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MISSING

The Canadian Engineer

A weekly paper for Canadian civil engineers and contractors

Design of Turbine Runner Bands

With Special Reference to High Speed Runners — Detailed Analysis of Hydraulic Conditions at the Band—Development of Simple Formula to Determine Angle of Band with Vertical

By JOHN S. CARPENTER

Hydraulic Engineer, James Leffel & Company

THAT a detailed analysis should be made of hydraulic conditions at the band of high speed runners, was suggested some time ago to the writer by Frank B. Fish, chief engineer of James Leffell & Co. Mr. Fish believed that the band angle with the vertical should be increased quite a little; he contended further that the band when so inclined would discharge more water by reason of its outward component. This angle, to eliminate pressure against the band, is coincident with the resultant of the horizontally acting centrifugal forces and the vertical pressure forces.

Referring to Fig. 1, and considering a slice of area A and thickness dl, we have the following forces acting: The velocity head, the pressure head, acceleration due to gravity, the pressure below the slice, centrifugal force, friction head, and suction head.

In the following formulæ, A is the area in square feet; γ, the specific weight of water per cubic foot; v, true velocity of water in space in feet per second; H_p, head in feet untransformed into velocity; g, acceleration due to gravity; r' and r'', radii in feet to the point in question; w, angular velocity in radians per second; e, the mechanical efficiency.

In this investigation we will consider forces rather than velocities in order to facilitate mathematical transformations.

Due to velocity, we have a force

$$F_v = A\gamma(v^2/2g)\cos Q \quad \text{(I)}$$

acting vertically.

Due to pressure head,

$$F_p = A\gamma H_p \quad \text{(II)}$$

Due to gravity,

$$F_w = (Adl\gamma/g)g = Adl\gamma \quad \text{(III)}$$

Pressure from below,

$$F_b = -Adh\gamma \quad \text{(IV)}$$

acting upwards.

Centrifugal force,

$$F_c = (Adl\gamma/g)rw^2 \quad \text{(V)}$$

acting horizontally.

Due to friction, which may be conveniently expressed as part of the total or static head, H_s,

$$F_f = -A\gamma H_s(1-e) \quad \text{(VI)}$$

Due to suction: Due to the centrifugal force generated by the runner, especially at the band, the water is drawn into the runer with an artificial pressure which may be expressed as a force of

$$F_s = [(r''^2w^2/2g) - (r'^2w^2/2g)]A\gamma \quad \text{(VII)}$$

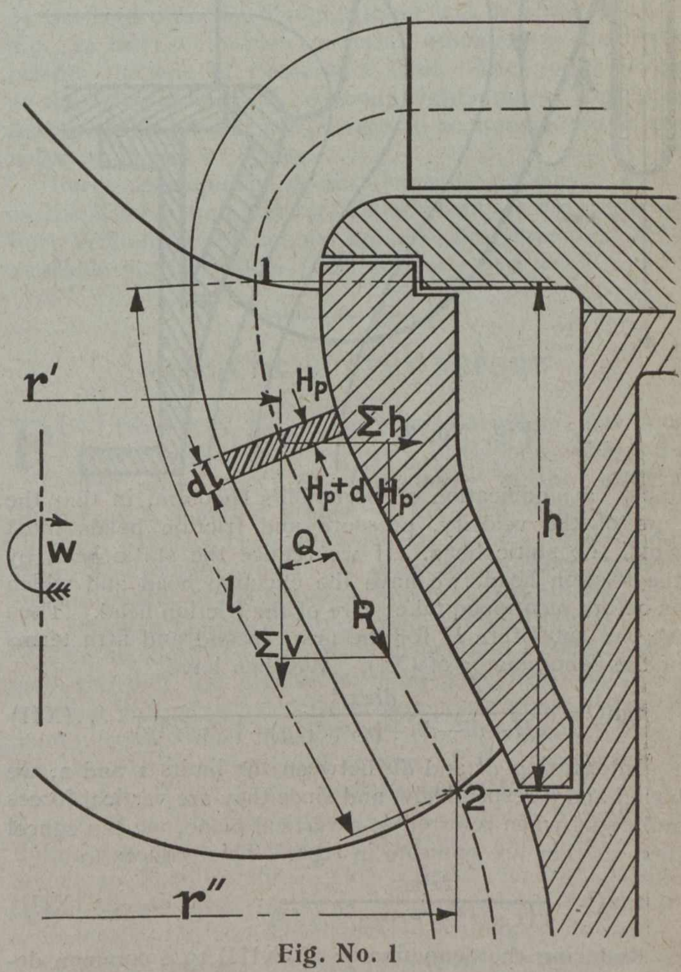


Fig. No. 1

The total horizontal force is that due to centrifugal force

$$\Sigma_h = F_c = (Adl\gamma/g)r'w^2 \quad \text{(VIII)}$$

and the total vertical force equals

$$\Sigma_v = F_v + F_p + F_w - F_b - F_f + F_s \quad \text{(IX)}$$

The tangent of the angle then, that the resultant of the horizontal and vertical forces makes with the vertical force is

$$\tan Q = \Sigma_h / \Sigma_v \quad \text{(X)}$$

Factoring out all the $A\gamma$ which affects all the members of (IX), we have

$$\tan Q = \frac{dlr'w^2/g}{(v^2/2g)\cos Q + H_p + dl - dh - H_s(1-e) + [(r''^2w^2/2g) - (r'^2w^2/2g)]} \quad \text{(XI)}$$

Now equation (XI) is objectionable for one reason at least, because the first two items in the denominator are exceedingly difficult to obtain. This is because the pressure and velocity relations in runners are very complex. But this phase is immediately cleared up when we

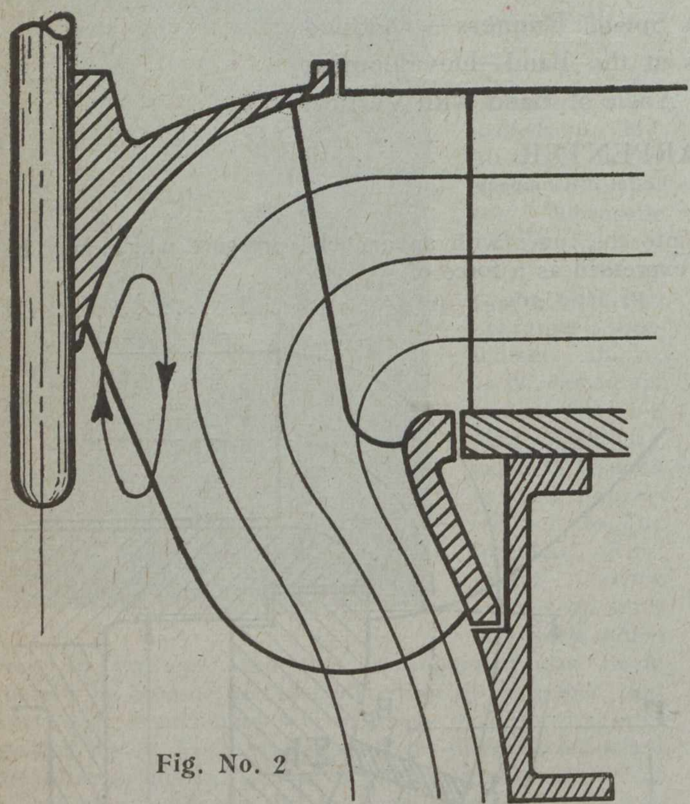


Fig. No. 2

apply a modification of Bernoulli's theorem, in that the sum of the velocity, pressure and friction heads must equal the static head. If we reduce the static head by the friction head, we have the effective head and which as before mentioned takes care of the friction head. Then we can substitute H for the first, second and fifth terms of the denominator of (XI). We then have

$$\tan Q = \frac{dlr'w^2}{gH + dl - dh + (r''^2w^2/2g) - (r'^2w^2/2g)} \quad \text{(XII)}$$

Integrating dl and dh between the limits 1 and 2, we have l and h respectively, and since they are vertical forces and equal when referred to a vertical plane, we can cancel them as they are opposite in sign. This reduces to

$$\tan Q = \frac{lr'w^2}{gH + (r''^2w^2/2) - (r'^2w^2/2)} \quad \text{(XIII)}$$

Reducing the denominator of (XIII) to a common denominator and further simplifying, we have (XIII) in its most convenient form for numerical calculation:—

$$\tan Q = \frac{lr'}{(gH/w^2) + (r''^2 - r'^2)/2} \quad \text{(XIV)}$$

It will be noticed that the angle increases with an increase in speed, the head remaining the same. Bulging a given runner out at the band will decrease the angle. Operation at part load will bring shock against the band because the apparent head is decreased and which therefore increases the value of Q as obtained from (XIV) if the speed remains the same. Another point in this connection is that the centrifugal force component Σ_h remains the same regardless of gate opening and the other component decreases, thereby increasing Q.

This explains why there are serious secondary cross flows at the upper flange near the lower edge of the buckets (see Fig. 2). Let us take a practical example from a runner design at hand. In this case this runner is under 16 ft. head. $r' = 1.96$ ft., $w = 21$ radians per second, $l = .625$ ft.

Since we know what r'' is because it is a function of r' and Q, we can assume Q at 30° for trial.

$$r'' = r' + l\tan Q = 1.96 + (.625 \times .5774) = 2.32 \text{ ft.}$$

We can now proceed:—

$$\tan Q = \frac{.625 \times 1.96}{(32.2 \times 16/441) + (5.40 - 3.85)/2} = .630,$$

showing that our assumption was too small. In this case the writer takes two-thirds of the difference between .630 and .5774 and adds it to .5774, making a new trial tangent of .612. Again we find r'' as above, this time with $\tan Q = .612$; r'' then is 2.432 ft.

$$\tan Q = \frac{.625 \times 1.96}{(32.2 \times 16/441) + (5.50 - 3.85)/2} = .611,$$

which corresponds to an angle of 31° 30′ in round numbers and is a sufficiently exact figure.

If this same wheel is placed under double the head of the preceding example and the speed changed accordingly, that is in the ratio of the square roots of the heads, the angle Q will not change. Similarly if placed under 8 ft. head the angle will still remain the same. So for any homologous series of runners, the angle Q will be identical, regardless of size.

This angle can be shown to be a function of the specific speed, n_s, as follows: Let all quantities be referred to a one-foot-head basis, and the subscript 1 be added to such quantities.

Taking equation (XIV), H in the denominator can be omitted, as it would not, on a one-foot-head basis, affect the results. The quantity r' is a function of the capacity or power of a runner, in that

$$r' = (M_1/v_1\pi)^{1/2} \quad \text{(XV)}$$

where M_1 is the quantity of water for 1 ft. head, and v_1 is the throat velocity at the same head. Now at 88% efficiency, which is a fair value for present day high speed, high efficiency runners,

$$M = 10N/H \quad \text{(XVI)}$$

where N is the power.

Substituting (XVI) in (XV), we have

$$r' = (10N_1/v_1\pi)^{1/2} \quad \text{(XVII)}$$

for 1 ft head.

Inserting (XVII) in (XIV) and reducing the denominator to a common denominator, we have

$$\tan Q = \frac{lw_1^2(10N_1/v_1\pi)^{1/2}}{g + w_1^2(r''^2 - r'^2)/2} \quad \text{(XVIII)}$$

Also, w is a function of the speed in revolutions. This is:—

$$w = 360\pi n/60.180 = .1047n \quad \text{(XIX)}$$

Separating w^2 into $.1047wn$ and bringing N_1 out of the parenthesis of (XVIII), we have

$$\tan Q = \frac{.1047lw_1n_1N_1^{1/2}(10/v_1\pi)^{1/2}}{g + w_1^2(r''^2 - r'^2)/2} \quad \text{(XX)}$$

Now $n_1N_1^{1/2}$ is the specific speed or type characteristic n_s. Substituting n_s and reducing, (XX) becomes

$$\tan Q = \frac{.187 l w_1 n_s (1/v)^{1/2}}{g + w_1^2(r''^2 - r'^2)/2} \quad \text{(XXI)}$$

The writer wishes to express his thanks to Mr. Fish and Mr. Balbach for their co-operation and encouragement.

A.I.E.E. MEETING IN TORONTO

An official meeting of the American Institute of Electrical Engineers will be held in Toronto to-morrow and Saturday, November 22nd and 23rd. It will be the 344th meeting of the Institute and the first official meeting of the whole Institute which has been held in Toronto since the Toronto section was founded fifteen years ago.

Members and guests will assemble at noon at the Engineers' Club, where there will be an informal reception and registration, followed by luncheon. In the afternoon a technical session will be held in the assembly room of the club.

Arthur H. Hull, chairman of the Toronto section and assistant electrical engineer of the Hydro-Electric Power Commission of Ontario, will read a paper on "Electric Power Development in Ontario," dealing chiefly with the Hydro-Electric Power Commission's systems. He will describe briefly the generation, transmission and use of the power sold in each system.

W. G. Gordon, transportation engineer of the Canadian General Electric Co., who is a past chairman of the Toronto Section, will present a paper on "The Electrical Equipment of the Canadian Northern Tunnel, Montreal."

An informal dinner will be served at the Engineers' Club at 6.30 p.m. for which tickets may be obtained from the secretary of the club. Sir Robert Falconer, president of the University of Toronto, will deliver a post-prandial address.

At 8 p.m. another technical session will be held in the lecture room of the University of Toronto's Chemical and Mining Building, on College Street at the head of McCaul Street.

S. Svenningson, designing engineer of the Shawinigan Water & Power Co., Montreal, will read a paper on the 110,000 volt transmission line which crosses the St. Lawrence River near Three Rivers. As described in previous articles in *The Canadian Engineer*, these overhead power cables have approximately a mile span, being suspended from two steel towers which are 5,000 feet apart and which rival in height the main posts of the Quebec bridge.

On Saturday morning there will be three excursions, of which the members may take their choice. The trips will be to the Hydro-Electric laboratories and sub-station, to the British Forgings plant and to the Leaside Munitions factory.

The switchgear in the Hydro-Electric sub-station controls transformers of 75,000 k.v.a. capacity. The laboratories are equipped for special insulator testing, photometry, meter testing, structural testing, etc.

The British Forgings Co. are operating the world's greatest electric steel plant, with ten 6-ton Heroult furnaces, all being supplied with energy from Niagara Falls. The Leaside Munitions plant is described in the Institute's program as "one of the largest and most perfectly equipped shell factories in America."

