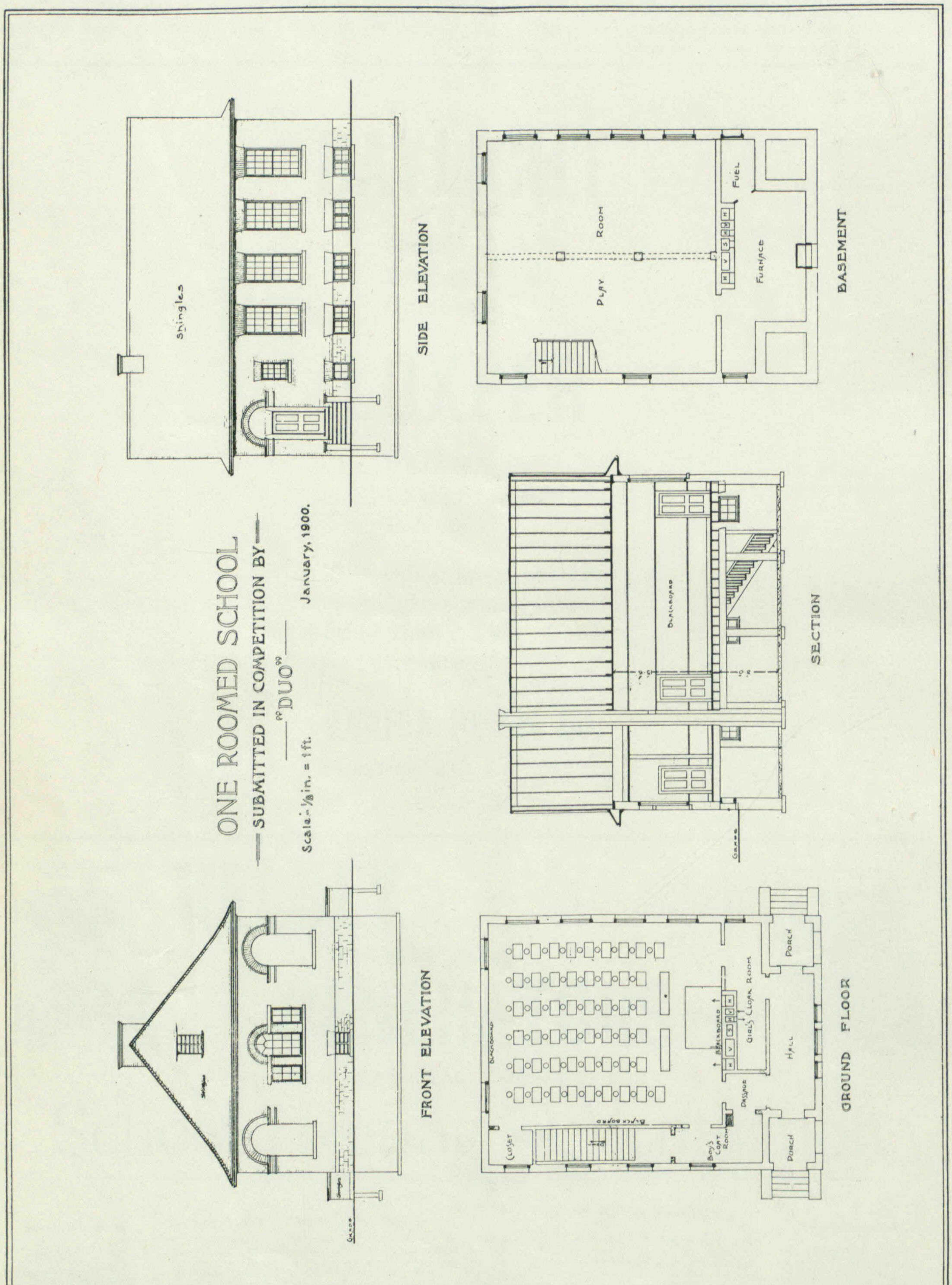
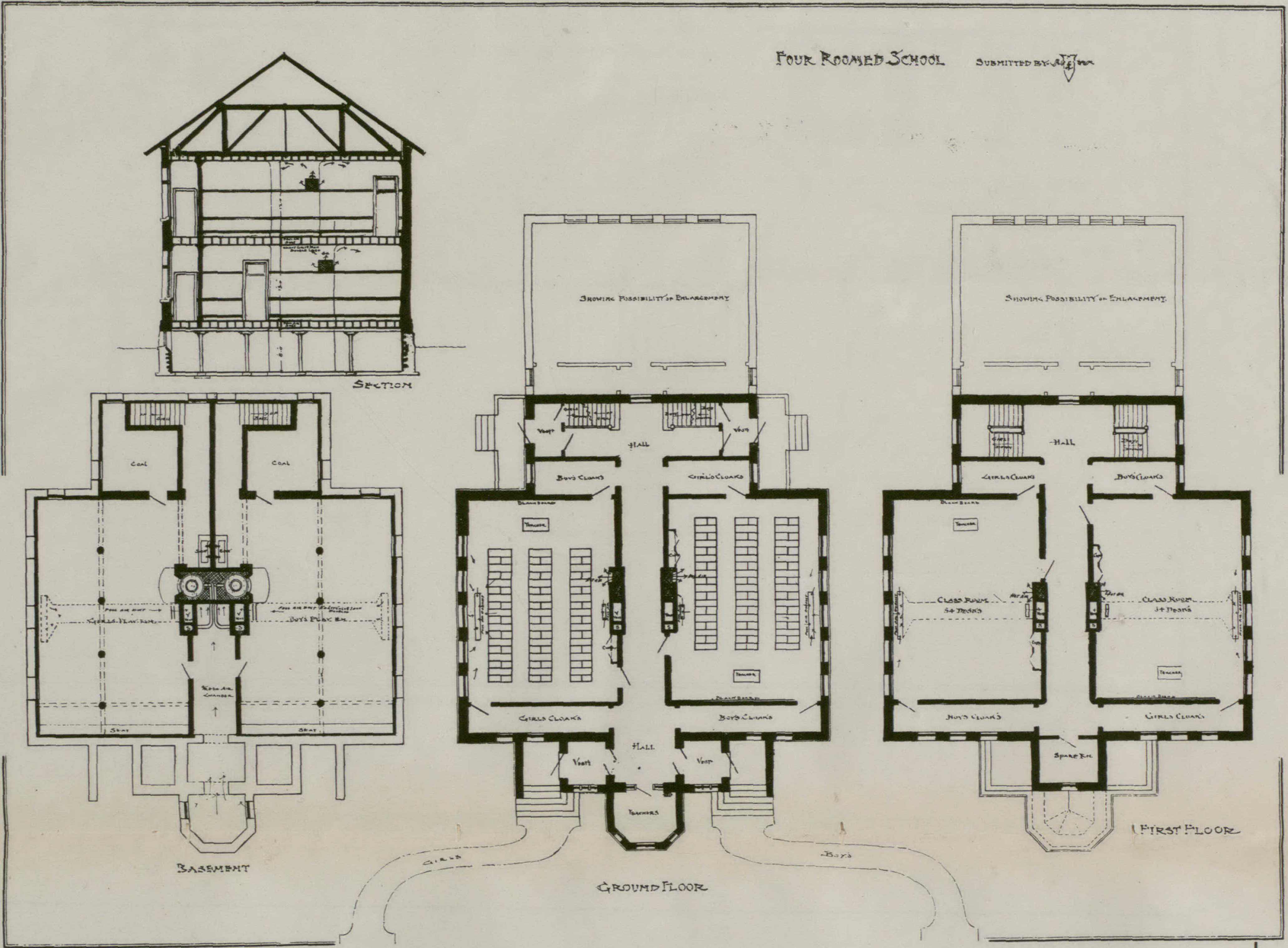
PAGES

