Mt. Laurier.

Montreal, Que.—It is rumored that the Dominion Bridge Co. plans installation of a forging plant.

Montreal, Que.—Warehouse owned by the Montreal Cotton and Wool Waste Co., Ltd., 173 Common St., totally destroyed by fire.

New Glasgow, N.S.—J. W. H. Sutherland plans to erect a business block.

New Westminster, B.C.—City Council contemplates remodelling city hall. Clerk, W. A. Duncan.

Niagara Falls, Ont.—The City Council decided to spend another $2,000 to build a bunk-house. City clerk, W. J. Seymour.

+—**Ottawa, Ont.**—City Council let general contract to R. J. MacKEY, 19 Arlington Ave., for erection of $20,000 branch library.

Port Bruce, Ont.—Hales and Black contemplate the erection of a packing house, etc.

Regina, Sask.—The Goold, Shapley and Muir Co., Ltd., 7th and Halifax Streets, plans erection of a $20,000 warehouse.

+—**Sillery, Que.**—The following contracts have been awarded in connection with the erection of a $40,000 convent for the Assumption Fathers: Masonry, carpentry and plastering, J. GOSSELIN, 85 Dalhousie St., Quebec; steel, EASTERN CANADA STEEL & IRON WORKS, Lesage Ave., Quebec; roofing, E. FALARDEAU, 308 Queen St., Quebec; plumbing, heating and electrical work, BROUSSEAU & FRERE, 320 St. Paul St., Quebec; painting and glazing, MARIE & TREMBLAY, cor. Des Fosses and Bridge Streets, Quebec.

St. Catharines, Ont.—Factory owned by A. L. Florence, Dalhousie and Redpath Streets, destroyed by fire. Loss, $30,000.

St. Catharines, Ont.—Paper mill owned by the Kinleith Paper Co., Welland Canal, destroyed by fire.

Sydney Mines, N.S.—Mine plant of the Nova Scotia Steel and Coal Company destroyed by fire. Loss, $15,000.

Toronto, Ont.—Cottage hospitals are to be erected at once in High Park by the Militia Department.

Toronto, Ont.—The Board of Education will call tenders shortly for the erection of a $45,000 annex at Perth School, a $60,000 annex at Alexander Muir School and a $60,000 annex at Queen Alexandra School. Secretary, W. C. Wilkinson, 155 College St.

Toronto, Ont.—The British Forgings, Ltd., 27 Atlantic Ave., are erecting a $3,500 galvanized iron and frame factory.