Arthur H. Hull is chairman of the Toronto Section of the Institute, and Ernest V. Pannell is secretary. Comfort A. Adams is president of the Institute; F. L. Hutchinson, secretary. The following are members of the Entertainment and Reception Committee of the Toronto Section:—W. M. Andrew. E. M. Ashworth, R. G. Black, E. T. Brandon, W. A. Bucke, H. C. Don Carlos, F. G. Clark, F. A. Gaby, W. G. Gordon, H. U. Hart, Jas. Kynoch, G. D. Leacock, Wills MacLachlan. D. H. McDougall, W. R. McRae, P. H. Mitchell, A. L. Mudge and T. R. Rosebrugh.

MORE "HYDRO" PLANTS PLANNED

It was announced some weeks ago that the Hydro-Electric Power Commission of Ontario would spend about $10,000,000 on water power development in Northern Ontario. It is now stated that this work will include the development of Ranney's Falls on the Trent River, near Campbellford, where 10,000 h.p. will be generated; the development of High Falls on the Mississippi River, where the Commission will obtain 3,000 h.p.; and a 50,000 h.p. plant at Cameron's Pool on the Nipigon River.

The Nipigon development will likely be the first to be undertaken, as the demand for power on the Port Arthur system has greatly increased. The ultimate development by the Hydro on the Nipigon River will be about 150,000 h.p., as the Commission has other schemes for that river besides the one at Cameron's Pool. The power house at the latter point will be about eighty miles from Port Arthur, to which city the power will be transmitted at 110 volts, 3 phase, 60 cycles.

Early development is also expected at Silver Falls, on the Kaministiquia River, about twenty-five miles from Fort William, where 25,000 h.p. will be generated. The available head at Silver Falls is nearly 350 feet.

GEODETIC SURVEY REPORT

Publication No. 1, on precise levelling, has been issued by the Geodetic Survey of Canada. This is the first report which has been issued by the Geodetic Survey as a separate branch of the Department of the Interior. It has been compiled by F. B. Reid, supervisor of levelling, under the direction of Noel Ogilvie, superintendent of the Geodetic Survey. The title is "Certain Lines in Quebec, Ontario and British Columbia."

The booklet is 6½" x 10", 66 pages and a folded index map showing the precise levelling previously published and that not published. Descriptions are given of bench-marks from Rouse Point, N.Y., to Sherbrooks, P.Q.; Ste. Rosalie Junction to Farnham, P.Q.; Chaudiere to Richmond, P.Q.; Loop line around Montreal, P.Q.; Brantford to Lucan Crossing, Ont.; Guelph Junction to Palmerston, Ont.; Fergus to Melville, Ont.; Port Dalhousie to Port Colborne, Ont.; Franz to Port Arthur, Ont.; Jasper, Alta., to Loos, B.C.; Abbotsford to Resplendent, B.C., and Revelstoke to Kamloops, B.C.

There are tables showing elevations above main sea levels and also tables of rail elevations, and an index which gives an alphabetical list of cities, towns and villages at or near which bench-marks have been established.

F. J. Coyle, of St. Catharines, George McC. Crysler, of Kenmore, and J. H. Gardner, of Welland, are the provisional directors of the Gardner Construction Co., Ltd., of Welland, incorporation of which was recently announced.

MR. MACDONALD REPLIES TO MR. TAYLOR'S LETTER REGARDING DIVING BELL

IN the October 31st issue of *The Canadian Engineer*, appeared a letter written by John Taylor, of Hamilton, claiming the invention of the diving bell and protesting against certain statements that had been made by J. J. Macdonald when the latter read a paper at the Halifax professional meeting of the Engineering Institute of Canada. Mr. Taylor's letter dealt very severely with Mr. Macdonald and intimated that the latter, when designing the Halifax Diving Bell, had adopted without authority the principle of the former's invention as used at the Hamilton Harbor.

In a letter received last week by *The Canadian Engineer*, Mr. Macdonald is very indignant about Mr. Taylor's attack, and strongly defends his own position in the matter, claiming that he had never heard of Mr. Taylor's caisson and that the contract for the Halifax bell was awarded before any description was published of Mr. Taylor's design, although the latter was in operation at Hamilton some months previously.

Mr. Macdonald points out differences in design and scope of work between his bell and Mr. Taylor's caisson, and intimates that Mr. Taylor's device lacks novelty so far as regulation of draft is concerned. The following excerpts from Mr. Macdonald's letter explain his position in more detail.—

"Mr. Taylor states that he invented and designed a floating caisson or diving bell in May, 1913, and put the device in operation in August, 1913; and that a description of this apparatus was published in the 'Engineering News' of April 23rd, 1914. Mr. Taylor goes on to say that this machine was in operation three years before the design of the Halifax caisson was prepared, and the letter insinuates that in all probability the principle of the Halifax apparatus was copied from his device.

"In rebuttal the writer begs to state that the detail drawings and specifications for the Halifax Bell were exhibited about March 15th, 1914. On March 23rd, 1914, the Maritime Bridge Company of New Glasgow submitted their bid for the construction of this bell, and on March 31st, 1914, the contract was awarded them. These dates may be verified by reference to the fyles of this company. The construction of the bell was started at once and it was completed ready for work in the autumn of 1914.

"The writer, and so far as he knows, the engineers associated with him on the Halifax work were totally unaware of the existence of the Hamilton apparatus when the design of the Halifax bell was made; and furthermore. when preparing the paper referred to, the writer had no knowledge, either from the article in the 'Engineering News' or elsewhere of Mr. Taylor's design.

"Mr. Taylor states: 'Mr. Macdonald calls his device a floating caisson or diving bell, and lays claim to being the originator of this type of apparatus'; and again: 'With regard to Mr. Macdonald's claim as to the unique and original features of the caisson, namely—the convertible buoyance and ballast chambers, if you will refer to the Engineering News,' etc.

"Referring to the paper, it states that 'for reasons of economy and adaptability to the conditions, it was decided to adopt a *self-floating*, *submerging* and *raising* type of mobile pneumatic caisson or bell,' and the whole context of the paper describes this apparatus as a self-floating, (self) submerging and (self) raising caisson.

"There is an essential distinction between this nomenclature, and the term 'floating caisson.'

"The last sub-division of the paper contains the only reference to personnel, and the features of the Halifax apparatus believed to be unique. Any reader will note that nothing is said about *invention*, and that there is no ostentation about patents, etc.

"The aim in writing this paper was, primarily, to explain and formulate the principles of design developed in connection with this apparatus, in the professional interests of engineers.

"Regarding unique features—after citing bells or caissons, which to the writer's knowledge, had been used on harbor work elsewhere,—the following statement was made:

"'The self-raising and self-floating features of the Halifax bell, the simplicity of its general construction, the method of ballast control and the great range of depth, 20′ to 55′ (a mis-print here gave 35′) at which it will work, coupled with its relatively small size in area, make it unique.'

"The writer has looked up the article re the Hamilton device in the fyles of the 'Engineering News,' and from the description given therein, would say that the following comparison of the two plants is obvious:—

"The Halifax caisson was designed for work while resting on the harbor bottom at depths up to 55 feet below the water surface, and the caisson, proper, has to be submerged and sunk, under control, to that depth after submergency, and by a reverse operation raised to the surface.

"In order to float the caisson when it was required to be moved, the buoyancy chamber was added, and this was its only function.

"The difficult problem was to take care of the sinking and raising of the caisson while submerged. This was solved by the device of a specially-proportioned vertical ballast chamber, which was separate in action and function from the buoyance chamber, and which handled the water ballast proper. This feature of the special ballast chamber is referred to in the quotation given above as 'the method of ballast control.'

"This fundamental problem was altogether absent in Mr. Taylor's design, and the principle of using separate buoyancy and ballast chambers is not even indicated.

"The Hamilton machine was a purely floating device for work about three feet below the surface of the water and was incapable of submergence; it was essentially a pontoon or scow, with a bottomless central well or compartment in which the water level could be lowered by turning in compressed air.

"The use of water ballast was not an essential principle of the plant, so far as its use as a floating caisson was concerned; a heavier scow would have served without water ballast. The real purpose of the water ballast in this case was to regulate the draft of the float, so that it could pass over the piling in getting into position, and this device of regulating or changing the depth of flotation of a pontoon, scow or floating device, by admitting water through sea-valves into chambers and forcing it out as required, is an old one used on floating gates for docks, scows carrying construction plant in tidal waters, etc.

"The problem of flotational stability while in the submerged condition was entirely absent in the case of the Hamilton apparatus.

"In speaking of stability, Mr. Taylor's statement that his machine was stable—'the metacentre being well *below* the centre of gravity for all conditions,' is surprising; but there is probably a stenographic error here."

"Hydro's" Queenston Generator Specifications

Tenders Called on Several 45,000 K.V.A. Machines—Ventilation and Insulation are the Main Problems in Design—Commission Says that Ultimate Capacity of the Station May Be a Million Horse-Power

SPECIFICATIONS have been issued by the Hydro-Electric Power Commission of Ontario for the big generators needed for the initial installation at Queenston, which will probably total 200,000 h.p. It is recognized, however by the engineers of the Commission that these specifications are tentative, and alternatives to be submitted by the tenderers will receive consideration.

As each generator will have an output capacity of 45,000 k.v.a. at the terminals (at a power factor of 80%, current lagging) the main problem is ventilation.

"Give me a method by which to get the heat away, and I could build a generator of 1,000,000 k.v.a.," says the chief engineer of a prominent electrical firm.

Ventilation

Various schemes have been proposed for the ventilation of these big generators, and it is expected that each of the bidders will submit plans of their own in this regard, as each of them has a ventilating engineer at work upon the subject. The Commission tentatively proposes that each generator be completely enclosed, cooling to be effected by air either forced in or exhausted by suitable fans.

It is the intention to draw the air from the gorge through the east wall of the station, above the flood level (elevation 296), and supply it direct (without treatment) through ducts to the generator, either at the bottom or at the bottom and top. The heated air will pass through ducts into the atmosphere at the rear of the station, at or near the roof.

If possible, the Commission desire the generator to ventilate itself by means of suitable fans located on the rotor, as it is thought advisable to dispense with external fans if at all practical to do so, the idea being to have the units as nearly self-contained as possible, and not dependent upon auxiliary equipment.

It is intended that the design of the ventilating system be withheld until full information is received from the generator manufacturers. The tenders will contain recommendations as to whether the fans, if any, should be located in the supply or exhaust ducts, and they will state the quantity of air required, and the pressure or supply or vacuum in exhaust ducts which it will be necessary to maintain; also the maximum velocity of air which will obtain in any part of the unit under operating conditions.

Temperature Rise

The specifications limit the temperature to any part of the generator to 100° C. with the cooling air at 40° C. This is with the use of mica and cambric insulation. With an all-mica insulation, the Commission may allow a slightly higher temperature.

"The above maximum temperature rise," states the tentative specification, "is below that allowed by the A.I.E.E. rules for class A insulation, but whether this class of insulation is used or not, it is the intention of these specifications to cover a unit which is conservative in heating.

"If, however, the tenderer is prepared to supply a different class of insulation and to recommend a higher maximum temperature, the Commission may consider such recommendation as an alternative, but in no event will the Commission consider temperatures of any part of the unit in excess of 90° C by thermometer and 110° C by embedded temperature detectors."

At least twenty-four embedded detectors are to be placed in different parts of each generator.

Mechanical Requirements

Each machine will have a vertical shaft, revolving field with thrust bearing, and possibly a direct-connected exciter. Each generator will be mechanically capable of delivering the rated capacity of each water turbine, namely, 52,500 h.p., and will be capable of carrying any momentary overloads to which it may be subjected.

The normal speed will be 187.5 r.p.m., and the frequency, 25 cycles per second. The machines must be designed so they will run continuously without load but with normal field current at 347 r.p.m. without stressing any part to the elastic limit of any of the material, or in any other way injuring the unit.

The rated capacity is to be delivered at a normal potential of 12,000 volts, but the design must permit variation of the voltage to 13,200 for several hours at a time.

The voltage of the unit will be under the control of an automatic regulator.

The potential wave form of each generator must not deviate from a sine wave by more than 10% at any load from zero to the rated load.

The main shaft will be of forged steel. The Commission reserve the right to adopt the design of coupling submitted by the generator contractor or by the turbine contractor.

Brake Device

The brake device required for stopping the rotor after the turbine gates have been closed, consists of a number of brake cylinders and plungers secured directly to the foundation, the plungers bearing on a surface forming part of the rotor. It is intended that the brakes should bring the rotor to rest from normal speed within five minutes.

The armature of each generator must withstand for one minute a potential of 30,000 volts applied between all windings and ground, and between phases windings; and the field a potential of ten times the rated exciter voltage to ground for one minute. Wherever possible, the insulation of conductors and bracings will be covered with fire-proof material to prevent the spread of fire.

Each generator will be direct-connected to a single runner, vertical shaft hydraulic turbine, the tenders for which are now being considered by the Commission. An outline of the specifications for these turbines was published in the September 26th issue of *The Canadian Engineer*.

While it is not likely that the initial installation will comprise more than four units, it is intended to instal additional units from time to time as the power situation at Niagara may dictate. The specifications for the generators refer in a significant manner to this possible later enlargement of the plant, in the following two paragraphs:—

May Be Million Horse-Power

"Whereas only three or four units may be covered by these specifications, from time to time units of equal or greater capacity may be installed at the generator station, so that the ultimate capacity of the station may be in the neighborhood of 1,000,000 h.p.

"On account of the large amount of power dependent upon each unit, the magnitude of the plan and of the system of which it will become a part, the importance of the public service and industries served, it is required that all equipment be designed and built for the highest class of service, and completed and installed in the shortest possible time."

The above mentioned specifications for the generators were prepared by E. T. Brandon, electrical engineer of the Commission, and his assistant, A. H. Hull, under the direction of Sir Adam Beck, chairman, and F. A. Gaby, chief engineer.

The Engineer's Library

TOWN PLANNING IN MADRAS

Reviewed by James Ewing
of Ewing, Lovelace & Tremblay, Montreal

By *H. V. Lanchester*. Published by Constable & Co., Ltd., London. A review of the conditions and requirements of city improvement and development in the Madras Presidency. 115 pages, 8 x 11¼ ins., cloth. Price, $3 net.