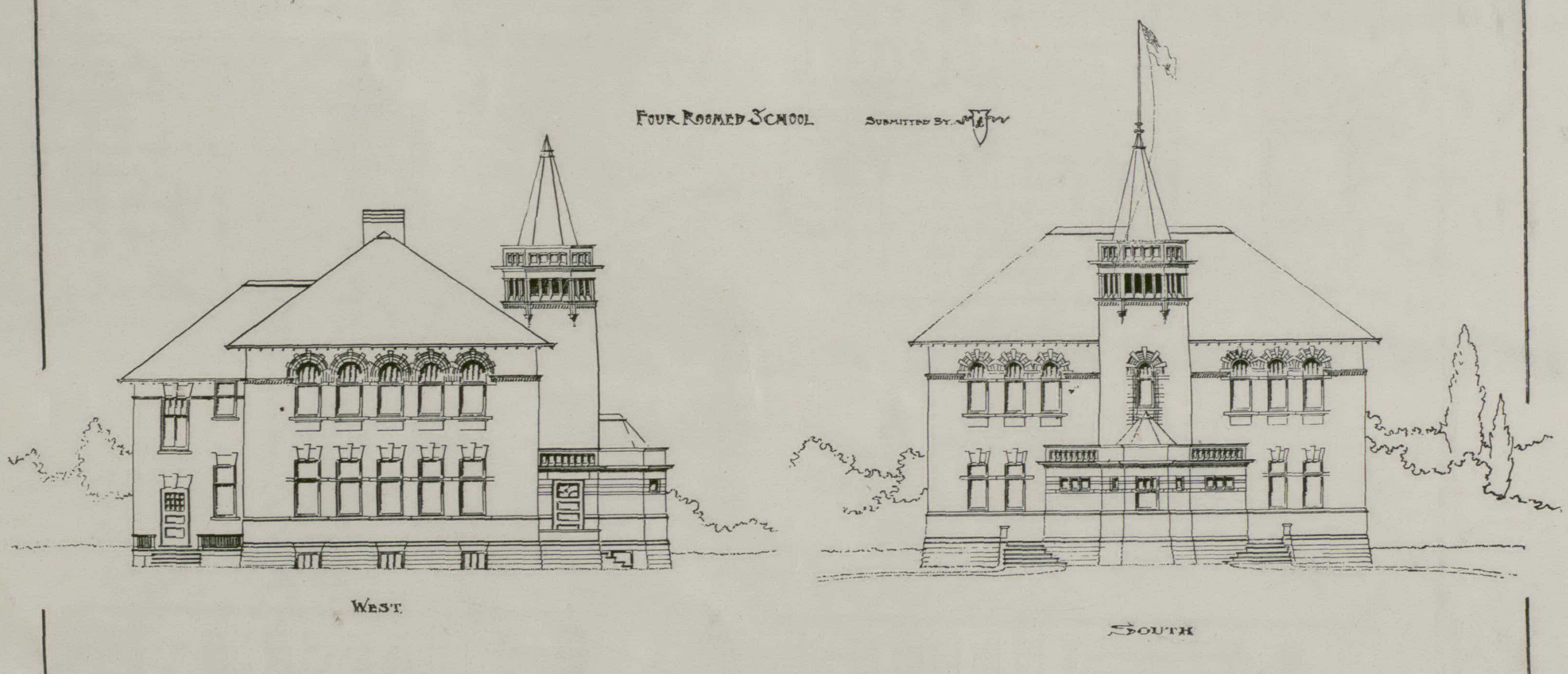
MISSING



ONTARIO GOVERNMENT COMPETITION FOR SCHOOL PLANS.—ACCEPTED DESIGN FOR ONE ROOMED SCHOOL.

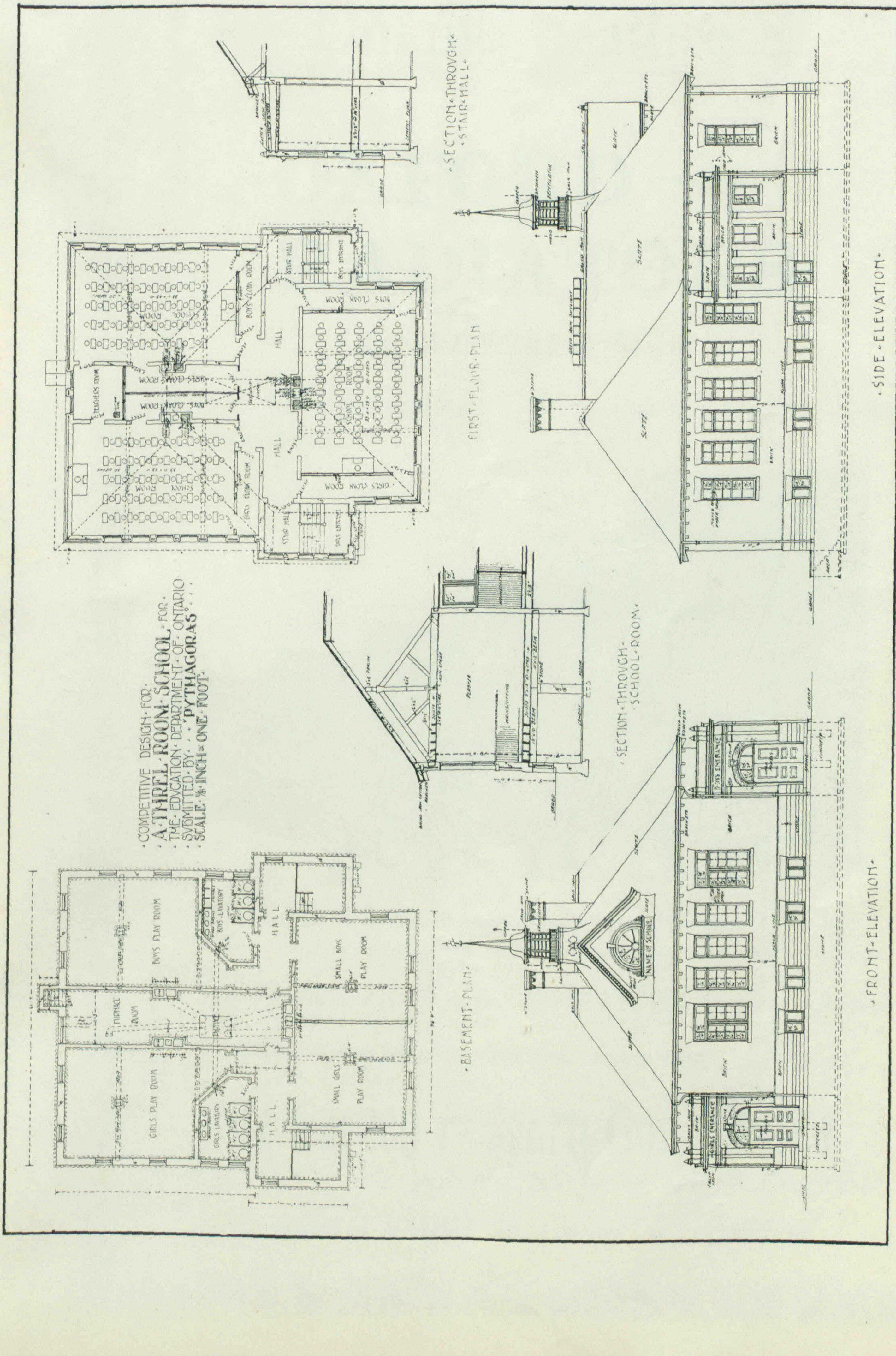
MR. HARKNESS, ARCHITECT.





ONTARIO GOVERNMENT COMPETITION FOR SCHOOL PLANS.—ACCEPTED DESIGN FOR FOUR ROOMED SCHOOL.

J. FRANCIS BROWN, ARCHITECT.



ONTARIO GOVERNMENT COMPETITION FOR SCHOOL PLANS.—ACCEPTED DESIGN FOR THREE ROOMED SCHOOL.

H. C. MCBRIDE, ARCHITECT.

ELEVATORS

Any desired capacity.

MILLER BROS. & TOMS
MONTREAL

Any service. Any motor.

BENT GLASS

MANUFACTURERS

FOR
- **Shop Fronts**
- **House Windows**
- **Show Cases**

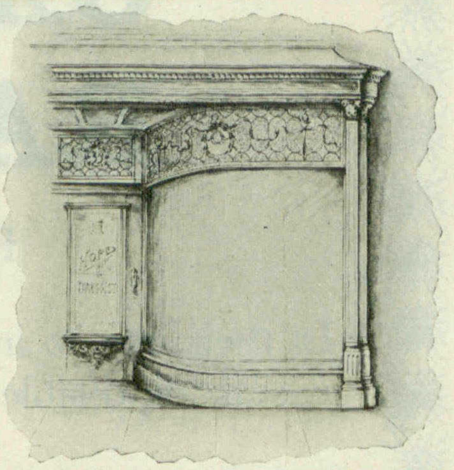
Fine Bent Glass for Cabinets and Art Furniture.

Toronto Plate Glass Importing Co.

ALL KINDS OF WINDOW GLASS.

135 and 137 Victoria St. - - TORONTO

Refractory Glass TRANSOMS for Light Diffusion.



Use Rock Wall Plaster

Wood Carpet, Borders for Rugs
Wainscoting, etc.
Turned and Twisted Grille Work

Designs on application.

ELLIOTT & SON COMPANY, LIMITED
MANUFACTURERS
79 King St. West, TORONTO

THE WIRE AND CABLE CO.

MONTREAL

Manufacturers of . . .

Telephone, Telegraph, and Electric Light . . **Conductors**

IRON

FIRE ESCAPES!

AND IRON STAIRS

Dennis Wire and Iron Co., London, Ont.

MANTELS

in WOOD, BRICK and TILE

Grates, Andirons, Fenders, Floor and Wall Tiles.

NEWEST DESIGNS AT LOWEST PRICES.

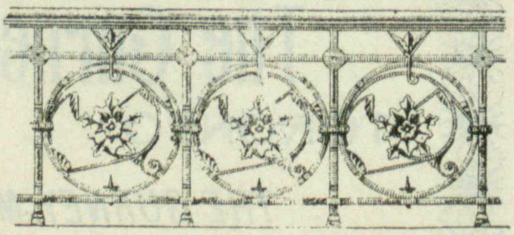
THE CHARLES ROGERS & SONS CO. LIMITED

97 Yonge Street, TORONTO

TORONTO FENCE & ORNAMENTAL IRON WORKS

Contractors for......

IRON STAIR-CASES



NEW COURT HOUSE, TORONTO

Estimates given for work in Iron, Brass or Bronze.
'Phone 15

JOSEPH LEA, Mgr.
99 and 101 Queen St. East, TORONTO

CANADIAN ARCHITECT AND BUILDER.

VOL. XIII.—No 6. JUNE, 1900 PRICE 20 CENTS. $2.00 PER YEAR.

—THE—

CANADIAN ARCHITECT AND BUILDER,

A Monthly Journal of Modern Constructive Methods,

(With a Weekly Intermediate Edition—The CANADIAN CONTRACT RECORD).

PUBLISHED ON THE THIRD WEDNESDAY IN EACH MONTH IN THE INTEREST OF

ARCHITECTS, CIVIL AND SANITARY ENGINEERS, PLUMBERS, DECORATORS, BUILDERS, CONTRACTORS, MANUFACTURERS OF AND DEALERS IN BUILDING MATERIALS AND APPLIANCES.

The C. H. MORTIMER PUBLISHING CO. of Toronto, Limited,

Publishers,

Confederation Life Building, - TORONTO, CANADA.

Telephone 2362.

Branch Office: NEW YORK LIFE INSURANCE BUILDING, MONTREAL.

Bell Telephone 2299.

SUBSCRIPTIONS.