This book is a compendium of a series of lectures given by Mr. Lanchester in the city of Madras, being the outcome of a distinct and important movement for the amelioration of living and working conditions in that city and several lesser towns in the same region. These lectures were delivered in 1916, so we can see that the stress and turmoil of the great conflict, centred, it is true, in European fields, but reverberating and felt in the furthermost corners of the earth, has been no conclusive bar to the consideration of questions pertaining to the real and intimate welfare of the people on eastern shores. And so we find that we who are wont to plume ourselves as being of the advanced and up-to-date Occident are only beginning to wake up and rub our eyes, while they of the slow-going and effete Orient are already well on the day's journey and ready to direct us in the way we should follow. Nor are the conditions, needs and tendencies, or the problems and perplexities that arise from them, whether it be East or whether it be West, radically or essentially different. Indeed, there is an astonishing likeness between the two, and the disparities are those of color rather than of embodiment. And there is much that we would do well to note regarding these civilizations, however foreign in appearance, that have seized so much of the essential of life while we are frantically grasping at the shadows.

From the title of Mr. Lanchester's book one might be apt to assume that the subject matter was of small particular concern to the general reader in this hemisphere, but we have not far to go to find much of the utmost interest, the utmost freshness and the utmost value to the student of town planning, wherever he is situated. Commencing with the ethics of town planning, the why and wherefore, the writer outlines in a sketchy but vivid way the historical development, covering the whole field of town planning endeavor through its various stages to the present day, noting its advances, stagnations, retrocessions and rennaisances, with the reasons and causes therefor, and then delves into a series of economic and sociological studies of city life, housing, commerce and traffic, finishing with something like a peroration on the technique of city development. Thus through the first eight chapters the attention of the reader is easily and closely held, while the remaining five, dealing more particularly with the titular subject matter of the book, and, therefore, of more local concern, are always interesting, if only for the sake of comparison. From beginning to end there is not a dull page in the book and hardly a dull sentence. It is not overburdened with exhaustive detail, but it is tersely and vigorously written, giving every evidence of an easy mastery of the subject.

There are numerous illustrations, showing ancient and modern, continental, Oriental, and even American examples. There are also a number of plates, being maps of the city of Madras, illustrating various statistical, sociological, hygienic and traffic conditions, together with the conclusions drawn and improvements recommended. Altogether, this book is a welcome addition to the literature of town planning.

HANDBOOK OF MATHEMATICS FOR ENGINEERS

Reviewed by A. S. L. Barnes
Hydro-Electric Power Commission of Ontario

By *Edward V. Huntington*, Ph.D. Published by McGraw-Hill Book Co., New York. 191 pages, 5 x 7 ins., flexible binding. Price, $1.50 net.

This is a reprint of sections 1 and 2 of the "Mechanical Engineers' Handbook," by L. S. Marks, and, besides the mathematical portion, it contains useful tables of weights and measures by L. A. Fischer, of the United States Bureau of Standards.

The book is of a very handy size, and is conveniently divided into two sections, the first containing mathematical tables and weights and measures, and the second is classified as mathematics, and treats of Arithmetic, Geometry, Algebra, Mensuration, Trigonometry, Calculus, Graphics and Vector Analysis.

There is apparently nothing new in the book which is not in the larger "Mechanical Engineers' Handbook," but its compact form makes it very convenient to have on the desk, or, if need be, in the pocket, for ready reference; many engineers would find it useful on this account.

Hon. Frank B. Carvell, Minister of Public Works, stated last week that he had decided to put in next year's Federal estimates a sum sufficient to complete the turning basin in Ashbridge's Bay, Toronto, and also to complete the concreting of the cribwork on the Sunnyside-Humber section of the Toronto harbor works. The latter work is that for which the Canadian-Stewart Company contract was cancelled by the Government, and a new contract will have to be let. Mr. Carvell did not mention any specific figure, but the work outlined is understood to involve about $500,000, of which $150,000 will probably be a re-vote from 1918, as this year's estimates contained that amount for work which was not done.

CONTROL OF SMALL SEWAGE DISPOSAL WORKS*

By James H. Edmondson

IN the control of small works, as in large ones, efficiency in combination with economy is the goal to be aimed for. The author has frequently seen when visiting various sewage works that the effluents leaving small works are infinitely better than those leaving larger ones—in fact, in the author's opinion, many of the effluents are too good, if such can be the case, and consequently economy must have suffered to attain this high degree of purity. This probably arises through insufficient knowledge of the sewage treated and effluent obtained, and consequently the sewage has been put through more processes or treated on a larger area than is really necessary to produce a satisfactory and stable effluent. If, however, systematic records, not necessarily of a highly technical character, were kept, they would be of great assistance in determining any further treatment, and also satisfy those responsible of the results obtained day by day.

Records

The quantity of sewage delivered at the disposal works is of the first importance. This is fairly simple to determine on a small works without going to the expense of fixing a recorder. Good approximate results can be obtained by the use of a rectangular weir or V-notch, and recording the depth flowing over same every hour or half-hour. The effluent can also be recorded by fixing a rectangular weir at the outfall from each channel or main channel from the filters, as at the Southall works.

The quantity of tank effluent each bed, filter or plot of land treats can often be approximately estimated by recording the number of hours each unit works per day, providing a practical test has been previously carried out of the quantity each unit treats per hour. In cases where pumping is necessary, the time the pumps are at work usually gives a true record of the flow, any appreciable increase being due either to loss of efficiency of the pumps or increase in flow.

The measurement of the sludge at the time of cleaning the tanks—which is easily accomplished—along with the number of days such tank has been at work, is of considerable value. Any appreciable increase may be due to increase of flow, which should be accounted for above or increased strength of sewage. On the other hand, should there be an increased flow of sewage delivered at the works whilst the production of sludge is normal, of course eliminating storm water, it will probably be found to be due to sub-soil water leaking into the sewers or some other sudden discharge into the sewers.

These, with many others, which are particularly adapted to individual works, are common-sense records, and are no doubt kept by many of the members of this institution. There are in addition, however, a few chemical and physical tests which can easily be applied, and in conjunction with the above records will enable one to have a small works under thorough control.

Analyses

You will no doubt be familiar with the items of analyses the analyst presents when reporting on the examination of a sample of sewage. The results given are usually expressed in parts per 100,000, and even then some of the figures are small decimals, which can hardly be arrived at by simple or rough-and-ready methods. There are methods, however, which approximate to one or two of the tests if not the figures. One of the principal tests which can be so approximated is the 4-hour's oxygen absorption test. This is carried out by placing a known quantity of the sample under examination in a standard solution of acidified potassium permanganate (containing available oxygen) which will oxidise any organic matter present. As is well known, potassium permanganate solution has a brilliant purple color, which gradually disappears with the loss of its available oxygen, being colorless when all the oxygen has been absorbed. Upon this characteristic a simple test has been devised. Other tests are presence of nitrates, turbidity, odor and stability, which will be briefly described along with the necessary chemicals and apparatus, which can be obtained at a very nominal cost.

Some Simple Tests

Oxygen Absorbed.—Apparatus and chemicals required: One pair of apothecary's scales, one or two weights totalling 0.4 gramme, one litre graduated flask, 10 c.c., 25 c.c. and 100 c.c. graduated cylinders, pure sulphuric acid, potassium permanganate, and a stock (6-8 oz.) of stoppered bottles.

Solution.—Weigh out on the scales of 0.4 gramme of potassium permanganate, and place in litre graduated flask, and dissolve in a little good tap water; add 100 c.c. of sulphuric acid and allow to cool. When cool, make up to the litre mark with water.

Method.—Place in a stoppered bottle 100 c.c. of sample to be examined and add 10 c.c. of the acidified solution of potassium permanganate. Note how long it takes for the color to entirely disappear. With crude sewage this may occur in a few minutes; with a good effluent it may take some hours.

Presence of Nitrates in the Effluent.—Apparatus and chemicals required: One Nessler tube, a solution of 1 per cent. brucine sulphate and sulphuric acid. Place 5 c.c. of effluent in the Nessler tube and add 2½ c.c. of brucine solution, thoroughly mix and add 2½ c.c. of strong sulphuric acid down the side of the tube, which will settle at the bottom. If a pink zone forms, gradually changing to amber, nitrates are present—the more marked the reaction the more nitrate present.

Turbidity.—Apparatus required: Piece of white cardboard with black lines ruled across, a ground bottom Nessler tube at least 6 in. in height and 1 in. in diameter, graduated up the side. Shake the sample thoroughly and slowly pour into the Nessler tube, which is placed on the paper, until the black lines are obscured. A satisfactory effluent should show a depth of 4 or more inches.

Should Have No Offensive Odor

Odor and Stability.—Apparatus and chemical required: Stoppered bottles and a solution of methylene blue. A good effluent should have no offensive odor at the time of sampling or even after being kept in a stoppered bottle in absence of air for four to six days at a temperature of 80 deg. F. The stability can be estimated by tinting the sample in the bottle with about six drops of methylene blue solution before placing on one side or in an incubator. Examine the sample daily, and should the color persist until the fourth day one can be satisfied of the stability of the sample. If an effluent has a deficiency of dissolved oxygen and nitrates it is invariably found that it is charged with an excess of organic matter, and consequently will be found to be unstable, emitting a disagreeable odor, and discoloring methylene blue upon incubation. If the color persists for four days it is usual to record it on

*Paper read before the annual meeting of the Institution of Municipal Engineers.

the record sheet with a + sign; if it disappears within four days, with a— sign.

The following is a typical method of recording the results:—

Final Effluent

Date.	Oxygen absorbed.	Nitrates.	Turbidity.	Odor.	Stability.	Approx. quantity treated.	Rainfall.	Temperature Max.	Temperature Min.
Sept. 2	6 hrs.	Strong	$4\frac{1}{2}''$	Earthy	+	—	Nil	90	58
Sept. 3	3 hrs.	Slight	3″	Stagnant	—	—	Nil	98	60

Whilst advising that such records and elementary tests would prove of great assistance in the control of small works, and which can easily be carried out by any intelligent workman, the author would certainly recommend that periodical samples be submitted to an analyst and his report compared with the results obtained on the works. By such means the manipulator could fix his own limitations to the elementary tests just described.

In conclusion it may be mentioned that in considering an analyst's report the following four tests are usually taken as standards:—

1. The 4-Hours' Oxygen Absorption Test.—A permissible effluent should absorb less than 1.40 parts per 100,000; a good effluent under 1.0 part.

2. The Albuminoid Ammonia Test.—A permissible effluent should contain less than 0.15 part per 100,000; a good effluent less than 0.10 part.

3. Suspended Solids.—The Royal Commission recommends that a final effluent should contain less than 3.0 parts per 100,000.

4. Dissolved Oxygen Test (oxygen absorbed from tap water in five days at 65 deg. F.).—The Royal Commission recommends that a final effluent should not absorb more than 2.0 parts of oxygen per 100,000.

AZIMUTH OBSERVATIONS*

MOST surveyors and engineers in the past have dreaded azimuth determinations of any kind; observations were looked upon as a terrible ordeal, were dispensed with as much as possible, and were taken only when considered absolutely imperative. The two methods commonly adopted for determining the azimuth of a line were by means of the sun and of Polaris at elongation. Observations by means of the sun have the great advantage that they are, of course, always taken in daylight and may be taken at almost any time in the summer months, except within say two hours of noon; they have the great disadvantage in that they are not very accurate, and the computations are long. The observation on Polaris at elongation is both easy to take, simple to compute and accurate in results, and land surveyors who desire accuracy in their work have adopted it almost universally in the past. It has the great disadvantage, however, that, as elongation takes place only twice in twenty-four hours, the observation can be made at only two particular times of the day, and as one of these times is generally unsuitable on account of strong daylight and the consequent difficulty in seeing the star, in practice it generally happens that the observation can be made only once a day; if the weather conditions should, as may very likely happen, be unfavorable at that particular time the opportunity for observing is gone for another twenty-four hours. This is one of the main reasons why for some time back it has been the practice among an ever increasing number of surveyors and engineers to observe on Polaris at any time. The method, except when the star is close to upper or lower culmination is just as accurate as the elongation method but entails considerable computation. To overcome this, various forms of tables have been prepared. One form gives the azimuth with the hour angle and latitude as arguments, the declination being considered constant. A table of corrections for change in declination is also required. This form, therefore, requires the calculation of the hour angle from the watch time by means of a table giving the right ascension or the time of elongation by the star, double interpolation in the main table for hour angle and latitude, and a correction to this for change in declination, the last requiring also a table of declinations. Another form of table even less simple, is to compute the hour angle as above, interpolate in the table supplied for this value and for the year of the observation to obtain the approximate value of the azimuth, and interpolate in another table for this approximate azimuth and for the measured altitude to obtain a correction to the former. These tables are all arranged so as to be suitable for many years, and are a great convenience over the actual computations, but the double interpolations and the various correction tables make them clumsy to use.

*From Annual Report of the Topographical Surveys Branch, Department of the Interior.

Greatest Improvement Ever Made

Frequent azimuth observations are one of the primary necessities for accurate work. Now, if the taking of these observations can be made so simple and easy that surveyors will think nothing of them, a big step will have been made in raising the standard of survey work. About fourteen years ago the Surveyor General took the problem in hand. Transits were designed with telescopes sufficiently powerful to permit of the star being seen clearly in daylight, and tables were issued by means of which the azimuth was derived in a much simpler manner than in the tables described above. They have been in general use on Dominion Lands surveys ever since and, taken in conjunction with the observing of Polaris in daytime, have been generally conceded among surveyors to have been one of the greatest, if not the very greatest, improvement ever made in Dominion Lands surveys.

Modified Tables Issued

Although the tables have been prepared for the Dominion Lands system of township surveys and are not very convenient for any other purpose, their use has been increasing for some years among surveyors and engineers other than those engaged on Dominion Lands surveys. Last year, the Minister of the Interior was requested by the Minister of Lands, Forests and Mines for Ontario, on behalf of the Ontario Land Surveyors' Association, to issue astronomical field tables of the same kind, but modified to be convenient for these other Canadian surveyors and engineers. The preparation of the tables was authorized by the minister and five sets similar to those used on Dominion Lands surveys but extending from latitude 42° to 56° and having the latitude instead of the township as argument, have been computed.

Further progress has been made in the consolidation of the three constituent companies into the Niagara Falls Power Company. Notice has just been sent to stockholders who are entitled to receive stock in the company that, pursuant to the consolidation agreement, effective October 31st last, the plan of exchange of stock has been arranged. The shareholders are entitled to receive in exchange for each share of the stock now owned, two shares of the 7 per cent. cumulative preferred stock and 171-1000 of a share of the common stock of the new consolidated company.

PROBLEMS ARISING IN TOWN PLANNING*

By A. Horsburgh Campbell
Borough Engineer, Edinburgh

EIGHT years' experience by the writer in the active operation of the Housing and Town Planning, &c., Act, 1909, has revealed its minor deficiencies as well as its excellences. That the Act possesses both these qualities all its students who have been endeavoring to put its provisions into practice are well aware, and this is not to be wondered at. It was an entirely novel piece of legislation, inspiring in its vision and bold in its aims; yet it has suffered much delay in its operation by conditions that have retarded its easy translation into the language and act of practical town planning. Up to the present, it may be stated, the schemes which have been passed in England (some six or seven in number, and, alas! not yet one in Scotland) have been in their nature necessarily experimental. All honor to those pioneer authorities, such as Birmingham and Ruislip, who have not been afraid to launch out upon the contentious currents of many opposing interests that come to the surface on the appearance of actual town planning.

Unprepared for Peace

But the foundation of this work having been so courageously laid by these and other authorities, it now lies to the hand of that great body of local government throughout the country to take up determinedly this work; it is pre-eminently a work suited to wartime, so that when peace shall come it will find the country prepared with those schemes upon which that great housing structure foreshadowed by the Government can be fitly reared. Unless this is done we shall find our cities, our towns and urban districts as unprepared for peace as our nation was in 1914 unprepared for war. And here the writer may be pardoned a word of appeal to the membership of this institution—particularly the younger section—to realize the great boon which the Town Planning Act can bring to our individual cities, towns and districts, and that in great part without money and without price. I mean by that, without the payment of any price as compensation for provisions of such priceless worth in city, town and district development as in the language of sec. 59—2 of the Town Planning Act, enacting that:—

"Property shall not be deemed to be injuriously affected by reason of the making of any provisions inserted in a town-planning scheme, which with a view to securing the amenity of the area included in the scheme or any part thereof, prescribe the space about the buildings or limit the number of buildings to be erected, or prescribe the height or character of buildings, and which the Local Government Board, having regard to the nature and situation of the land affected by the provisions, consider reasonable for the purpose."

Magna Charta of Urban Development

This may not inaptly be described as the "Magna Charta" of urban development. It puts in the hands of local authorities such powers, such opportunities of negotiation in their relations with landowners as no other piece of legislation (public or private) has conferred.

The new circular letters upon the national housing policy of the Local Government Boards for England and for Scotland are calls to action in the field of town planning, for, unless the housing schemes are preceded by well-considered, carefully-matured schemes of town planning, then delay and disorder will result, and grave mistakes develop in the work of housing, which the skill and forethought of town planning can successfully avert. But at least two discouragements are present to the enthusiasm and initiative of municipal engineers and surveyors in their pursuit of this work, particularly in the smaller and less populous boroughs and districts. These are—(1) The stirring up of local hostility and opposition, and (2) lack of recognition. These two are in reality one, for if the arduous and long-sustained labor involved by town planning is to go unrecognized by the authority for whose sole advantage it is intended, and at the same time hostile currents to be set in motion against those unfortunate officers mainly responsible for town planning, what inducement is there for them to see this business through? This initial handicap of town planning has been frankly faced and admitted by the Royal Commission on Housing (Scotland), who in their report, recently issued, state in paragraph 82 as follows:—

"We recommend that conditions similar to those we propose for medical officers of health and sanitary inspectors should apply to burgh engineers, burgh surveyors, masters of works and town planning engineers—viz., that their appointments and salaries should be subject to the approval of the Local Government Board; that they should not be removable from office except by or with the sanction of the board, and that the board should have power to require combination of local authorities for the appointment of such officers."

The Lack of Recognition

The laborer is worthy of his hire, whatever may be the sphere of his labor. In no sphere of local government will the practical results be so positive and direct as in that to be gotten from town planning. What are some of these direct advantages? Improved amenity, the orderly lay-out of the town or district or suburb, good roads, transit facilities created and developed, better homes, improved chances for infantile life, and in the result a markedly improved physique and social tone, and with these a reduced mortality rate and enhanced public health are among the immediate positive benefits conferred by town planning. Municipal engineers become then the vanguard of a new constructive *regime* of health and amenity. It is therefore right that the officers and their staffs, charged with the duty of preparing schemes of town planning so potential of public benefit, and bearing, as these officers do, the burden of battle against vested interests, should be suitably recognized for this responsible appendage to the daily tasks of office. For such good and valid reason, then, representations should be addressed to the Local Government Boards for both England and Scotland in support of the recommendation of the Royal Commission, above quoted, that they may do their part in seeing that this specialized technical skill and service, which the municipal engineer and his staff alone are able to give, are adequately recognized.

But whatever may be the results personal to the officers concerned and their staff, that keen sense of personal service to the community they serve will continue the mainspring of their initiative in the pursuit of this all-important work of town planning for the betterment of their city or area.

Now, to come to some of the actual points of town planning, it may be well to make a very brief survey of town planning, and to know exactly what it does and does not include.

*Paper presented at the annual meeting of the Institution of Municipal and County Engineers.

It has been said that town planning includes "anything that the local government may choose to admit within the clauses of a scheme." This is correct only to a point.

What Town Planning Includes

Town planning provisions must not be *ultra vires* of the general statute. They must be consistent with and yet limited by the terms of the statute. Thus, by way of illustration: (1) You may restrict the number of houses or buildings per acre upon any piece of land—thereby creating an open plan of development—but it is doubtful whether you may say that any particular piece of land shall be left unbuilt upon and reserved as common, or as recreation ground, or even as allotment land, except by consent, or by compensation. (2) You may say that a factory shall not be built upon any particular piece of land; you may not say that any particular site—however suitable and enticing from the points of view of convenience and amenity—shall be reserved as the site of a school, a church, or a public building, such as befits the prominence of particular sites for any such particular function, and which would make its contribution both to convenience and amenity. (3) You may plan your arterial roads along lines, and of widths and formation, consonant with convenience and amenity; it is doubtful if you may exceed the widths recognized by local or public statute or by-law, except by consent or compensation. (4) You may "town-plan" a piece of undeveloped land in the country; it is doubtful if under "town-planning" you may replan an overbuilt and congested area in a town. (5) You may require the width of a road to bear its due relation to the height of buildings which will front it, but it is at least open to question how far you may require the lay-out of estate roads upon a plan that expresses art and amenity; in short, while controlling many matters less important, you are inadequately equipped in ensuring the greater things that do contribute so much towards convenience, amenity, health, utility, and the ordinary pleasures of domestic life.

Liberal Interpretation Required

These are but a few illustrations of certain anomalies that turn up in the course of preparing town-planning schemes, and show the need there is for amplification of the Act, or for its more liberal interpretation, so that town planning in its legal sense and expression will become as spontaneous as its practical exponents would exhibit it in material form, embodied in the settings of avenue, house, garden, allotment, play-fields and other attributes of suburban development. Fortunately, however, the legal exponents of town planning—scenting its atmosphere—are beginning to realize its freedom and elasticity and are now disposed towards extreme simplification of a town planning scheme in the first instance, reserving the "infilling" of details as regards any piece of land until it is maturing for building development, so that we may now have within one and the same "area" the super-imposing at a later date of a detail scheme or schemes upon an earlier skeleton scheme previously made—that is to say, the same piece of area of land may be the subject of two or more successive and supplementary schemes, the second (and it may even be still later ones) being but the carrying on as items of detail development of the first and earlier scheme or schemes. This point is very clearly brought out in the annual report of the Local Government Board of Scotland, 1917. . . . .

The institution may here note that all the Act requires is that the local authority should satisfy the board that there is a *prima-facie* case. A *prima-facie* case for what? For showing that a piece of land is "in course of development, or appears likely to be used for building purposes." This issue surely is a simple one—not of argument, but of fact; not of policy, but of practice; not of subtle legal quibble and the rival proof of experts arrayed against each other at a formal inquiry, but of simple discernment of the facts as they appear to the eyes and judgment of a skilled practical commissioner or inspector such as the Local Government Board appoints to report to them. It is in this procedure stage that the Act seems almost to break down in its operation, and it is important to note that the procedure regulations, although deriving their power from clause 56 of the Act, are not a compulsory appendage of the Acts, but are in their form optional or permissive upon the Local Government Board, and they are the product of the Local Government Board and not of Parliament.

It is agreed that some simple regulations are necessary to secure the orderly and smooth working of the Act, but not to smother it.

Usefulness of Act Impaired

The Procedure Regulations which the Local Government Boards of England and of Scotland have drawn up and the abuse or license which, under cover of these regulations, opposing interests have set up in this preliminary procedure, are together strangulating progress and so cumbering the Act that its usefulness is seriously impaired if not indeed threatening to reduce the Act to comparative nullity.

If the Act be followed in its straightforward provisions the need for amendments is limited to points of detail and not of principle: it is the complete rescission of the existing Procedure Regulations that is wanted, and the substitution of a shortened code of regulations in harmony with the simplicity and spirit of the Act itself, so that the duty of satisfying the board that "land is in course of development or is likely to be used for building purposes" may be treated as a question of fact and of practice in as simple, expeditious and inexpensive a way as the simplicity of the issue justifies. And here may I suggest to the membership of this institution, which has taken the most prominent and leading part in the pursuit of town planning, the desirability of approaching the Local Government Boards for the two-fold purpose (1) of co-operating with the boards in the drafting of an amended and simplified set of Procedure Regulations suited to the need of the times and of the issue; and (2) of co-operating with the board in the drafting of a set of "General Provisions" forming the fourth schedule of the Act. It is more than time that such a set of "General Provisions" should be prepared for the guidance in particular of the smaller local authorities, and the cumulative experience of those authorities who have been active in town planning work should now be co-ordinated and placed at the disposal of the two boards.

The views of this institution upon this proposed simplification of the working of the Act are desired, and would prove helpful to the cause of town planning at this critical juncture of its administration.

Engineers To Act Conjointly

The Procedure Regulations are big enough to form the subject of a separate paper, but it will be agreed that their suitable amendment can be best carried through by the co-operation of Select Committees for England and for Scotland, representative of town and district clerks with engineers and surveyors acting conjointly and in an advisory capacity with the officers of the two boards in the drafting of amended regulations, and preparing the draft of a set of "General Provisions."

This is no innovation, for in recent practice upon other subjects of a technical kind the great departments of State have called to their aid the co-operation of men skilled in particular subjects to advise them. And that is what is now respectfully submitted as a suitable and simple means of expediting procedure in this most pressing work of town planning.

"Tailings" of a City

In all cities there are many fragments of land, the development of which has stopped short due to the ordinary processes of ebb-and-flow of building enterprise before the war. These fragments of land are probably in many cases isolated patches, although in the aggregate they may count as considerable tracts of territory justifying the application to them of town planning powers and provisions.

It is, of course, open to all local authorities to include all such "tailings" or fragments in a scheme, but unless the "procedure anterior to the making of a scheme" is very much simplified as above indicated, the difficulties in the way of such grouping and embracing in one scheme all isolated patches or "tailings" are very considerable, with the result that these fragments of land may remain immune from the operations of town planning and will thus be on a privileged plane compared with "virgin land" with the same local government area which may be put under restrictions of a town-planning scheme. To leave out here and to include elsewhere in the same area would be inequality of treatment, importing preference which is not right as between land-owning interests in the same district, nor indeed to the district itself.

As an alternative to this course of procedure for these unbuilt-on remnants of estate development, it may be expedient to enact by statutory provision in any amending legislation which will probably be introduced consequent upon the Government's new housing proposals that all such land within the area of any local authority as is unbuilt upon shall in respect of its proximity to developed territory be *de facto* land subject without any "anterior" procedure to the provisions of sec. 59—2 of the principal Act and to the confirmation of the Local Government Board. May this point not be advanced further? And I suggest that if this form of treatment could be extended by law to embrace all urban and suburban territory without the cumbrous preliminaries that now hinder town planning, it would be but a logical step forward in the planned and orderly development of cities and of urban areas. It would likewise satisfy the case of old and congested built-up areas in need of clearance and of re-planning, and which, in the words of the Royal Commission, should be brought under the application of town planning, where such areas are "unsatisfactory on account of their age, their initially unsatisfactory planning of which are of an insanitary or unhealthy kind."

Acquisition of Land for Town Planning

For the manifold purposes of town planning the essential want is land. It may be for the formation of new or for the widening of existing roads. It certainly will be for the creation of those great housing suburbs under State and municipal auspices. These carry in their train the requisite of land for schools, churches, libraries, baths, pleasure-grounds, play centres for child-life, and last, but not least, for garden allotments which have come to stay.

The Royal Commission on Housing (Scotland) have given in this, as in other points of reform, a splendid lead to legislation upon this question. Their summary of recommendations and suggestions contained in Chapter 24 of their Report forms a compendium of statesmanlike grasp of the problem—fearless and businesslike in its way of combating the prejudices attaching to this problem of land values. . . .

These recommendations may to the Southerner appear somewhat drastic and revolutionary, but in their application to the Northern Kingdom with its tenemental and feuing traditions and the enormously inflated values which that system creates, the recommendations are most welcome and opportune.

Conclusion

The following re-statement in summary of the points that have been here discussed may now be desirable. They are:—

(1) That this war-time is our work-time for the preparation of town-planning schemes as the essential preliminary to housing.

(2) That the Local Government Boards should recognize the responsibility of those who thus labor in the cause of public health and entitle them to recognition by the State in manner and form advised by the Royal Commission on Housing (Scotland).

(3) That preliminary procedure to town planning should be greatly simplified and shortened, and thereon the Local Government Boards of England and of Scotland should be memorialized; towards this end it is suggested that advisory boards of practical technicians in town planning might be constituted upon the invitation of the Central Authorities to co-operate with their officers in this work, and in the drafting of a set of "General Provisions" as model clauses for town-planning schemes.