The CANADIAN ARCHITECT AND BUILDER will be mailed to any address in Canada or the United States for $2.00 per year. The price to foreign subscribers is $2.50. Subscriptions are payable in advance. The Journal will be discontinued at expiration of term paid for, if so stipulated by the subscriber; but where no such understanding exists, will be continued until instructions to discontinue are received and all arrears of subscription paid.

ADVERTISEMENTS.

Prices for advertisements sent promptly on application. Orders for advertisements should reach the office of publication not later than the 12th, and changes of advertisements not later than the 5th day of the month.

EDITOR'S ANNOUNCEMENTS.

Contributions of value to the persons in whose interest this journal is published are cordially invited. Subscribers are also requested to forward newspaper clippings or written items of interest from their respective localities.

Subscribers who may change their address should give prompt notice of same. In doing so, give both old and new address. Notify the publishers of any irregularity in delivery.

The Toronto Municipal Buildings. IN our legal column will be found the terms of the decision of Mr. Justice Street in the action brought by the city of Toronto against the county of York, to determine the county's liability with respect to the cost of erecting, furnishing and maintaining the new municipal buildings at Toronto. The county contended that under their agreement with the city they were only liable for their proportion of the cost of the site and buildings, such cost being limited to $400,000. The decision of the Court, however, is that the county is also liable under the agreement for its proper share of the expense of heating, lighting and furnishing the court house.

Electrical Work. IF report speaks truly there are many architects who know less than they should about electrical work. This is especially true of some of the older men in the profession, who apparently have neglected to study and acquire a sufficient knowledge of the subject. We hear of specifications being prepared by wiring contractors instead of by the architect, and of specifications prepared by architects which are too indefinite in their terms to be of much value. Of course an architect who cannot prepare his own specifications is not capable of judging whether or not the work has been properly done, and as the number of incompetent contractors in this line is said to greatly exceed those who are skilful and honest, much bad work is being done. True an inspection is made by the underwriters, but the work is beyond the capacity of a single inspector to perform. It is therefore incumbent upon architects to thoroughly acquaint themselves with the requirements in this line and in the interest of their clients to specify the character of the work and judge of its efficiency when completed.

Signed Buildings. THE Council of the Royal Institute of British Architects recently adopted a resolution, as follows : "That it is not derogatory to the profession for an architect to sign his buildings in an unostentatious manner, similar to that adopted by painters and sculptors." We should be pleased to see it become the practice of architects to attach their names to such of their buildings at least as they might consider to be satisfactory architectural examples. It would help to define more clearly in the public mind the character and duties of the profession, enhance public respect for it, and awaken greater interest in architecture. On the other hand, a stimulus would be given architects to design more carefully.

Canada's Mineral Production. From the annual preliminary statement published by the Geological Survey of Canada, it is learned that the production of minerals in this country has more than doubled during the last three years, the increase for 1899 being 22.2 per cent., of which 15.52 per cent. is to be credited to the output of gold from the Yukon. Building materials contributed only 8.99 per cent. to the total production, the total value being placed at $4,250,000. There was a large increase in the production of cement. The quantities and values of building materials are given as follows : Asbestos and asbestic, 25,285 tons, value $483,299 : limestone for flux, 53,202 tons, value $257,329 ; Natural cement, 131,387 barrels, value $119,508; Portland cement, 256,366 barrels, value $513,983 ; flag stone, $7,600 ; granite, $9,542 ; slate, $33,406. Some of the figures given above would appear to be under the mark, as for example granite, the total value of which is placed at less than $10,000.

Lessons from the Ottawa Fire. NOT even a disaster such as the recent destructive fire at Ottawa has sufficed to lead to the adoption by the authorities of that municipality of proper safeguards to life and property. A few months previous to this calamity the Ottawa Board of Trade attempted to secure certain amendments to the building by-laws of the city corresponding with enactments already adopted by the leading cities of the United States and Canada, with the object of lessening the fire risk. These amendments were strongly opposed by some of the local contractors on the ground that they would result in restricting building enterprise. Some of the leading architects as strongly urged their adoption. Again since the great fire an attempt to restrict the use of inflammable materials was defeated. On the contrary the city of Hull has adopted precautionary measures in this direction. It is probable that when insurance rates in Ottawa are largely increased, as they are certain to be, the force of public opinion will compel the council to follow the example of the neighboring city.

Proposed Combination in the Heating Trade. IT is learned on apparently good authority that American capitalists are endeavoring to secure control of the works of Canadian manufacturers of stoves and heating apparatus. The Canadian firms in this line were first approached on behalf of the syndicate to learn whether or not they would be willing to sell a controlling interest in or dispose of their business entirely. Subsequently representatives of the syndicate visited the various factories to make estimates of the value of the plant, buildings and patterns, and to learn, from an examination of the books what had been the profits of the last three years. The idea of the syndicate is said to be to close up some of the smaller factories and operate the others on special lines—that is to say, one would make nothing but heating apparatus, another ranges, another base burners, and so on, the capacity of each shop being made to equal the demand for the special line of goods manufactured. The Canadian manufacturers interested have been given until first December to decide whether or not they will sell out to the syndicate or keep in their own hands the control of their business.

Tests of Non-Combustible Wood. A SERIES of valuable tests of wood rendered fireproof by an electric process, were recently made under the direction of the Board of Underwriters and the Building and Fire Department, of New York. Wood treated by this process was but slightly charred by being subjected to a temperature of 1,900° Fahr. A still more practical demonstration of its fire resisting qualities was shown by a recent fire in the Dun building, New York. So fierce was the fire that glass melted and iron twisted, but the "fire-proof" woodwork proved to be an effectual barrier to the flames, which by its agency were restricted to a single room. Material so effective in checking the spread of fire, should find extensive employment, especially in a country like Canada, where wood is so abundant. In the presence of such great conflagrations as those which have occurred at New Westminster, B. C., Windsor, Nova Scotia, and Ottawa, the larger use of fire resisting materials in the construction of buildings, should commend itself to the judgment of all. But if not, then public safety demands that the municipal authorities should legislate in this direction. We observe that a company has just been formed in Montreal to fireproof wood in the above described manner.

Toronto Technical School. IT is to be hoped that another great mistake has not been made by the City Council in purchasing the Toronto Athletic Club building with the object of remodelling it for use as a technical school. The peculiar purpose for which the building was originally designed, makes it extremely doubtful if any portion of it beyond the four walls and the roof, could be made available for a technical school. Can it be considered economy to pay $60,000 for the site and outer shell of a building and an unknown amount on an attempt to adapt it to a purpose for which it was never intended ? A wiser method would surely be to choose a suitable site, and erect thereon a new building which should be most carefully designed to fulfil the special requirements of the case. An influential committee of citizens was recently appointed to promote the establishment in Toronto of an Art Museum. The views of this committee should be sought regarding the proposed so-called technical school. This school ought properly to be known as the Toronto School of Industrial Art and Design, and as such should form a part of the Art Museum scheme. There should be prepared, a carefully elaborated scheme for the establishment in Toronto of a building, or group of buildings, to serve as the home of the arts. To such a group of buildings the above mentioned school would fittingly belong. It is therefore to be regretted that the Council should have acted with such haste in the matter, without allowing time for the consideration in all its aspects of the larger project.

ARCHITECTURAL EDUCATION.—1900.*

By Eden Smith.

Last year The Architectural Eighteen Club, of Toronto, was invited by some members of the Ontario Association of Architects to give criticisms of the Association's work and suggestions for the better co-operation of architects in the interest of the profession.

An impromptu paper was read by a representative of the Architectural Eighteen Club at the Annual Convention of the Association, in January of this year, in which a suggestion of improvement in the matter of education excited enough interest to lead to the formation of a joint committee chosen from the Association and the Eighteen Club, to enquire into and report on this suggestion. The report this committee drew up was favorably received, and another committee was elected to get the scheme into working order, which it is now endeavoring to do.

We have no generally approved and accepted course of training for the architectural student. The usual system of a few years' apprenticeship in an average architect's office cannot be seriously taken as sufficient. That it really is not, is evident from the many attempts to supplement it with courses in Art schools and colleges and various systems of training; some of them very valuable to the student who is able to avail himself of them, although he finds himself after all his pains, placed in the eyes of the community on an equal footing with one who has obtained only the scantiest office training.

We have no system which gains the approval of architects as a body, as being the best course a student can follow to get an efficient training in that many sided business, the practice of architecture has become—"The harmonious association of all the crafts"—to use the words of Mr. Lethaby in an article in the "Quest," July 1896, on "Art, the Crafts and the Function of Guilds."

"That architecture is an association of such varied things as are some of the crafts, makes the education of an architect a matter of no small difficulty."

Architects have formed societies, with the intention of mutually advancing their own interests and that of architecture for the good of the community.

If it will not irreparably damage the dignity of the profession to compare these societies for a little while with a trade guild, we may get food for thought from some remarks of Mr. Lethaby's. In this same article he says :—

"Whatever the trade societies do or leave undone, they must ultimately if they are to continue, take up the overlooking of quality in the common interest. If society generally, gets to understand that the Unions, as far as may be, are interesting themselves in the quality of commodities, it will soon pay back the debt in sympathy."

Our commodity is architecture; it is our business as Guilds to improve the quality or raise the standard of it, and instead of grumbling at the community for its want of sympathy we "must discuss materials and methods and build up a new tradition of beautiful craftsmanship, and become by means of our societies responsible to the community."

First of the "materials and methods" must be the matter of education.

Some societies have established a system of qualifying for membership by means of examination, but without any sufficient course of education, but those interested in the subject of education, know now that education without examinations is of more value than examination without good education. If we are to be responsible to the community for the craft we must see to the making of the craftsman, and establish a standard of education.

In his work, the harmonious association of all the crafts, an architect should be one of the first to understand the most effective and economical way of combining different kinds of workers to get the most effective whole; but the fact that in his own education no system yet meets with general approval, seems to point out that this work has been neglected.