(4) That amending legislation be introduced to bring all undeveloped building sites in urban areas within the scope or operation of town planning, without the necessity of establishing in relation to them a *prima-facie* case.

(5) To deal with old or overbuilt or badly planned areas in cities as town-planning areas, and to supply the provisions of the Town-planning Act to their clearance or to reconstruction on approved town-planning lines.

(6) To facilitate the acquisition for public purposes (particularly housing and town planning) of lands and heritages in manner as advised by the Royal Commission on Housing for Scotland.

It was officially announced last week that Hon. T. W. Crothers, Minister of Labor, who has gone to California, had handed his resignation to Sir Robert Borden, and that it had been accepted. Hon. Gideon Robertson, who has represented labor in the Cabinet for some time past, in addition to acting as chairman of the Canadian registration board, has been appointed Minister in succession to Mr. Crothers.

An Ottawa despatch to the daily newspapers says that "work on the Welland Canal will be continued as soon as conditions permit. The Dominion's part in the development of the St. Charles at Quebec will be considered shortly. Other proposals in view are: Dredging at Fort William and in the Fraser River, B.C.; deepening of the St. Lawrence Canal; continuation of harbor works at St. John; and the Halifax Ocean Terminals."

Toronto Harbor Commissioners decided at a meeting held last week that a survey should be made to see what work can be gone on with next season. They wish to know to what extent the Commission can assist during the period of reconstruction and whether all employees now overseas can be taken back after demobilization. The Commissioners decided to oppose the application of the Toronto Terminals Company to secure permission to run a steam line from the Toronto Electric Light Company's plant at the foot of Scott Street to heat the new station. The Commissioners are also anxious to know the attitude of the railways regarding the viaduct.

BRIDGE CONSTRUCTION WITH TIMBER, CONCRETE AND STONE UNDER PRESENT CONDITIONS*

By O. L. Grover

IN many communities culverts and bridges must be built, even under war conditions, to keep the highways in shape for use, even where no new road construction is under way or would be authorized.

Steel has been the favorite bridge material for several years. It has been used for small as well as large structures. At present steel is not available in any quantity for bridge construction. It cannot be had at all where its use can be avoided, while all large steel construction necessarily must be abandoned or postponed until peace and normal conditions return. This situation forces the use of other material—timber, concrete, stone, and brick.

For long bridges and for temporary work where the cost must be kept down regardless of high maintenance expenses, timber is the material which must be used for superstructures. In small, permanent structures concrete, stone and brick are excellent materials, preferably in the order named. The character of the structure should be governed by the material most readily obtained, though in some instances the available labor may be the determining factor.

Culverts of Rubble Masonry

Small structures, built even under the present war conditions, should be constructed with a view to permanence. Culverts with small spans can be built readily without the use of steel, and of the most substantial construction.

In locations where suitable stone can be procured culverts of rubble masonry with stone covers may be constructed where the spans do not exceed 4 ft. Such culverts will prove satisfactory and will last for a long time. The construction is simple and where suitable stone is found in the neighborhood within easy hauling distance the cost should be reasonable. In the selection of the stone the most durable should be used.

The following table gives the thickness and width of cover stones for culverts of 2, 3, and 4-ft. spans:

Dimensions of Cover Stones

Span in feet.	Thickness in inches.	Width in inches.	Length in feet.
2	10	20	4
3	12	24	5
4	15	30	6

The masonry walls should be laid in cement mortar, and the stone slabs composing the cover should be laid in mortar beds and the cracks between stones filled with mortar.

Rubble stone suitable for masonry is found in many localities, where there are no stones suitable for the cover. Where this is the case the top may be made of reinforced concrete. This will require a small amount of steel reinforcement, but will permit the use of a longer span than is safe with the flat stone top.

While suitable stone for the rubble masonry is to be found in many sections throughout the country there are many places where it can not be obtained. In some localities it may be desirable to substitute plain mass concrete in place of the rubble masonry, because of the difficulty in obtaining suitable stone.

*From "Public Roads."

Where it is necessary to make longer spans the arch is the only type of permanent structure that can be built without metal. The height needed and foundation conditions are the controlling features in this construction.

The Construction of Arches

The arch span will not prove substantial without a solid foundation, either of cemented gravel, hardpan, or rock. So important is this in securing permanency that the arch should not be selected until after the most thorough examination of the location. In some streams the bed is of such a character that there will be no great difficulty in securing the proper foundation. In others all sorts of conditions may exist and make it difficult to provide one.

Where it is possible, the foundation should be on solid rock. Where this is not possible, it is often practicable to secure adequate foundations by carrying the footings deeper, by driving piles or sometimes by spreading the footing over a wider area.

The three materials most used in arch construction are concrete, stone, and brick. preferable in the order named.

It is necessary to carry the foundations well below the bed of the stream. For the smaller spans this should not be less than 1 ft. 6 in. and for the longer ones not less than 2 ft., unless they are laid on a bed of solid rock. Riprap and channel paving should be provided where it is necessary to prevent scour.

In building arches of stone or brick, the top of all masonry should be protected by copings of concrete or by copings of large, selected stone with grouted joints.

Brick Disintegrates by Freezing

In the South, where the climate is not subject to hard freezing, common hard burned brick may be used in building arches, but should not be used where good rubble stone is to be had. In the colder sections of the country brick does not give as good results, because it absorbs moisture and disintegrates by freezing.

The foundations should be carried to good firm material, and have a minimum depth delow the bed of the stream of 1½ ft. unless on solid rock. The brick should be laid in cement mortar and be covered with 1-in. of cement mortar troweled smooth.

Timber Trestles and Bridges

Timber may be used with satisfactory results for both temporary and permanent structures, and to good advantage where brick, stone, and concrete are not easily secured. There is hardly any part of the country where good timber can not be obtained, and for spanning streams of considerable size the timber trestle or bridge is the usual type of construction under emergency conditions. It is often hard to draw the line as to just what is meant by temporary and permanent structures. Roads and bridge building are determined by the expected uses, the necessity of early completion, probably most often by the available funds. At present, the labor available must also be a controlling factor. Bridges will be built to last as long as they will perform the required service, though it may be expected to replace them with better and more permanent structures when additional funds are at hand or conditions warrant.

Timber deteriorates unless protected or treated for preservation, and for that reason is recommended only for temporary structures and where other materials are not available. The ordinary life of a timber trestle or bridge can be practically doubled by a good preservative treatment, and if the structure is expected to remain in use beyond the natural life of the wood it may be advisable, in order to keep down heavy maintenance expenses, to use a preservative treatment.

Bridges may be built of timber to serve any purpose required and will last many years. They can not be so economically maintained as bridges of reinforced concrete, but so long as it is not practical to make use of reinforced concrete, the timber structure will be the one to build, but it must be borne in mind that it should rest on permanent foundations.

In timber construction the most durable timber should be used that can be obtained locally. The general type of temporary construction is the trestle.

The more available timbers with a fibre stress of 1,600 lbs. per square inch include long-leaf pine, white oak, and Douglas fir. In the 1,400-lb. class is included Pacific post oak, Western larch and tamarack; in the 1,200-lb. class bald cypress, Norway pine, and hemlock, and with a fibre stress of 1,000 lbs. per square inch red spruce, chestnut, and red cedar. Piles used should be yellow pine, cypress, white oak, or some equally durable species.

Construction Under Present Conditions

In meeting the present-day conditions limiting the construction of bridges, local supplies of material and labor will be the determining factors. In general, the decision as to construction should be as follows:—

Keep large structures in service by repair, whenever it is possible.

Put temporary spans on permanent substructures.

Put in temporary trestles where it can be done.

Small structures should be made permanent.

Where large structures are destroyed and must be replaced to keep the road open or where emergency use requires the building of a new crossing, making temporary pile trestle structures if the nature of the stream does not make this type impracticable. Where temporary structures are not advisable, timber structures may be protected so as to be more or less permanent.

SUGGESTED SPECIFICATIONS FOR CAST IRON PIPES FOR WATER AND GAS MAINS*

SOCKET and spigot pipes, with both plain and turned-and-bored joints, have been standardized up to 48 in. diameter in lengths of 8 ft. from 3 in. to 12 in. diameter and lengths of 12 ft. from 4 in. to 48 in. diameter. Flanged pipes and special castings have not been standardized above 24 in. diameter as the demand for such is very limited and the conditions under which they are to be used frequently call for special designs.

Division Into Classes

There are to be 4 classes of pipes, A, B, C and D, varying in thickness to withstand the respective test pressures of 200, 400, 600 and 800 ft. head of water, while it is recommended that the working pressure shall not exceed one-half of the test pressures.

Class A pipes are only intended for gas or other purposes where the working pressures are low.

The special castings have been divided into two classes only, so designed that one pattern suits Classes A and B pipes, and the other, Classes C and D. pipes. By this means the number of standards for specials has been halved.

*Abstract of report submitted by a committee of the Institution of Water Engineers, England.

The standards have been so designed that pipes and specials of all classes up to 10 in. diameter can be jointed together and leave a sufficient lead space for caulking Above 10 in. diameter the pipes of Classes A and B can be interchanged, as also can those of Classes C and D.

Constancy of External Diameter

In order to render the pipes and castings interchangeable it was necessary to standardize the external diameter and allow the internal diameter to vary slightly with the thickness and describe it as the nominal diameter or bore. This has had the effect of enormously reducing the number of patterns, as those for the barrel and socket, of any group remain the same throughout.

The variations are really trifling, thus a pipe of 3 in. nominal bore may vary between 3.00 in. and 2.96 in. diameter and a 48-in. pipe between 48.00 and 48.44 in. diameter according to its thickness or class. In practice this can have no measurable or important effect as, in the first place, it has not been the practice to split inches of diameter, and, in the second place, it is exceedingly doubtful whether, in any pipe-line, the relationship between the actual and theoretical discharge may not vary to an extent greater than would be produced by the small differences in diameter in the proposed standards. In any case it is simply a matter for calculation for those who profess to work within such narrow limits.

Strength and Testing of Cast Iron

The tensile strength has been fixed at the minimum of 9½ tons per sq. in., and the traverse strength, on the standard of 2 in. by 1 in. bar with supports 36 in. apart, at the minimum of 28 cwt. and deflection of .33 in. The forms and dimensions of the test bars are illustrated in an appendix to the specification.

Variations in Thickness, Length and Weight

The tolerances above and below the normal thickness, length and weight, have been fixed, but, after much consideration, it was decided not to introduce into a technical specification any clauses touching the question of the actual weight to be paid for by the purchaser, this being considered as a purely commercial matter, which would more properly be dealt with as a clause in the "General Conditions of Contract" or "Agreement."

It may, however, be observed that the system of payment at a price "per pipe or casting" is the simplest, and entails no calculation as to the deduction to be made for individual pipes or castings being heavier than the maxima weights specified, while all light-weight pipes would be rejected upon inspection.

Casting Pipes

The enquiry showed that many current specifications provided for the heating of both the pipes before coating, and the composition itself; to unsuitable temperatures, such as would volatilize the lighter oils, and thus continuously change the consistency of the composition.

Marking and Weighing

Provision is made for using standard forms of identification markings, including the brand mark of the Engineering Standards Committee, and for weighing and registering the weights of all pipes and castings.

Makers' Certificate

To meet cases where pipes or castings are bought from stock, or where the purchaser does not employ an inspector, provision is made for the issue, upon demand, of the Makers' Certificates, based upon the tests of the iron from which the batch of pipes was cast, and upon the hydraulic test applied to each pipe.

The circular and bolt-hole dimensions of all flanges are to follow the existing Standard Flange Specification, which is in general use by engineers and valve-makers; while the thicknesses are arranged in two classes, AB and CD, and set out in the specification.

Provision is made for the machining of all flange faces, and of the sockets and spigot-ends of turned-and bored pipes. The taper on the latter has been fixed after careful enquiry, it having been found that if this is too steep the pipes rebound rather than make a good fit when driven up at the time of laying.

Arbitration

Matters in dispute, arising out of the specification, are to be the subject of arbitration, by a single arbitrator, to be agreed upon between parties or, failing agreement, appointment by the Chairman of the Engineering Standards Committee for the time being.

Tables

The specification is accompanied by 14 tables showing (a) The dimensions and weights of each size and class of pipe; (b) The dimensions of each size and class of socket and spigot for pipes and specials; (c) The dimensions of standard flanges, and (d) The form and dimensions of 1/4, 1/8, 1/16 and 1/32 bends, tees, 45° branches, enlarging and reducing tapers and collars.

In order to limit the number of standard tapers, differences in the diameters of the ends have, in general, been restricted to 2 in., and where greater differences have to be provided for, the tapers will have to be used in combinations of two or more castings.

St. Lawrence River Power Development

Dominion Government Requests Co-operation of United States in Comprehensive International Scheme

WITH the return to a peace basis, the Dominion Government will, it is understood, take up the question of joint development with the United States of the St. Lawrence River water powers. A comprehensive scheme has already been tentatively submitted in its broad outlines.

Surplus power generated and not needed in Canada would be exported to the United States under treaty arrangements permitting of its return when required on this side of the international boundary.

One phase of the scheme would entail the practical abandonment of the present canal system of the St. Lawrence, it is said, as the result of a deeper waterway by means of dams.

International Action Urged

International development of St. Lawrence water powers was urged on the government of the United States when the application of the St. Lawrence Power Co. was before the International Joint Commission. It was represented to Washington that the endeavor should be to design at the outset a complete scheme into which successive developments might be fitted from time to time. But in such a scheme, it was pointed out, there was always present the great danger that the ultimate possibilities of St. Lawrence navigation might be neglected or irreparably injured. "On the other hand," reads an order-in-Council passed at the time, "it is certain that the subordinate and incidental but important use of these international boundary waters for power purposes can never be rendered as efficient and productive through a policy of simply permitting a haphazard series of unrelated private enterprises as through a carefully considered and comprehensive scheme of development carried out under public auspices by the two countries; and obviously it is only by agreement and concerted action between the two countries that such development can be undertaken."

Now that the armistice has been signed and there is no longer any need for intensive aluminum production for the building of aeroplanes, there is no longer any valid international reason for the installation of the submerged weir in the St. Lawrence River. But the International Joint Commission gave permission for this weir for the period of the war or for five years, whichever might be the longer. That war is over before the weir is half completed does not affect the company's right to the weir until the end of the year 1923, says a government official who is in close touch with the work. If it be found that the weir is actually in the way of any larger international development within the next five years, the company may be persuaded to remove it upon being compensated for part of the expenditures involved in its construction. It is thought that by restricting the flow of water through the company's canal, and by other measures, the two governments could easily persuade the company "to be reasonable" at any time.

That the International Joint Commission is keenly alive to the fact that public sentiment is against granting any permanent rights to the company is shown by a booklet just issued by the Commission. This booklet contains the text of the Commission's interim order and a long legal opinion upon same by P. B. Mignault, K.C., one of the Canadian commissioners. Discussing the scope of the order of approval, Mr. Mignault says:—

"The principle which dominates the order of approval granted by the Commission is that the construction of the submerged weir is approved merely for a term of five years or until the termination of the present war, whichever shall last occur. The order of approval is adopted 'as an interim measure,' and the Commission does not, at the present time, finally decide the question whether it should approve of the construction and permanent maintenance of the weir. In other words, following the practice of courts familiar to all lawyers, an interim order is made, and the whole question of the right of the applicant to construct and maintain the weir is not finally passed upon. The question therefore remains an open one, and no right of any government or interest to object to the weir as a permanent structure is affected by the order of approval.

No Further Order Needed

"The order goes further and obliges the applicant to remove the weir at the expiration of the period specified. By constructing it under the terms of the order, the applicant accepts this condition, and without any further order of the Commission is bound to remove the weir. There does not seem therefore to be any ground for the fear expressed by Hon. Mr. Guthrie, in his argument before the Commission, that 'if it goes in, it will never come out,' for it must come out unless the Commission, on a new application, and after hearing all parties interested, allows it to be maintained. The removal of the weir, at the end of the term fixed, is not even conditioned on the reimbursement to the applicant of the moneys it has expended in constructing it. In other words, if the applicant builds the weir, it can only build it as a temporary structure, and must remove it unless a new order is obtained from the Commission, and if the company applies for a new order, the whole question of its right to place an obstruction in the South Sault Channel will be examined anew as if this order of approval had never been granted.

War Department's Proviso

"It is to be further observed that the applicant is identically in the same position should the Secretary of War of the United States order the removal of the weir. The permit of the War Department contains the express condition, 'that if future operations by the United States require an alteration in the position of the structure or work herein authorized, or if, in the opinion of the Secretary of War, it shall cause an unreasonable obstruction to the free navigation of said water, the permittee will be required, upon due notice from the Secretary of War, to remove or alter the structural work or obstructions caused thereby without expense to the United States, so as to render navigation reasonably free, easy and unobstructed; and if, upon the expiration or revocation of this permit, the structure, fill, excavation or other modification of the water-course hereby authorized shall not be completed, the permittee at his own expense, and to such extent and in such time and manner as the Secretary of War may require, shall remove all or any portion of the uncompleted structure or fill and restore to its former condition the navigable capacity of the water course. No claim shall be made against the United States on account of such removal or operation.'

"Mr. Gordon, in his argument before the Commission, stated that if the company does not remove the structure within the time specified by the Secretary of War, it would be liable to a fine of $5,000 a day. Looking at the matter from any viewpoint, it is clear that the applicant acquires no vested right by virtue of the order of the Commission, and the condition imposed by this order is even more rigorous than that contained in the permit issued by the Secretary of War, for the expiration of the term specified, without any further order of the Commission, compels the applicant to remove the weir.

Rights Carefully Safeguarded

"As a matter of fairness, however, and because the order of the Commission is a mere interim measure, this order reserves to the applicant or any other interested party the right to apply to the Commission, at least one year before the expiration of the period specified, for a further continuance of the submerged weir. It will make this application without having acquired any vested right by reason of the present order, and then the Commission may approve of such continuance on such terms and conditions as it may deem appropriate and equitable for the protection of the rights and interests of the people on both sides of the line in accordance with Article VIII of the Waterways Treaty. It is not easy to see how the rights of the people in both countries could be more carefully safeguarded, and if, on such application, the continuance of the weir is not allowed, the applicant will be obliged to remove it."

The Webster-Ashburton Treaty

The main contention of the Canadian Government and of the other interests opposing the application was that Article VII of the Webster-Ashburton Treaty of 1842 is an absolute bar to the construction of the proposed weir in the South Sault channel. This article is in the following terms:—

"VII.—It is further agreed that the channels in the river St. Lawrence on both sides of the Long Sault islands (Croil island was then called 'Upper Long Sault island') and of Barnhart island, the channels in the river Detroit on both sides of the island Bois Blanc, and between that island and both the American and Canadian shores, and all the several channels and passages between the various islands lying near the junction of the river St. Clair, with the lake of that name, shall be equally free and open to the ships, vessels and boats of both parties."

On the one hand it was contended that this provision absolutely prevents the construction of the proposed submerged weir, and on the other hand, while there was some discussion as to the exact meaning and effect of Article VII, the chief contention was that this article has been superseded by the provisions concerning navigation of the Waterways Treaty, and is no longer a binding enactment.

"It is needless to say," states Mr. Mignault, "that the legal problem thus submitted to the Commission is an extremely important one. Without any idea whatever of reflecting in any way on the arguments of counsel, it may be added that this question should be most exhaustively argued, and that before deciding it the Commission should have ample time for full consideration.

"Neither of these requirements has been available to the Commission. The arguments of counsel—probably on acount of the very magnitude of the interests involved and the many questions of fact arising out of the testimony, and also on account of the number of those who desired to be heard—did not deal exhaustively with this question. Giving the fullest possible effect to Article VII of the Webster-Ashburton Treaty, it still remains to determine whether the words 'free and open' have the absolute and unqualified meaning contended for.

No Time for Full Consideration

These words are used in other provisions of the same treaty, especially in Article II where it is stated that 'all water communications and all the usual portages along the line from Lake Superior to the Lake of the Woods, and also Grand Portage from the shore of Lake Superior to the Pigeon River, as now actually used, shall be *free and open* to the use of the citizens and subjects of both countries.'

"These words are also used in the Treaty of Washington of 1871 as to the navigation of the River St. Lawrence, from the forty-fifth parallel of north latitude to the sea, and this is a treaty right secured by the citizens of the United States. Would it be contended that the closing of the Rainy River at International falls for power development, which has been done, or of the St. Lawrence River at the Lachine rapids, where an alternative navigation route exists via the Lachine canal, would be a violation of treaty rights? And there is further question whether the High Contracting Parties in 1909, did or did not, by the navigation provisions of the Waterways

Treaty, extending to all navigable boundary waters as defined by this treaty,—and the South Sault channel is a navigable boundary water—supersede or at least absorb the prior and incomplete navigation provisions of the Webster-Ashburton Treaty of 1842. It is sufficient to simply state these questions to show that they should not be hastily decided, but only after the most exhaustive argument and the fullest consideration.

"Time was wanting for this full consideration. A sudden emergency had arisen. The Secretary of War of the United States, in a letter dated August 23, 1918, and addressed to the Commission urged that the permit he had granted to the applicant be approved. He stated that 'the War Industries Board is apprehensive that the supply of aluminium will not be adequate for the requirements of the Government and of our Allies, and is therefore wisely encouraging the increase of output. The War Department is, I need not say, vitally interested that there shall be at all times an adequate supply of this product to meet the requirements of our military program and the program of our Allies.'

"The uncontradicted evidence showed that this weir had to be immediately commenced, and that if the authority to construct it should come later than the 15th of September, it would be very doubtful whether it could be completed this year. Under these circumstances the Commission had to take the responsibility of acting immediately so as to cope with this sudden and very urgent emergency. It is confident that while discharging its duty so as to fully provide for this emergency, it has so framed its order of approval that no rights of either country or of any of its citizens can possibly be jeopardized by its action."

GENERAL PHASES OF STREET CLEANING*

FROM the economic or theoretical engineering side we should know whether we are cleaning streets for public convenience, for aesthetic reasons or for protection of the public health; or otherwise for what definite purposes these expenditures are made.

Undoubtedly the primary reason for street cleaning is for the promotion of public comfort or convenience. The annoyance of dust to the users of the highway and to those adjacent, as well as damage to property, may well be considered primary, especially if coupled with its wet condition as mud.

The second consideration, the aesthetic, may well have its weight, especially in elimination of rubbish, waste paper and larger debris which so offend our sense of propriety, but have little bearing on either health or comfort.

Clean Streets and Health

The third consideration, that of health, may be one which should warrant extensive and expensive work in this line. The Street Cleaning Committee of the American Public Health Association, Samuel Whinery, chairman, in its report of about two years ago, after diligent inquiries and collection of practical evidence, strongly inclined to the opinion that, while theoretically there might be much danger from unclean streets, from the health viewpoint, there was little or no positive evidence of such. This opinion was largely based on lack of definite information that those engaged continuously in street cleaning and similar work suffered any ill effects from what might be considered an abnormal or excessive exposure to those conditions supposedly deleterious to health from street dust and similar influences. At least one member of your committee, from experience with local spring and fall epidemics of influenza and bronchial affections when street cleaning in northern cities is interrupted, is firmly of the opinion that the consideration of health may be well ranked as the most important factor in determining the extent of such work. Lacking, as yet, any definite conclusive evidence, it may now be assumed that cleaning, such as to remove fine dust and mud which may cause such, offers a reasonable task in street cleaning for comfort and health. The aesthetic considerations in removal of unsightly litter, unless the same be considered a source of dust by pulverization, may be given consideration to the extent which the locality may warrant in expenses.

The change from dry to wet methods of cleaning, now so increasingly evident, has a material bearing on the above considerations.

Use of Motor Vehicles in Street Cleaning

From the practical or operative end of street cleaning two phases stand out prominently as modifying practice; the substitution of motor vehicles for animal power and of flushing for dry sweeping.

The use of motor vehicles both for actual cleaning and for collection and hauling of municipal waste is but a phase of the general and increasing use of such vehicles, and must largely be a local question of economics, dependent in desirability of change from horse-drawn vehicles, upon loss of investment in existing equipment, length of haul, available funds and other local conditions. Apparently all plans for future development should contemplate the large ultimate use of motor vehicles.

The same change to serviceable motor vehicles has largely increased the practicability of flushing in cleaning. There were certain limitations to obtaining and maintaining adequate flushing pressure in horse-drawn vehicles.

In many cities the functions of street cleaning and sewer cleaning or sewage disposal are under somewhat separate supervision, and where such is the case there may well be required closer joint study of the problem as a whole for ultimate economy. Where no systematic gutter cleaning follows flushing, either the heavy street detritus is left in the gutters or is flushed into catch basins, and much of it ultimately into the sewers. We may, therefore, well bear in mind that this successful cleaning method may demand some modification in catch basin practice for protection of sewers. In combined sewerage systems we may reasonably expect some added expense in sewer cleaning, but where ultimate sewage treatment is given or required, as it soon will be in many cities, the question of the effect of the added burden on the detritus tanks or on the general operation of the whole plant must be given close study.

Dry Cleaning Also Expensive

One engineer of a large city says: "Cities having sewage disposal works find that the detritus from the streets somewhat complicates the question of sewage disposal. All of it cannot be handled in detritus chambers, except at very great cost." While such cost may be a material added burden to sewage treatment it is equally true that the cost of gutter sweeping or the dry removal of street dirt is a very large expense in dry street cleaning, and the engineering determination of an absolute combined minimum in expense presents one of those nice problems which we must solve. The solution is only possible

*From report to American Society of Municipal Improvements, by G. H. Norton, Rudolph Hering and R. C. Harris.

through the collection of complete data and careful analysis. This would seem to offer an early and fertile field for study.

Snow Removal

One other phase of street cleaning is of especial interest to the northern cities—that of snow removal, in connection with use of motor vehicles.

In case of heavy snow falls, usually the first streets opened to traffic are those containing surface car tracks, and the northern cities are mostly equipped to keep their tracks clear. The result is that motor vehicle traffic is at once diverted to these streets with resulting congestion and delay in traffic. The universal use of motor vehicles for all classes of traffic warrants the provision for its accommodation, and cities must be equipped and ready to keep thoroughfares open for this traffic while snow is falling and afterward to make viable streets.

Often the motor equipment provided for other phases of cleaning is most applicable and available for this work, and any consideration of motorizing in these northern cities should include the use and availability of such in solving the snow problem.

Collection and Disposal of Rubbish and Garbage

The collection and especially the disposal, of rubbish and garbage, has been materially effected by war conditions.

The demand for utmost economy in these trying times has made it evident to cities not fully utilizing these sources of saving that they are to an extent wasting; that much of the various materials which would be of service to the cause are being wasted. But this has been so thoroughly impressed on the public that the individual economy in saving paper, rags and metals, and especially in squeezing the plethoric American garbage can, has most materially affected the various plants in operation for these purposes. The general individual saving and sale of rags, waste paper, etc., and more particularly, the very general elimination of grease content from garbage, make any studies of operation of these plants under present conditions of little comparative value unless we assume that the American public has learned lessons of economy which may be enduring.

More than a word of caution therefore should be given to those who may now study past and even present quantities and recoverable values in refuse that neither may safely be used for estimates of the future. No one can predict how far our lesson of economy under trying war conditions may be remembered or practiced under a return to what we may hope will be a condition of happy prosperity.

RECOVERING FROM LIQUIDATION

Despite the falling off of construction work caused by the war, the firm of Mussens, Ltd., Montreal, which has been in liquidation since March, 1915, has up to date repaid 80 per cent. of its total liabilities, and,—according to a circular letter issued by W. H. C. Mussen, president of the firm,—it will be a matter of but a short time when the firm will repay the remaining 20 per cent. and the liquidation proceedings will be terminated.

This will be very good news to Mr. Mussens' many friends throughout Canada, who never lost their faith in his ability to pay his creditors one hundred cents on the dollar.

With the boom in construction business which is anticipated after the war, Mussens, Ltd., will no doubt again occupy the high place among machinery and equipment firms which they held before the war.