In the hope that this work may be further studied and experimented upon until some economical system is made known, approved of and adopted by the various societies, the following suggestions are offered :

The objection to the present system of apprenticeship in an architect's office, is that it is not possible to teach in the average office some things which are parts of the necessary mental equipment of an architect, and some of them only with great difficulty in any office, so that the student has to obtain them elsewhere. Some students may do this; many do not.

This inequality of training is a serious hindrance to the development of architecture, beside the fact that the well trained architect has to compete all along the line with the untrained one, who has learned in the office that part of his profession only which can be learned there, the commercial side, and who generally poses as the practical business man, which means a great deal to the employer who pays for the work. The student left to his own guidance develops himself in such an unsystematic way, that we hear such names as an "artist architect," which suggest to the business-like employer something impracticable, lacking such qualities as are suggested in the name "engineer," the man of exact science, as to be almost the opposite of it.

It is this separation of Science and Art which so tells against Art in this scientific age.

In bygone ages, the age of architectural precedent, the architect was the scientific man, or at least kept pace with the practical science of his time. Now through the fault of our training we have let science get so far ahead of us that the thought of looking one way for precedence and another way for progress, points out the gap between Science and Art.

The most important work of the art education of to-day is to repair that breach.

If the element of quality in workmanship or art has been brutalized in the name of science we have to find out how to debrutalize it.

We must recognize that the architect as well as being a business man and an artist, must be a man of science.

For the purpose of developing a scheme of education it would be well to think of these three things as divisions of his work: The art, science and business or craft of architecture, neither one of these greater or less than either of the others, but all of them equally necessary to form the symmetrical whole; all equally important for the sake of the community.

How, when and where each of these divisions may be best studied we may find out by examining the present system's weaknesses.

The office, though the best place for a business training, is a poor place as a rule for scientific instruction, and the average office at least, for art study.

The college is not a good place for business training, and is not likely to be the best for art study, while scientific instruction, because the mental training this requires depends so much on the routine, proper progression and relation of the various sciences, is best acquired in a scholastic manner, under such competent professors as are found in our School of Practical Science, and not picked up in a hap hazard manner in his later years, which the student even with difficulty finds is the best he can do now. It should have become part of his mental equipment, part of his thinking machinery as soon as he attempts to design.

We know a designer must understand the nature and functions of the materials with which he expresses himself. This is a scientific age. In these things he needs not only information, but training in the beginning to give him ease in the artistic use of them—not to come on them as obstacles which impede his work, and have to be laboriously mastered, or put aside as something which interferes with the present uncritical adaptation of dead precedent.

The time for acquiring this habit can only be found in the beginning of his career and for a few years, while time and opportunities for the other branches of his study may be found all the rest of his life. It need hardly be pointed out why a college course is not an effective training for the business part or craft of architecture, the harmonious association of all the crafts, to understand which, one must live among them, and be where the real difficulties come and where the problems are practically worked out.

And for the same reasons an art is never so well taught in a school or by professional teachers, as by real workers in that art, who live by the practice and not by the teaching of it, as in the atelier or studio where the patrons or masters are the men who have faced and worked out the live problems of the day, and who give that most valuable of all gifts, enthusiasm, and where the change and variety of teachers, of opinions and criticism, shines light in from the most diverse sources on every object.

We think that the practice of architecture has not the position in modern progress it should hold, because it is so imperfectly taught that few persons know what it is, and the first and best thing architectural societies can do for architecture is to raise the standard of the architect by fostering only the best scheme of education—not by legal restrictions and examinations without anything which could be called education, but by education first, and that this is the best way to earn the sympathy and good will of the community.

We believe that the system of a few years of indenture in an office can never be considered a sufficient training, but should be supplemented with a course in a school of science and studio or atelier arranged concurrently with the years of indenture.

The system proposed by the joint committee of the Ontario Association of Architects and the Architectural Eighteen Club of Toronto, is :

The student shall first pass the matriculation examination of the Toronto University, and then take transferable articles for a period of five years, during which time he will follow a specially arranged scientific course at the School of Practical Science, of so many hours per week, and a studio course of two months in the third, fourth and fifth years of his indenture, passing periodical examinations in practical office work.

* Paper read before the Architectural League of America.

ILLUSTRATIONS.

DESIGNS FOR ONE ROOM, TWO ROOM, THREE ROOM, AND FOUR ROOM SCHOOL BUILDINGS, AWARDED FIRST POSITION IN THE RECENT COMPETITION BY THE EDUCATIONAL DEPARTMENT OF ONTARIO.

The Educational Department of Ontario recently offered a series of prizes for designs of school buildings, suitable for rural localities. One hundred sets of plans are said to have been submitted by architects in this competition. By the courtesy of the Minister of Education reproductions of the selected designs are given in this number. The names of the authors are as follows: One room school, Mr. Harkness Toronto; two and four room school, Mr. J. Francis Brown, Toronto; three room school, Mr. H. C. McBride, London.

Below will be found an abstract of the authors' descriptive specifications accompanied by estimates of cost.

ONE-ROOMED SCHOOL.

The building has been designed for brick elevations, but with a few slight alterations in minor details is equally suitable for stone.

The basement walls are of stone and the gables and roof of shingles. The steps and floors of the porches would be of wood. The basement floor would be concreted.

All the woodwork in the building would be of a very simple description; the architraves, baseboards, etc., being plain with rounded corners.

The ground floor throughout would have a cement dado to the height of the window stools.

The remainder of walls and the ceiling would be plastered in two coat work.

The class room would be sand-stucco finished and painted a suitable tint. A picture mould would be provided and the angles at the ceiling in the class room would be slightly caved.

A recitation seat, a necessary adjunct to a single roomed school, is also shown on the plan in front of teacher's platform.

Heat is supplied to the classroom by a hot air furnace through two flues of the proper size discharging over the blackboard.

The room is ventilated by means of a flue leading from a register under the teacher's platform.

The girls' cloak room is heated through a register placed at some height above the floor, and the boys' through a register in the floor.

Both cloak rooms are supplied with vents, thus insuring the proper airing and drying of the garments left in them.

It has not been considered necessary to show inside lavatories, as such buildings are seldom, if ever, provided with a water supply or drainage system.

In the basement a suitable well lighted play-room is provided for the boys for rainy and cold weather. The furnace and fuel rooms occupy one end, being separate from the play room.

Attention is called to the arrangement of the separate entrances, and cloak rooms. This arrangement of the cloak rooms in direct connection with the class room and lighted from the outside is the one most approved by the best authorities on school architecture

Since the play-room in the basement is for the boys only, it was not considered amiss to give access thereto through the boys' cloak room.

The following estimates are made on the basis of first class workmanship and material at such prices as are likely to prevail in country places. The estimates do not include the seats, teacher's table, blackboards, or any other school furniture.

Excavation	$45
Masonry and concrete floor	440
Brickwork	365
Carpentry	615
Plastering	130
Painting and glazing	115
Heating	175
	$1,885

TWO-ROOMED SCHOOL.

The ground floor shows two well proportioned rooms about 24 × 32 × 14, scientifically lighted from the left of scholars, is provided with ample blackboard space and with separate cloak rooms for boys and girls to each room.

Basement is simply divided into play-rooms for boys and girls, and with heating and ventilating compartments compactly arranged.

The following has been avoided:— a two storey building, flat roof, tower, roof valley situated directly over entrances, combined cloak rooms, etc.

The heating and ventilation has been carefully considered and amply provided. A furnace with a capacity of 40,000 cubic feet is necessary, and may be a wood or a coal heater; two large brick or galvanized iron heating ducts convey heat to the class-rooms, and a hot water coil to teachers' room. Separate vent flues have been provided for each class room, with smoke flue adjoining to insure efficiency of operation; vent flues are calculated to exhaust air of class-rooms every twelve minutes when furnace is heating. Foul air ducts of heavy galvanized iron of ample capacity are connected with floors at the coldest positions in rooms at windows, and are carried at basement ceiling to vent flues; this arrangement being quite simple, economical and most effective. A foul air gathering room can easily be provided, but the author considers it no improvement. If foul air registers are placed other than as shown, cold air from windows travelling across floor to them, chill the feet of the scholars in the room, and impair the utility of the system.

Basement walls to be built up of local stone, and may be faced on interior with grey brick in colored mortar, wainscot to be alternate courses of red and grey brick, stonework above grade to be of broken ashlar or coursing.

Brick walls above foundation to be 14" thick laid up of sound stock brick in lime and mortar.

The estimate of the various trades is based upon recent work of similar description erected under the direction of author, and will be found quite reliable.

Masonry	$1,385
Carpentry	1,600
Plastering	200
Painting and glazing	140
Heating and ventilating	195
Galvanized iron work	85
	$3,605

If the roof is to be slated instead of shingled add $150.00

In some districts where labor and material is cheap 5 and 10 per cent may be deducted from the above amount.

THREE-ROOMED SCHOOL.

All the outside walls tinted blue on foundation plan to be built to the forms and dimensions shewn with large flat limestones.

All the exterior stonework above ground line where exposed to view to have stones laid with joints quite horizontal and vertical and to be rock faced.

All the walls colored red on plans and sections to be built up with good hard well burnt brick. All those used in foundation walls to be hard green clinkers.

The finishing throughout in clear red pine or black ash which will be put on proper bevelled grounds.

All wood-work to be of pine unless otherwise specified and to be thoroughly seasoned throughout.

The rooms on ground floor throughout to be sheeted up 4' high with inch matched and beaded sheeting in 3" widths and to be finished on top with moulded capping.

The building will be heated with one furnace for burning wood or coal. The furnace to be of sufficient capacity to properly heat the building up to a temperature of 65 degrees when the thermometer is 20 degrees below zero.