REINFORCED CONCRETE SEA-GOING CARGO STEAMERS NOW BEING BUILT IN GREAT BRITAIN*

By T. G. Owens Thurston

WHEN in April, 1914, I had the honor of reading before this Institution a paper on "Some Questions relating to Battleship Design," I would never have imagined that my next contribution would be on the construction of ferro-concrete ships. For years past one has heard of the construction of small vessels or barges of ferro-concrete, but these were never of sufficient size or importance to warrant closer investigation, and the whole subject appeared to be one that could safely be ignored so far as ocean-going ships were concerned.

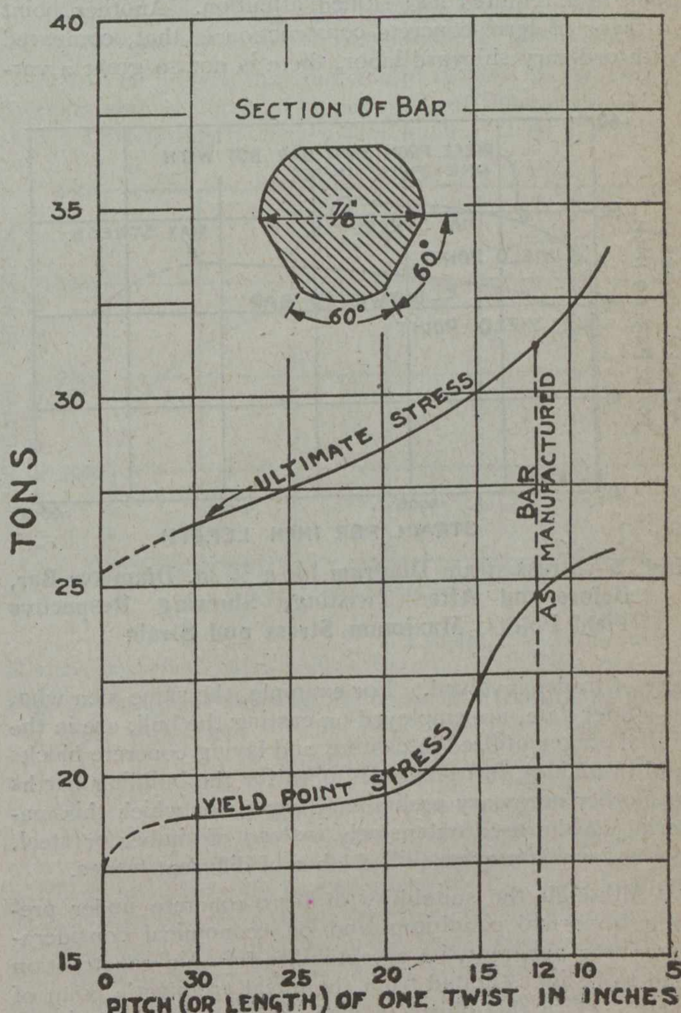


Fig. 1—Curves Showing Comparison between Rates of Increase of Yield Point Stress and Ultimate Stress for a 7/8 in. Diameter Bar, By Actual Test, of Piece Cut from Same Bar, but with Different Length of Twist

The enormous losses of cargo-carrying ships during the war, coupled with the great scarcity of steel for shipbuilding on account of the diversion to other uses, have made shipbuilders endeavor to find some other material to replace steel for ship construction, even if only as a temporary measure; in this particular direction, shipowners have perhaps been really more progressive in their ideas

*Extracts from paper presented at Spring Meeting of the Institution of Naval Architects, London, Eng.

than the shipbuilders. It was largely owing to shipowning friends of mine, who recognized the disastrous effect which the immense losses of mercantile tonnage would eventually have on the country, that steps were taken which led to the inception of the design and construction of the ships forming the subject of this paper. Without knowing anything as to the merits of ferro-concrete for shipbuilding purposes, they considered that if small craft had already been built with such material it was worth a trial, under present conditions, in larger ones, and after much consideration and investigation of the work previously done in this direction the author finally agreed with them.

The system of construction calls for a minimum amount of steel and a minimum amount of skilled labor. Such construction also reduces capital expenditure on yard plant, as it is much less costly than ordinary shipyard plant and requires less skilled attention. Another point in favor of ferro-concrete construction is that, compared with ordinary shipyard labor, there is not so great a variety of trades involved. For example, the same men who, at a later date, are employed on casting the hull, are in the initial stages utilized in casting and laying concrete blocks and in making ferro-concrete piles for the building berths and other necessary preliminary work, for which this material can be used extensively instead of timber or steel, both of which require skilled labor of different trades.

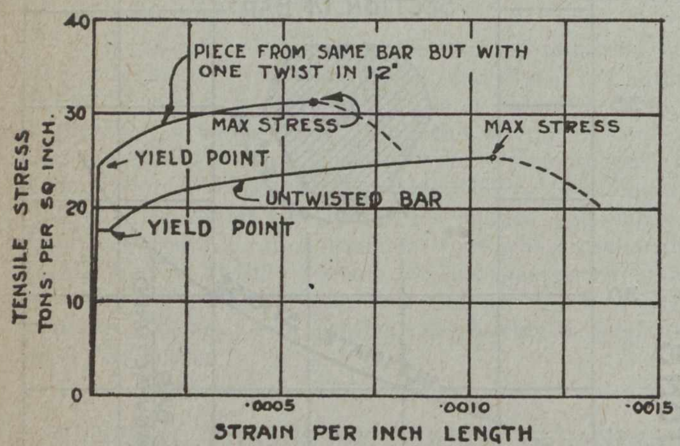


Fig. 2—Stress-strain Diagram for a ⅞ in. Diameter Bar, Before and After Twisting, Showing Respective Yield Points, Maximum Stress and Strain

Although the suitability of ferro-concrete under present abnormal conditions and on economical considerations was apparent, its acceptability for ship construction had to be investigated from the naval architect's point of view. With this object in view, we decided to design a sea-going cargo vessel of reasonably large dimensions, to assure ourselves that such a vessel, constructed of ferro-concrete, would satisfy conditions of strength, seaworthiness, deadweight capacity, etc. The difficulties in preparation of the design proved much greater than was anticipated, for whilst we, as shipbuilders, could prepare and supply the particulars and drawings of the vessel and approximate to the maximum stresses coming on the various members, we had no practical experience of the construction of the ferro-concrete part of the hull, so that it became necessary to work in conjunction with a reliable firm of ferro-concrete engineers, who would carry out this part of the design, basing it on work actually done. This association of shipbuilders and ferro-concrete engineers has proved mutually satisfactory and advantageous, and each party found that it had something to learn from the other with respect to shipbuilding of this type.

It was eventually decided that a self-propelled cargo vessel of about 1,150 tons deadweight was as large as we were justified in commencing as a first venture. It was agreed that the vessel should comply with all the requirements obtaining for steel vessels, and the general scheme was based on that of a similar ship constructed of steel. The dimensions, for reasons which occurred in preparing the design, differed from those of a steel ship of the same deadweight carrying capacity, especially in length. The dimensions and other particulars finally decided upon were as follows:—

Length between perpendiculars ..	200 ft.
Breadth moulded	32 ft.
Depth moulded	19 ft. 6 in.
Draught when loaded	15 ft. 6 in.
I.H.P. (about)	400
Speed (about)	7¾ knots.

The various arrangement drawings were prepared and scantlings arranged in accordance with Lloyd's Rules for Steel Ships. Using these scantlings, a list was made up of the calculated section moduli of the various members. Upon these particulars the engineers prepared constructional sections, on the principle of "equivalent strength," which were adopted as a basis of calculation of weights, etc.

Lower Centre of Gravity

The design was then carefully reconsidered and calculations made as far as possible for the stresses which the vessel would be subjected to, both longitudinally and transversely, under all reasonable conditions of construction, launching, and service.

One of the first things observed in the case of the ferro-concrete hull was that the centre of gravity of the structural material worked out much lower than in the case of a steel hull, the result being a greater metacentric height than was desirable. To minimize this, the original beam of 34 ft. was reduced to 32 ft., and in order to obtain the same hold capacity the depth was increased from the original 17 ft. 6 in. to 19 ft. 6 in., fortunately, from the point of view of longitudinal strength, a modification in the right direction.

Longitudinal Strength

In calculating longitudinal stresses the vessel was first of all assumed to be in still water with the holds loaded uniformly to the full-load condition, giving a displacement of 2,350 tons. In this condition the maximum bending moment worked out at about 4,100 foot-tons. For hogging stresses the vessel was taken as being in the same load condition and on the crest of a trochoidal wave of length equal to the length B.P. of vessel, and height equal to $\frac{\text{Length}}{20}$, giving a maximum shearing force of 180 tons and a maximum bending moment of 10,000 foot-tons.

In the sagging condition the vessel was much more severely loaded, three-fifths of the cargo being placed in the middle of the hold space, and one-fifth at each end respectively, resulting in a maximum shearing force of 180 tons and a maximum bending moment of 7,000 foot-tons.

In the case of launching, the maximum shearing force reached as high as 220 tons, with a maximum bending moment of 10,000 foot-tons. A generous margin was allowed over these figures, and the vessel was designed to stand the stresses corresponding to the following:—

$$\text{Hogging moment } \frac{\text{Displacement} \times \text{length}}{35} = 13{,}500 \text{ foot-tons}$$

$$\text{Sagging moment } \frac{\text{Displacement} \times \text{length}}{48} = 10{,}000 \text{ foot-tons}$$

$$\text{Shearing force } \frac{\text{Displacement}}{9.8} = 240 \text{ tons.}$$

the structural material being arranged so that the tensile stress on the reinforcement, taking account of all local stresses, never exceeded 9 tons per square inch, and the maximum compressive stress on the concrete 750 lbs. per square inch.

Transverse Strength

In calculating transverse strength, the transverse framing was analyzed in order to ascertain the maximum bending moment to be resisted by the floors, frames, and beams under the various systems of loading to be met with in service.

The conditions assumed, for which calculations were made, are as follows:—

(1) Vessel, without pillars, loaded to deep draught in still water. Cargo load in hold and on deck.

(1*a*) Vessel, with two pillars fitted, one at each side of hatch opening, loaded to deep draught in still water as in condition (1).

(2) Vessel, with two pillars fitted, loaded as in (1), and situated on wave crest, with no cargo on floor girder.

(3) Vessel, with two pillars fitted, loaded and situated in wave hollow with full cargo, load centrally placed below hatches and no deck cargo.

(4) Vessel, with two pillars fitted, in light condition, in dry dock, docked on centre keel.

The calculations were investigated on the "principle of least work," taking the reinforced framing as monolithic.

In the moment as calculated there has been taken into account the stresses in the framing where only a partial support is received from the pillaring through the medium of longitudinal girders spanning between the transverse frames. The scantlings of the framing have been proportioned to the more severe conditions met with at the centre of floor girders, bilge, side frame, deck corner and beam.

As a basis for calculation of strength, the following were adopted as working limits for safe stresses on concrete and steel:—

Concrete

Item.	Working Stress, lbs. per sq. inch.	Ultimate Stress, lbs. per sq. inch.
Compression in beams	750	4,000
Compression direct	700	4,000
Shear	70	280
Adhesion	60	240
Adhesion	100	500

Steel

Item.	Working Stress, tons, sq. in.	Elastic Limit, tons, sq. in.	Ultimate Stress, tons.
Tension, spiral bars	9	23½	30-36
Tension, plain bars	7½	15	27-30
Compression	7½	15	27-30
Shear	5½	..	24

Particulars and Description of Hull

Particulars are given of a ferro-concrete, a steel and a wooden ship, each designed for a deadweight carrying capacity of 1,150 tons, as follows:—

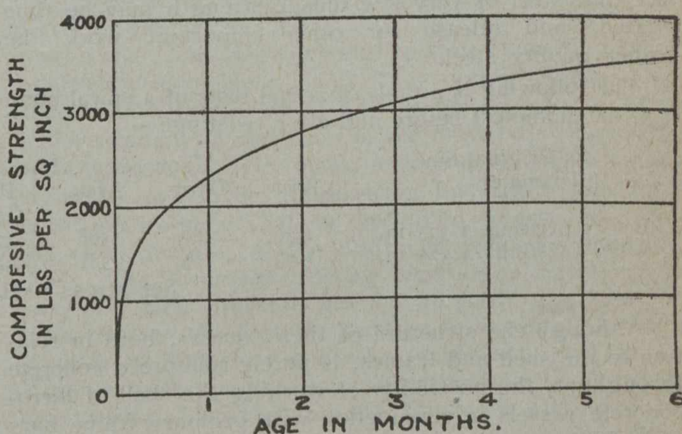
	Reinforced Concrete.	Steel.	Wood.
Length	205 ft. 0 in.	188 ft. 0 in.	205 ft. 0 in.
Breadth	32 " 0 "	30 " 3 "	36 " 0 "
Depth	19 " 6 "	17 " 3 "	18 " 9 "
Draught	15 " 6 "	14 " 6 "	16 " 6 "*
Deadweight	1,150 tons	1,150 tons	1,150 tons
Displacement (load)	2,350 "	1,800 "	2,400 "
I.H.P. (about)	400	400	400

Weights.

	Reinforced Concrete.	Steel.	Wood.
Steel in hull†	190	445	140
Remainder of hull	860	80	960
Machinery and boilers	80	80	80
Outfit‡	70	45	70
Deadweight	1,150	1,150	1,150
Load displacement	2,350	1,800	2,400

*Includes 12-in. wood keel.
†Includes hull castings and forgings.
‡Includes anchors, cables, boats, auxiliary machinery, etc.

It will be noticed that the weight of steel in the ferro-concrete ship is about 42½ per cent. of that in the steel ship. This is not by any means such a large reduction



	Cement.	Sand.	Aggregate.
Mixture (by volume) of concrete used.	1.0 :	1.2 :	2.4

Fig. 3—Diagram showing Increase of Strength of Concrete with Age

as some writers on ferro-concrete ship construction have anticipated, nor is it probably the minimum quantity which should be adopted, had we been prepared to incur a certain amount of risk in structural strength. In view, however, of this being our first venture in a new method of construction, we did not feel justified in reducing the strength until we had ascertained from experience how a ship constructed on this principle would act under ordinary conditions of service. One reason was that, should the vessel prove weak, it would be a matter of the utmost difficulty to introduce additional stiffness and strength. A second and even more potent reason was that we were not justified in risking the safety of the ship or the lives of the men who might navigate her, for the purpose of endeavoring in the first ship to reduce the quantity of steel that might be used to the minimum. Actual service will perhaps give an indication where weight may be saved, either in the steel or concrete of the hull; and that such saving will ultimately be effected, even with identical methods of construction, we confidently anticipate. It must not be overlooked that the saving of steel effected, especially under present conditions, is of the greatest importance. If we take, say, 200 vessels similar to the one under discussion, we should have an additional carrying capacity of 230,000 tons added to our mercantile fleet, whilst there would be a total saving of 51,000 tons of steel as compared with a similar number of steel ships of equal carrying capacity. Moreover, this steel is worked in the form of reinforcement rods and is not dependent upon the plate rolling mills for its production. This is the more important, as at the present moment it is largely the limited output of the rolling mills which adds to the difficulty of procuring an adequate amount of shipbuilding steel.

We came to the conclusion that the most economical as well as the most efficient rod for ship construction was that known as the spiral bond bar. This is an ordinary mild steel bar, which subsequent to being rolled is stressed by being twisted in such a manner that the elastic limit is raised about 35 per cent., the twist in the bar giving it at the same time a continuous mechanical bond with the concrete in which it is imbedded. With this high elastic limit smaller sections may be employed than would be possible with any ordinary mild steel bar, which means a reduction in weight of steel used. As the continuous mechanical bond justifies shorter overlapping of bars at junctions, the weight of steel is again reduced. A further advantage of the special twisting treatment lies in the fact that steel of very low tensile strength may be thus treated, and release for other important work the higher quality steel.

The following is a table of actual tests of a spiral bond (1⅜ in. diameter) before and after twisting:—

Original Size. Diameter.	Area.	Contraction of Area. Diam.	Area.	Per Cent.	Elongation in 8 in. Inches.	Per Cent.	Ultimate Stress. Actual Tons.	Tons per sq. in.	Elastic Limit. Actual Tons.	Tons per sq. in.
Before twisting, 1.375 in.	1.39	.88	.568	59.2	10.40	30.0	37.4	26.9	24.5	17.62
After twisting, 1.375 in.	1.39	.89	.581	58.2	9.68	21.0	41.3	29.7	33.2	23.86

See stress-strain diagram, Fig. 2.

Although the structure of these vessels, both in relation to the shell and frames, is purely reinforced concrete throughout, the possibility of working the shell of ferro-concrete vessels in conjunction with ordinary frame bars or built-up frames has not been lost sight of, although the problems attendant on such a departure from a purely monolithic structure present difficulties. It is conceivable that a vessel might be satisfactorily constructed in which the ordinary steel frame is used in conjunction with the present system of reinforced concrete hull, and in the United States they appear to have adopted some such method. With our present knowledge there would appear to be in this connection an element of danger unless a system is used, blending together the parts in such a way as to leave no possible chance of disruption. The experience gained by American builders in this respect may help to solve this difficulty, as the principle, if successful, appears to be well worthy of adoption. It may indeed be essential in ferro-concrete ships of large tonnage. Such a system, too, would overcome some of the difficulties in connection with the fitting of various details, which, at present, it is necessary to arrange for before the concrete portion is commenced. A further advantage, and probably the principal one, is that without having to introduce a much greater proportion of skilled labor, the system would result in a decreased weight of hull.

Hull Fittings and Their Connection

Many problems have arisen regarding fittings and their connection and relation to the ship, which in ordinary steel construction are simple, but which, in the case of ferro-concrete construction, offer difficulties which have had to be carefully examined and overcome. Amongst these are the openings in the ship's bottom, stuffing boxes, the passage of pipes through bulkheads, the connection of fittings to the bulkheads, and the connection of stanchions, fairleads, bollards, etc., to the deck. Added to these are important problems, such as the connection to the hull of the rudder post, stern post, and the stern tube.

Lines and Tank Trials

It is obvious, in view of the fact that the whole of the vessel's hull has to be cast in moulds or shutters, that the simpler and straighter the lines of the vessel the more cheaply and easily the shuttering can be constructed, and the more rapidly the work can be proceeded with. For this reason, when designing the lines, a simple midship section was adopted having a perfectly straight side and bottom with only a very small curvature at the bilge. This section was retained in a parallel middle body for half the length of the vessel amidships, and the waterlines forward rounded into an easy entrance, still retaining, however, the straight-line sections. In rounding in the waterlines aft the straight-line sections were retained as far as possible and then run aft to the propeller and faired in with a minimum of curvature.

Propelling Machinery and Boilers

With respect to the propelling machinery, the considerations which have to be taken into account as to suitability of type are practically the same in ferro-concrete as in steel ships; but the method of efficiently connecting the machinery to the hull of the ship, the arrangement of the stern tubes, the special attachment to the shell of sea connections, etc., require more consideration in the former case, and great care has to be taken to ensure reliability in this respect.

In the present six boats building to this design the adoption of machinery has been largely governed by what it has been possible to obtain under existing circumstances.

In three of the vessels we are fitting compound surface condensing single-screw engines of approximately 350-400 horsepower with cylinders 17-in. and 34-in. diameter, 24-in. stroke, working at about 100 revolutions per minute.

The boiler installation consists of two cylindrical boilers 9 ft. 6 in. diameter by 9 ft. long, working at a pressure of about 130 lbs.

In the remaining three we intend fitting triple expansion engines of about 500 I.H.P., which will somewhat reduce our deadweight capacity but give an appreciable increase of speed.

Two boilers were decided upon, so that in the case of a breakdown of one there would be sufficient boiler-power in the ship to drive the vessel at a reasonable speed. When in port one of the boilers will be of sufficient power to work all necessary auxiliary machinery, including that for loading or discharging. Incidentally, there are other advantages in having two small boilers, such as the possibility of their transport by rail instead of by sea from the place of manufacture to wherever the machinery is

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Principal Contents of this Issue

WILL INTERVIEW INSTITUTION

IN the November 7th issue, *The Canadian Engineer* suggested editorially that Col. C. H. Mitchell should be requested to make representations to the Institution of Civil Engineers of Great Britain regarding recognition of the University of Toronto, Faculty of Applied Science. Under date of November 18th, Sir Robert Falconer, president of the University of Toronto, has kindly written: "After reading your editorial, I wrote to Colonel Mitchell and asked him to take steps to secure if possible the recognition of the Faculty of Applied Science on equal terms with that of McGill by the Institution of Civil Engineers." This will be good news to the engineering graduates of "S.P.S." If men of action and prestige like Sir Robert Falconer and Col. Charles Mitchell take up the cudgels on their behalf, the Institution will give them more consideration than in the past. The refusal to recognize "Toronto" is obviously a misunderstanding anyway, and we will wager that Col. Mitchell succeeds in straightening it out if he can spare the time for the job.

THE SASKATCHEWAN DRAFT BILL

THROUGH official channels, *The Canadian Engineer* some weeks ago received for publication a copy of the draft of a bill which the Saskatchewan engineers propose to introduce in the legislature of that province.

The draft was handed to *The Canadian Engineer* with the idea that its publication would call the matter to the attention of engineers throughout Canada,—all of whom are interested, whether members of the Institute or not—and so result in valuable suggestions and criticisms being forwarded to the legislative committee of the Saskatchewan Branch or to the council of the Institute.

It was published because it was of *vital* interest and great importance to every engineer in Canada, and so that every engineer might have a copy of the draft to study and criticize. It did not for a moment occur to *The Canadian Engineer* that the Institute would desire to keep the engineering public "in the dark" in regard to any of its activities, even in regard to admittedly "rough drafts" of legislation. We were therefore much surprised in reading the following editorial in the last issue of the Canadian Mining Institute's Bulletin to note the words that we have here italicized:

"In its issue of October 10th The Canadian Engineer prints a 'rough draft of the proposed bill' as prepared by the legislative committee of the Saskatchewan Branch of the Engineering Institute of Canada, for the regulation of the engineering profession in that Province. The draft has been submitted to other branches of the Engineering Institute for discussion and suggestions, and to the Council of the society for approval. It is planned that uniform legislation along these lines shall be introduced in every Province of the Dominion. The Chairman of the committee is careful to state 'that the draft is admittedly incomplete,' and 'that certain sections are capable of improvement.' This is quite obvious. There is, for example, a provision in the draft requiring qualified engineers of every class, including of course mining engineers, to join the Engineering Institute of Saskatchewan' before they shall be permitted to practice. This and other features of the draft are decidedly objectionable. *The Canadian Mining Institute is assured, however, that these proposals are not authoritative; that the publication of the draft in question in a public journal is regarded as premature and ill-advised;* and that in accordance with the existing understanding between the Engineering Institute and the Canadian Mining Institute the views of the latter will be sought and given every consideration in the framing of any legislation of the kind proposed."

In *whose* opinion was the publication of the draft bill ill-advised? To men who prize freedom of action, compulsion such as suggested by the Saskatchewan committee is most irritating. The Council of the Engineering Institute agrees that such compulsion cannot be tolerated. An official statement which has been published by the Institute, referring to these Saskatchewan proposals, says:

"The intense interest which has been aroused shows clearly that there is a feeling on the part of the average engineer in Canada that something should be done, and soon. It is evident that there never was a more opportune time for the engineering profession to come into its own than at the present moment. Both during the present war and for a long period thereafter the engineer must play a very prominent part and it is natural that he should assume the position in which the importance of the work he is doing, in a national manner, would be recognized. Whatever the form any legislation that is to be sought, may take, it must be founded on the basic principle, that, in securing the elevation of the profession, who are members of the Institute, no attempt should or will be made to insert any clause or clauses, either designed to force engineers to join the Institute or to interfere in any way with the rights of qualified engineers, who are non-members other than to give them the benefits that they as qualified engineers may gain by any legislation which may be effected, dealing with the intersts of engineers in general."

The status of engineers in Canada should be raised. *The Canadian Engineer* is naturally in hearty sympathy with every effort in that direction. But endeavors to *legislate* the desired status should be approached most carefully, discreetly and conservatively. Such endeavors should not be confused with membership campaigns of the Engineering Institute.

We respectfully submit to our readers that the publication of the Saskatchewan draft bill was not ill-advised nor premature; but that, to the contrary, it was *desirable* and *timely* in the interests of all engineers in Canada, and of the Engineering Institute of Canada, which organization is content to rest its claim for members upon its merit and will not resort to legislative compulsion.

PERSONALS

Frank M. Preston, who was recently appointed city engineer of Victoria, B.C., was born in 1881 in Penzance, England, a son of the late A. Eley Preston, M.Inst.C.E., who was formerly a member of the firm of Preston & Johnson, civil engineers, of Bradford, Yorkshire. He was educated at Rugby, afterwards taking a civil engineering course at the Armstrong Engineering College, Newcastle - on - Tyne. For two and a half years after graduation, Mr. Preston was an articled pupil to H. A. Johnson, civil engineer of Bradford, subsequently becoming chief assistant to Mr. Johnson for six years, engaging in municipal undertakings, chiefly sewerage, water supply and parliamentary work. In 1911 Mr. Preston decided to go to Canada, and was appointed assistant engineer for sewers and special work at New Westminster, B.C., where he spent two years, chiefly in the design of large combined sewerage systems. In 1915 he became connected with the city engineering department of Victoria as designing engineer to the construction department. For two years he was engaged on the design and construction of the North-West sewer. From 1915 to 1916 he was engineer in charge of sewers and bridges, and then was appointed assistant city engineer. Last September, when C. H. Rust resigned as city engineer, Mr. Preston was appointed as acting head of the department. He is an associate member of the Institution of Civil Engineers and also of the Engineering Institute of Canada, and a fellow of the Geological Society of England.

Ducane, Dutcher & Co., consulting engineers, of Vancouver, B.C., have changed the name of their firm to the General Engineering Co.

OBITUARIES

Charles R. Lavelle, secretary of the St. Mary's (Ont.) Portland Cement Co., died recently after an attack of influenza. He was 38 years of age.

William Kern Shelly, vice-president and general manager of the Tiffin Wagon Co., Tiffin, Ohio, died November 3rd at the age of 74 years. Mr. Shelly is well known among the municipal engineers of Canada on account of his earnest work in the development of modern street flushing equipment. He was actively engaged in manufacturing at Tiffin for thirty years, having been the organizer of the Tiffin Wagon Co., which he built up from a small institution, marketing a limited number of wagons, to a very large organization, building one of the largest lines of both horse-drawn and motor-driven vehicles of all sorts. Mr. Shelly was born in Washington, Ill., his boyhood being spent at Peoria, Ill. Throughout his life he was very active and just last year drove a touring car from Tiffin to Philadelphia, New York and Washington, and return.

REINFORCED CONCRETE CARGO STEAMERS

(Continued from page 458)

being installed. Further, the advantage of being able to ship the boilers through the hatchways, as leaving any part of the deck unfinished for this purpose is very undesirable in ferro-concrete ships.

The machinery is fitted aft, a usual position in this type of cargo vessel; but another reason for this was to reduce the length of tunnel; as if this were of ferro-concrete instead of steel it would form an important item of weight.

Coming next to the question of launching, this is an operation which, in the case of ferro-concrete ships, requires more than ordinary consideration and care. This operation, always fraught with anxiety, is doubly so when dealing with a vessel of ferro-concrete construction. Take, for instance, the launching arrangements for the vessel under discussion. A launching weight of 1,100 tons has to be dealt with as compared with about 550 tons in the case of a steel ship of corresponding size. To keep down the stresses, a modern declivity of ways with ample depth of water on the way ends has been arranged; but, even so, quite a considerable hogging stress and excessive way-end pressures are met with just before the stern commences to lift. Some internal shoring has to be arranged at suitable parts of the vessel as additional precautions before launching. The shearing forces at the fore poppet are severe and must be met by an adequate strength of hull.

Generally speaking, the severe launching conditions may be taken as an adequate test of the vessel's ability to withstand any stresses she may be called upon to meet under ordinary conditions of service.

Some statements should perhaps be made here as to the time for construction of vessels of this type as compared with steel ships, and our experience so far leads us to believe that in the case of the first vessel of any type, the time of construction approximates very closely to that of a steel ship, but that in building successive ships of the same size and form there will be a marked reduction owing to the possibility of using repeatedly a large proportion of the shuttering or moulds. By this means I believe that, with all the material to hand, a vessel similar to that described in this paper could be completed in three and a half to four months.