The following is the estimate of cost:

Brick and stonework	$1,900
Carpenter work	2,500
Plastering	170
Painting and glazing	300
Plumbing	400
Heating and ventilating	200
	$5,470

FOUR-ROOMED SCHOOL.

The ground and first floor plans have four properly proportioned class-rooms 24 × 32, are well lighted from the left of scholars with five large windows arranged to operate from top to bottom; ample blackboard space is provided at teacher's end of room; separate cloak rooms for boys and for girls are provided to each room.

Plan shows possibility of enlargement without disturbing present plan, and can be executed at the minimum of expense. Stairways and rear entrances would be central then and most convenient.

The heating and ventilation has been carefully considered and amply provided for. Two furnaces with a capacity of 40,000 cubic feet are necessary aud may be wood or coal heaters; four large brick or galvanized iron heating ducts convey heat to the class-rooms, and a hot water coil to teacher's room. Separate vent flues have been provided for each class-room with smoke flues adjoining to insure efficiency of operation; vent flues are calcuated to exhaust air of class-rooms every ten to twelve minutes when furnace is heating. Foul air ducts of heavy galvanized iron of ample capacity with floor at the coldest positions in rooms at windows and are carried at basement ceiling to vent flues; this arrangement is quite simple, economical and most effective.

The following objectionable features have been disregarded; flat roofing, extremely high ceilings, the arrangement of class-rooms with but a single wall or partition division between them, narrow or cramped hall or entrances, entrance doors exposed to overflow of roof valleys, combined cloak rooms, indifferent heating and ventilation, the placing of w. c. in building.

Basement walls to be built up of local stone, and may be faced on interior with grey brick in colored mortar; wainscott to be alternate courses of red and grey brick. Stonework above grade to be of broken ashlar or coursing.

Brick walls above foundation to be 14" inches thick laid up of sound stock brick in lime mortar.

Flooring to be first quality kiln-dried birch 3" widths for ground floor. Basement to be floored with wrought 6" plank on cedar sleepers. Furnace room floor to be of brick.

Trim windows and doors with 5½" double moulded architraves. Base to be 14" x 1¼" double, chair rail to continue around all rooms and halls, also black board mouldings.

The estimate of the various trades is based upon recent work of similar description, executed under the direction of author, and will be found quite reliable:

Masonry	$2,075
Carpentery	2,390
Plastering	360
Painting and Glazing	240
Galvanized Iron Work	105
Slating	330
Heating and Ventilating	350
	$5,850

If roof is shingled instead of slated deduct $150.00.

In some localities this design could easily be executed for less than the above amount.

BY THE WAY.

A PLUMBERS' strike at Halifax has terminated by all the strikers going into business on their own account. They will now have an opportunity to learn what an easy life is that of the master plumber, and how magnificent are his profits.

× × ×

THE City Commissioner of Toronto has been asked to find a suitable site for a handsome model of Windsor Castle, which was recently presented to the city by Messrs. Lever Bros., the well known soap manufacturers. The model was exhibited at the World's Fair at Chicago and afterwards removed to England.

× × ×

As a means of commemorating the devotion of the colonies to the mother land during the present war, the Rev. J. S. Sinclair, vicar of Cirencster, makes the suggestion, in the columns of The Spectator, that there should be erected in front of St. Paul's Cathedral, four great masts, set in emblematic bases and properly decorated, like to those in front of St. Mark's at Venice, to represent Canada, Australia, New Zealand and South Africa. The proposal has been favorably received.

× × ×

IT is gratifying to learn that the Canadian club propose to put a distinguishing mark upon historical buildings. The first step in this direction has been taken by placing on the old Canada Company building on King street, east Toronto, a granite tablet bearing the following inscription.—"The Canada Company building, built in 1807. One of the earliest brick edifices erected in Toronto. Occupied from 1853 to 1895 as the chief office of the Canada Company in this province." The house was built by the late Mr. Quetton St. George and is now the property of the Baldwin estate.

× × ×

UNDER the title of a "Lost Principle in Architecture," a writer in the "Fortnightly Review" says: "If the visitor to Athens places his hat or other small object at the corner of one of the steps of the Parthenon and tries to sight it from the other end he will find it has sunk beneath the delicate curve in the middle which the designers saw would appear pleasanter and softer to the eye than if each step were shaped to a line of ruler-like straightness from beginning to end. All parts of the great building—the floors, architrave, and even the layers of stone that constitute the main walls—have been shown to conform to a like principle, and some portions to be curved both in a vertical and in a horizontal manner. Important as was this discovery, it does not stand alone. Mr. Ruskin has found that deliberate divergencies of a similar kind exist in the old Gothic buildings of Venice, and he considers that they were introduced so as to avoid a too obvious precision, as does nature, even in her most symmetrical creations—the two sides of the human face, for example.

× × ×

IT may be remembered that the architect of the Imperial household of Japan, visited Europe, the United States and Canada last year in connection with the project to erect a palace for the Crown Prince's household and to contain some of the state offices. In view of the numerous earthquakes which occur every year in Japan brick structures are soon destroyed. Wood though better adapted to withstand the shocks is objectionable by reason of its inflammability. Consequently it was finally decided to erect this palace, to cost $3,000,000, on a framework of steel. The contract to design, manufacture and supervise the erection of this steel framework has been given to American firms. The fundamental principle and leading consideration in the design, says the Engineering Record, has been not only to provide for its stability under a single severe earthquake shock, but to ensure its endurance of numerous shocks continuing year after year at frequent intervals. To meet these strains and vibrations every part of the building is supported or reinforced by a skeleton steel framework made continuous throughout, so as to act as a whole to resist displacement of any part. There are very few adjustable members or loose joints. Nearly all connections are riveted with unusual strength, although they are not so rigid but that the members may deflect within the limits of their elasticity without injury. Special lateral strength and stiffness are introduced by systems of struts and ties in all the horizontal planes, which develop the strength of the beams and practically create great horizontal trusses to resist distortion and distribute strains. The masonry is massive, proportioned for stability, and abundantly anchored at all points to the steel framework. The solid continuous floors add to the strength and rigidity of the structure, and its stability is promoted by making the cornice, parapet and other upper parts as light as possible. The whole building is seated on wide continous footings of solid concrete, to which the columns are each bolted.

MONTREAL

Branch Office of the CANADIAN ARCHITECT AND BUILDER,
Imperial Building.

June 12th, 1900.

PLUMBERS' CONVENTION.

The National Association of Master Plumbers of Canada will meet in annual convention in this city on the 27th, 28th and 29th inst. The local plumbers are making arrangements for the entertainment of the delegates who may attend the convention.

NEW BRIDGE ACROSS THE ST. LAWRENCE AT QUEBEC.

For several years the project of bridging the St. Lawrence at Quebec has been before the public. It may now be said to be certain to be carried out, contracts having recently been awarded to Messrs. Wm. Davis & Son., of Ottawa, for the substructure, and to the Phoenix Bridge Co., of the United States, for the superstructure. Mr. E. A. Hoare, of Quebec, is engineer in charge of the entire work. The total length of the superstructure is 3,310 feet. The bridge is intended to carry two railroad tracks, two electric car tracks and two carriage roads.

THE NEW CITY BUILDING INSPECTOR.

The accompanying portrait is that of Mr. Alcide Chausse, architect, who has recently been appointed as head of the Building Inspection Department of Montreal. Mr. Chausse, who is a son of Ald. Chausse, and a native of this city, is 32 years of age.

MR. ALCIDE CHAUSSE.

He studied architecture in the office of Mr. A. Raza, and began practice when only twenty years of age. He is a member of the Council of the Province of Quebec Association of Architects, as well as of the Societe Nationale des Architectes de France, the American Institute of Architects, Societe Centrale d'Architecture de Belgique, International Congress of Architects (Paris, 1900). Mr. Chausse, whose appointment is coincident with the adoption of new building regulations, will have opportunity to put into operation many necessary reforms for the improvement of the architecture of the city.

A LEGAL DECISION OF INTEREST TO CONTRACTORS.

In the action of Beauchamp vs. Cyr, which recently came up before Mr. Justice Doherty in the Superior Court of Montreal, the plaintiff sought to recover $350 for work done and materials furnished for the construction of a stone encasing wall, under and in virtue of a contract entered into between the parties on the 13th November last. The defendant pleaded admitting the contract alleged, but averring that the work was very badly done, and with inferior materials: that the walls were packed with pieces of stone, whereas, they should have been packed with dry brick; that the mortar used was of very inferior quality, and contained too little cement: that the plaintiff did not lay the stone with a sufficient incline inwards; so that instead of leaning inwards, the walls worked outwards until they fell out; that the plaintiff did not place a sufficient number of iron bolts to support the wall: and that by reason of these defects of construction, the walls began to fall away before the work was finished; that defendant refused to accept the work so done; that by reason of the defects mentioned, the walls threatened to collapse; that since the completion of the work large portions of the walls had fallen down; that defendant had frequently notified the plaintiff of the conditions of his contract, and of the law, both verbally and by notarial protest; that the work not being completed according to law and the contract, the defendant was not now bound to pay, and the action was premature. The plaintiff answered this plea, denying these allegations, and alleging that his work was well done, and that if it be in the condition alleged by the defendant, it was due to the defendant's own fault and negligence, the only ground of complaint alleged by the defendant as to the work done by the plaintiff, which defendant had proved, was that the plaintiff had put in the spaces between and behind the large stones in the encasing wall in question, a number of small pieces of stone instead of brick—the testimony of plaintiff's own witnesses establishing that in all other respects the work was well done. The plaintiff did not by his contract bind himself to use brick for such filling, and in view of the extremely contradictory evidence as regards the comparative advantages of using stone or brick for such purposes, and of the absence of any proof that in the wall in question the mortar froze by reason of stone being used instead of brick—which was the danger which, according to plaintiff's witnesses was to be apprehended where stone is so used—it was impossible to say that the use of stone for such purposes instead of brick constituted such a defect of construction as to render the wall unacceptable, or that it contributed to bring about the falling out of a portion of the wall, which occurred some weeks after plaintiff had completed his work, and after the wall had been exposed to an extraordinarily heavy fall of rain, which lasted for several days. The preponderance of evidence established that the plaintiff fulfilled his obligations under the contract, and that the work was well and properly done. The defendant, since the institution of the action, had paid $220 on account, and the court, making a deduction of this amount, gave judgment in favor of the plaintiff for $130, ballance due, with costs of action as brought.

LEGAL.

THE CORPORATION OF THE CITY OF TORONTO VS. THE CORPORATION OF THE COUNTY OF YORK.—Judgment by Mr. Justice Street in Single Court at Toronto upon special case stated for the opinion of the court as to the proper construction of the agreement dated 26th June, 1884, between the corporations for the erection of a court house in Toronto. The agreement was validated by ch. 73 of 8 Vic. (o), and is set out in schedule A of the Act. The plaintiffs claim that the sum, not to exceed $400,000, mentioned in the agreement, includes only the cost of the site for and of the erection of the court-house as a completed building, and that defendants are also liable to pay to plaintiffs (beyond the "annual" sum payable in respect of the $400,000) their just share and proportion of the cost of the first furniture and other furnishings of the court-rooms and the offices connected therewith, and for other offices mentioned in said agreement. The defendants claim that the amount to be paid annually by them should be based upon the total cost of buildings and site, including original cost of such furniture as aforesaid, not in any case to exceed in all the sum of $400,000. By secs 11 and 12 of ch. 39 of 48 Vic. (o), sections 465 and 469 of the Municipal act then in force were amended so as to require accommodation, fuel, light, and furniture for the library of the Law Association of the County of York to be provided, and the liabilities of the municipalities therefor are therein defined. The learned jndge is of the opinion that the scheme of the agreement is that the court-house is to be erected by, and is to be the property of, the city of Toronto, and is to be so built and arranged as to provide proper accommodation for the county and the administration of justice, and is from time to time to be heated, lighted, and furnished by the city. The county on its part agrees to pay the city from time to time its proper share of the expense of heating, lighting and furnishing the court house, and a just sum for its proportion of the use of the court house based upon its cost, such cost, however, not to be taken as against the county as exceeding $400,000. This sum was intended to cover the cost of buying the site and erecting the building, and not the cost of furnishing. The county pays its proportion of the annual outlay for keeping up the furniture, and in addition it pays a just sum annually for the use it makes of the building and the offices in it, based upon the assumption that the building and offices have, with the site, cost only $400,000. The argument to the contrary on behalf of the county is based upon the idea that "accommodation for the convenient transaction of business by the court and officers" could not be said to be provided, nor the building to be fully completed and ready for use by the courts until the court rooms and offices had been properly furnished, but the whole context of the agreement shows that these expressions refer only to the building itself, for everything else including furniture, is otherwise provided for and dealt with. But the city should provide accommodation, fuel, light, etc., for the Law Association. The agreement provides that the city "will assume and undertake the statutory obligations respecting a court house of the county of York for judicial purposes only," and that it will relieve the county therefrom. The libraries of the Law Associations of the different counties in the province are by secs. 506 and 509 of the Municipal Act recognized as a part of the outfit of the courts in the various counties in which they exist for the assistance of the judges and council in the conduct and decision of judicial matters. Order accordingly. Costs of the special case to be paid by the defendants to plaintiffs, except so far as they are increased by the question relating to Law Association, as to which by agreement there are to be no costs.

HOT WATER CIRCULATION.*

By Robt. W. King, Mech. Eng., Mem. Can. Soc. C. E.

I am announced to read a paper on hot water circulation; to this title should be added, "With test for efficiency for hot water boilers," since my reference to the principles of hot water circulation will be mainly for the purpose of opening up the subject and illustrating the points that have to be met in designing a hot water heating apparatus to obtain the best general efficiency, and also to give a method or plan of testing the efficiency of a hot water boiler. In Fig. 1 B represents hot water boiler, F, firepot; S, smoke pipe; F P, flow pipe; R, return pipe; R A D, radiators. The dark portions of shading represent heat, light portions of shading, absence of the same.

One of the main objects to be obtained in a hot water heating apparatus is the economical absorption of the largest amount of heat resulting from the combustion of the fuel, by the water in the boiler, conveying it by circulation to the radiators, and thence to the air of the room to be heated.

The motive power of the circulation is the difference in temperature between the heat of the flow pipe and the return pipe. Water being made lighter in weight by heating, rises, while the colder water falls, and so produces a circulation of the water in the apparatus. In the same way, in illustration, the heating of air causes it to rise, while colder air falls to take its place, producing circulation of air. This is also the cause of wind, etc.

It will be noticed from the shading that heat from the fire is gradually being absorbed by the water in the boiler as the gases pass to the smoke pipe, and then it appears in the water and is carried to the radiators by the circulating pipes, thence to the air of the room to be heated, the water returning to the boiler, minus a large amount of its heat, to be again re-supplied. The lower radiator (No. 2) represents the action of the circulation where the water is admitted into the bottom instead of the top of radiator; the circulation is likely not to be quite as perfect in this form as the upper.

If will be noticed by the shading of the smoke pipe and upper portion of boiler that there is a larger proportion of heat shown in the smoke on the way to the chimney than in the water of the

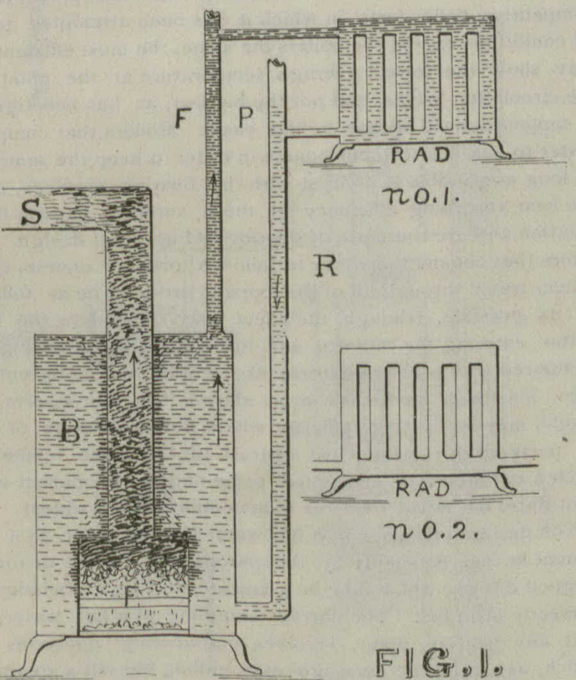


FIG. 1.

boiler at this its hottest part. This is necessarily so, since when the point is arrived at where the proportion of heat in the water equals the proportion of the same in the flue gases, the passing of heat from the one to the other must cease. Practically this point is never reached, so we here show the proportions as stated. Now we have in the form here shown two separate systems of circulation—one of the heat units in the flue gases, the other of the heat units in the water of the boiler. You will notice that the flow of these two circulations runs in the same direction. Now, could we reverse the direction of one of these systems so that the fire might commence its work where the water is hottest, and the gases be drawn to the chimney from the part of the boiler where the water is coldest, it is evident that we could by such means reduce our chimney gases to a much lower temperature, and thus absorb and capture a larger proportion of heat, increasing thereby the economy of the apparatus in the consumption of fuel. But to follow this point further is not an object in this paper.

*A paper read before the Toronto Engineers' Club.

The next point I will touch on is the circulation of the water in the system, allowing that Fig. 1 represents a system where the circulation is open and free, and for comparison Fig. 2 represents a system where the circulation has been impeded. It is immaterial where the impediment to the freest possible circulation occurs,—if you block a water pipe a mile long at either end, or in the middle, the same result occurs as regards the amount of water that will pass through the pipe as a whole. Therefore an impediment to the circulation in the radiators, or the piping connecting the same to the boiler, will have the same effect on the working of the apparatus as a whole, as it would were the piping and radi-

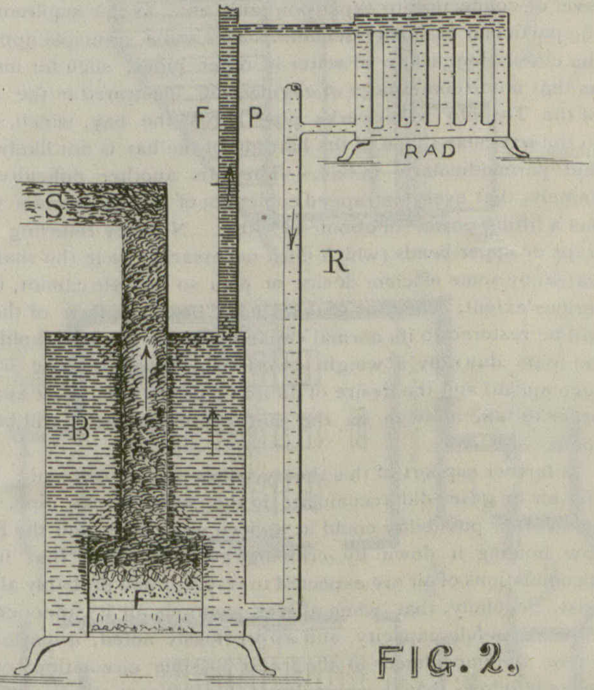


FIG. 2.

ators free and the impediment in the boiler itself. This is an important fact to remember.

I will now proceed to illustrate how any defect in circulation injuriously affects the economy of the system as regards consumption of fuel. An impediment to circulation having occurred, as in Fig. 2, the water not having free access from the boiler, remains longer in contact with the heating surfaces of the same. The heat continues passing from the flue gases to the water in the boiler in greater quantity than the lessened circulation allows to pass to the radiators, until the heat damming up in the boiler itself causes it to become congested or over heated, until the boiler surfaces assume such an elevated temperature that but little, if any, heat can pass into the boiler from the flue gases, consequently more heat must pass to the chimney, causing waste of the fuel that produced it.

The effect on the radiators is, that they being deprived of the heat for distribution that has been wasted as above explained, cannot radiate it into the rooms to be heated, and become on that account incompetent to perform the duty that may have been assigned to them. Fig. 2 is represented by this condition, you will note the flow pipe appears hotter and the return pipe colder, but the total heat given out will be necessarily less. Continuing to press the firing under these conditions in order to heat the room, results in an increased proportional waste of fuel, until the point may be reached where the boiler makes steam, and disorganization generally of the system takes place.

In regard to the laying of the connecting pipes it is necessary to have them free from all air traps or places where air can gath-

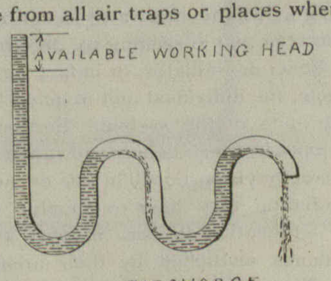


FIG 3.

er. To force water through a coil such as is represented by Fig. 3, requires a head equal to the combined height of all the bends.

With two bends one foot high, it will require a head of over two feet to force water through, air being allowed to remain or gather in the coil. For this reason perpendicular kinks or bends in horizontal flow or return pipes to a radiator whose height would equal the diameter only of the pipes, would almost, if not quite, close the circulation to that radiator. Since this imperfection would be noted, the chief danger lies in those bends or kinks that may close off only a smaller per cent. of the efficiency of the radiator. Lack of heat in the room will likely be blamed by the fitter on anything but his own bad workmanship or design. Where bends or drops in a pipe are unavoidable, the air traps thus caused can be relieved, and the pipe restored to its full circulating value by the running of air vents to above the water level or connecting to expansion tank, etc., as the requirement of the particular case may demand. This same principle applies to the circulation or flow of water in other pipes, such for instance as that unfortunate piece of engineering illustrated in the laying of the Toronto waterworks pipe across the bay, which, owing to the irregular shape of the bottom of the bay is not likely to be laid perpendicularly in line. There is another difficulty here, namely, that every entrapped cubic foot of air, when under water, has a lifting power of about 62½ lbs. Now by relieving these traps or upper bends (which must necessarily be in the shallower water) by some efficient device or plan so that air cannot, to any serious extent, collect or gather in the pipe, the flow of the pipe will be restored to its normal capacity (which the mere holding of the pipe down by a weight of cribbing stone or sand will not accomplish) and the desire of an iron pipe to tear itself apart in order to take a swim on the surface of the water will be over come.

In further support of this theory, allow me to point out: First, that air or gases did accumulate in the water works pipe, since by no other possibility could it, an iron pipe, float, and the fact of now holding it down by cribbing, etc., indicates that further accumulations of air are expected to re-occur and probably already exist. Secondly, that when a pipe contains air it cannot contain water to its full capacity, and as previously noted, it matters not where the impediment to the freest possible circulation occurs, hence it follows that the capacity of the pipe as a whole to convey water is reduced to the full extent or proportion of the air accumulation at any one point. Thirdly, a large accumulation of sand or other settlings was found in portions of this pipe. The presence of settlings in any portion of a pipe denotes that such pipe has not sufficient current passing through, or sufficient drainage or head to prevent settlings from accumulating, and this condition can be brought about in the first place by an accumulation of air as referred to, reducing the current or flow of water through the pipe, the more open parts of which then assume the duty of settling basins in the pipe itself. It should be the duty of the engineer in charge to examine the portions carefully to discover if it is not possible to not only restore the flow if impeded, but also to increase it in other ways. This might avoid the present necessity of the expensive tunnel proposed by Mansergh, and still give the increased capacity claimed to be required. It is not my wish that these remarks be taken as claiming to locate by one example the source from which all the difficulties occur, since there are other phases to this question of doubtful reputation, leaving considerable choice in the matter, but I have referred to this as being akin to my subject, which I have desired to make as widely interesting as possible. It has thus been shown that though the boiler in a system may be correctly designed and efficient under one system of radiation, it may entirely fail to accomplish the work expected of it in another, and that from no fault in the boiler itself. Also, that radiators may fail to heat the space assigned to them from defects in the boiler or in some other part of the system, as for instance the size or arrangement of the connecting piping as will be afterwards described.

Thus it will be seen that in seeking to determine the efficiency of a hot water boiler or radiator, or in fact any of the units of a system as a whole, the individual unit in question must be treated apart from other units of the system. Further, in reference to the connecting pipes between boiler and radiator, it is important that they be correctly proportioned in size or area to the various parts of the radiation they have to supply. Since the motive power of the circulation is due in part to the height of the driving columns multiplied by their areas, it follows that on the different floors different proportions in the area of the connecting pipes are required, so as to distribute to the radiators on the different floors their proper area of circulating power. By estimating the average height of floors one above the other at even distances we are at least within the mark in stating that in a house with basement, the effective proportional area of connecting pipes per square foot of radiation should run so as to give an excess or proportional area, etc., for the lower floor, of three to one of the upper floor. This may be put in more practical shape by proposing to determine from best general practice a common unit of proportional area per square foot of radiation, which may be used when once obtained in all cases for determining, according to the nature of the work, whether or not sufficient circulating area is provided in the boiler itself, or in the radiators themselves, or in the connecting pipes individually. This unit will be used as follows: Radiators having been selected and placed for the different floors, the sizes of the pipes individually required will be determined by multiplying the square feet of radiating surface in the radiators by the unit, and then by three for the radiators on the ground floor, by two for the radiators on the middle floor, and by one for the radiators on the upper story. These sizes or areas will determine by examination of the design if the individual radiators have sufficient water way in themselves, and the sum total of these areas will determine if there is sufficient water way in the boiler itself.

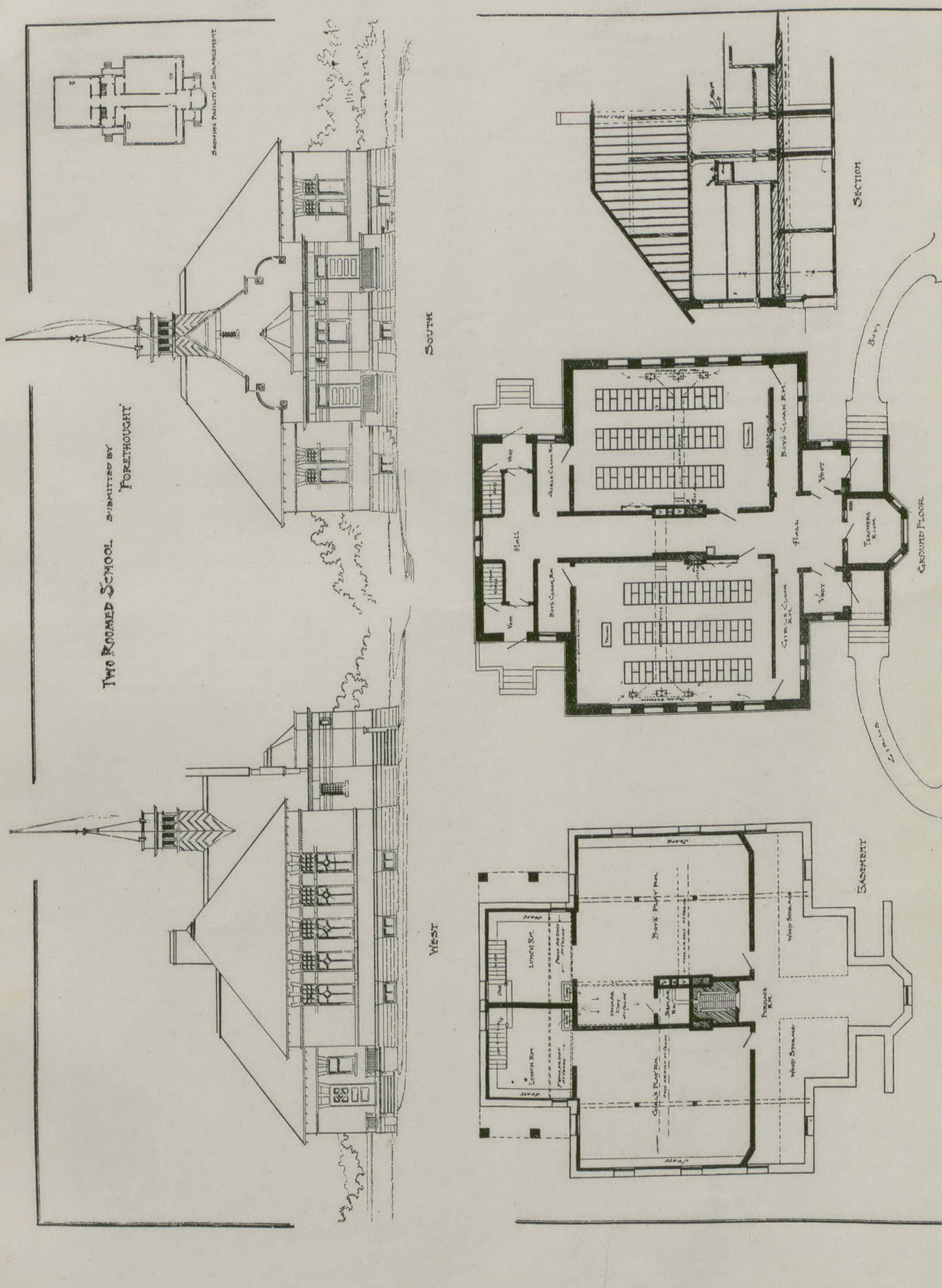
I will note here that since a pipe of 4 square inches area will convey more than double the water of a pipe of 2 square inches area, this difference should be taken into account, and may be found tabulated in books of reference. I will also note that it is important that the boiler be placed so that it may give an effective height to the circulating pipes in the basement equal to the average stories in the house. A boiler where the return pipes fall completely to the floor and begin to heat immediately on rising therefrom, will thereby utilize the full height of the basement for enforcing circulation, and its waterway will be of more proportional value than in one less effectively placed, for which due allowance must proportionately be made. In cases where the basement lacks sufficient height, the ground floor radiators are the ones most unfavorably affected. A lack of circulating force to a radiator can be improved by piping to the top of a radiator as in No. 1, instead of to the bottom as in No. 2, and may help in some instances to acquire the necessary amount.

I will close this portion of my subject by a few deductions that may be arrived at from the reasoning that has preceded. In competitive boiler tests in which it has been attempted to make all conditions except the boilers the same, the most efficient boiler may show the lowest average temperature at the point where the circulation leaves, and not the highest, as has been ignorantly supposed must always be the case. Boilers that compel the water to follow a tortuous course in order to keep the same water as long as possible in contact with the heating surfaces, destroy the heat absorbing efficiency of those surfaces, impede the circulation and are therefore of inferior and ignorant design. Radiators that compel the water to follow a tortuous course, so that it may travel through all of the loops in order to be as fully cooled as possible, (though the effect may be to show the hottest water entering the radiator and the coldest when leaving it, as compared with other radiators) are wrong and inefficient in design, inasmuch as it has been shown that that system, as a whole, may be the most efficient where flow and return, or in fact all parts of the system, are nearest to the same temperature. Such a radiator was attempted to be put on the market at a recent date, but failed I believe in accomplishing its object.

The desired efficiency of a hot water heating plant, as a whole, cannot be insured simply by the purchase of a boiler or radiators of good design, which may be guaranteed of high efficiency when correctly installed. The correct installing of a hot water, or in fact any heating plant, involves engineering questions about which, as a rule, the average man calling himself a steam fitter or pipe fitter knows very little. The employment of such a man in an engineering capacity is the direct cause of so many failures in such plants to do the duty expected of them. It is criminal economy to use too small connecting pipes to save first cost of apparatus. Also in using less leads than the boiler is designed to supply and plugging or reducing the unused holes intended for circulation.

Under some conditions it may be necessary to increase the area of circulation provided for general purpose or discard the boiler if this is not possible. It is necessary for the man who takes up this work expecting to succeed (unless by accident) to acquaint himself with such principles as in part have been enumerated, but which, owing to the limited scope of this paper cannot be further enlarged upon.

Having shown that in criticising the efficiency of a hot water circulating plant as a whole, it is necessary to independently handle the different units therein, we will now proceed to the



ONTARIO GOVERNMENT COMPETITION FOR SCHOOL PLANS.—ACCEPTED DESIGN FOR TWO ROOMED SCHOOL.

J. FRANCIS BROWN, ARCHITECT.

latter part of this paper namely, how to test the efficiency of a hot water boiler apart from its radiators and connections.

Most engineers are, in a way, familiar with the testing of steam boilers, but for hot water boilers I have not yet met with any method in use that will fill the requirement which is open to ordinary mortals to follow. I say ordinary mortals, since it is a custom in the higher schools of science and art, to so burden such investigations with algebraical logarithms, formulars, calculus, etc., combining so little practical information that ordinary mortals are excluded from following or find life too short to take up the subject in that way. In considering the task before us we will find we have three measurements to accurately obtain, on which to base calculations as to the amount of heat units captured by the boiler. These are :—1st. The temperature, or in other words the proportion of heat units in the water when it enters the boiler. 2nd. The temperature, or in other words the proportion of heat units in the water when it leaves the boiler. 3rd. The rate or quantity of the flow of the water.

It is comparatively easy to obtain the first and second values but not the third, because of the necessity of procuring an instrument delicate enough to measure the rate of flow correctly, that can be put in a pipe without obstructing it and so impeding the circulation, with injurious results. There are ways proposed for measuring, or I would rather say estimating the amount of water passing in a pipe without obstructing it, one of which only I will refer to in order to show the difficulties to be contended with.

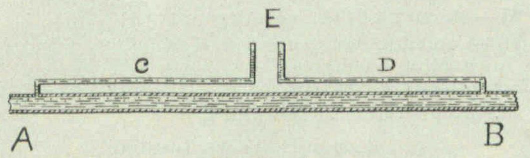


FIG. 4.

Let A B be a pipe with water flowing through it; at points A and B we tap in small pipes, C and D, and bring their other ends together and turned upright as at E. The head or force of the circulation will be represented by the difference in height of the water in the two columns at E. Having ascertained the head and the size of the orifice through which the water flows, the amount passing could be accurately calculated but for one thing, the allowance necessary to be made (scientifically the coefficient) for the friction of the piping, or in other words the impediment to theoretically free circulation. To obtain this correctly requires other tests and experiments of a complicated character, also the differences in height of the columns at E being very small, would have to be taken by microscopic and micrometer measurements, difficult to obtain. There is another trouble ; since the main circulating pipes will be found in the basement, the ends E might have to be extended a considerable height. This would necessitate note being taken of the temperature of the water in these columns, so that any variation in weight therefrom could be calculated. Furthermore, as during the test the rates of temperature and flow will be continually changing, observations would have to be continually made. This applies also to the proposition to use an ordinary water meter, could one of sufficient delicacy be found. When you consider in connection with this mass of figures, the skill and care necessary to obtain final results correctly, you will not wonder that the ordinary mortal referred to is discouraged and dismayed. Still the problem is before us and the question is, if we can't make a frontal attack is there any way to get around. Every man has his own way of doing things, and without wishing to show any disrespect for the methods of others, to which if presented I shall only be too pleased to listen, I beg your kind indulgence while I explain what I think is one solution of the difficulty, and afterwards invite discussion or criticism of it for mutual benefit and interest.

We have already shown how the efficiency of a boiler may be influenced by defects in the system. For the purpose of testing the efficiency of the boiler itself, I disconnect it from its system of radiation and treat it separately. It has already been explained that there are three measurements to be taken, and complications arise where the three measurements are unknown quantities that are constantly varying at all times during the test. In my test I endeavor to relieve this complication by making two out of the three measurements "known quantities" and constant at all times during the test, thus leaving practically only one measurement to be dealt with during the test, and proceed to explain briefly as follows : To the boiler, Fig. 5, is attached flow and return pipes of the full capacity provided for in the boiler, running upwards and connected to an expansion tank in the ordinary manner. In the overflow of the expansion tank at T, is placed (in preference) a recording thermometer or an ordinary thermometer as opportunity may offer.

Discharging into return pipe of the boiler is a pipe, T 2, carrying a known quantity of water per minute at a known temperature. With this our testing apparatus is complete. Let me here explain how the latter part of this apparatus can be made. Roughly, I would propose an ordinary closet tank maintaining water by tap and float at a stated level. From this tank a pipe leads to the return pipe of the boiler, the discharge of which under the head of water in the tank has been measured and adjusted to suit requirements. In the arrangement as illustrated herein, a set valve is shown at X for adjusting the rate of discharge. In such cases the total discharge at Y should be measured in bulk so that the average maintained during the test may be the better verified. A better plan would be to introduce a suitable and reliable water meter at X, were one obtainable.

For most accurate work I have devised a special water meter driven by clock work that will not only accurately measure an even continuous flow, but also automatically record the same. For obtaining a constant-known-temperature, water from a tank of melting ice should be used, or an ordinary water service which will run a stream at constant temperature. But to be exact in this measurement a thermometer should be placed at T 2, so that should there be any variation in this temperatnre it can be noted and allowed for, though complicating the calculation to some extent.

Now let me say a word on the thermometer and meter. I may be a crank on automatic machinery, possibly it is inherent laziness on my part ; but instead of putting ordinary thermometers at the points indicated and depending on taking their readings correctly (so I could swear to them,) every five minutes or otherwise during a 24-hour test, I want to put automatic recording ther-

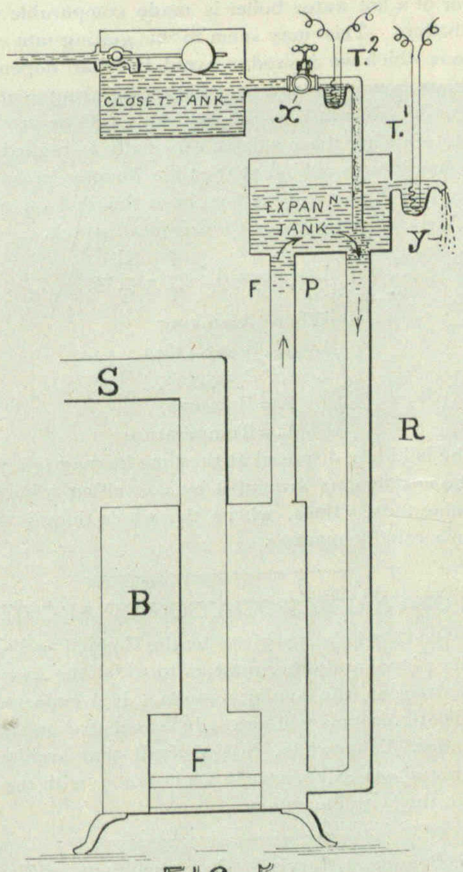


FIG. 5.

mometers there, say of the Callender pattern, that require no watching and will give results to a fraction of a degree and time, whose records can for evidence be photographed and reproduced in print, free from the possibility of personal error. So also with the measurement of the flow, but to explain such instruments would take one or more papers, so cannot be entertained at the present time.

Having rigged my testing apparatus, we will proceed as follows :—The apparatus being empty of water, we will start our water meter, stopping it when the water gets to overflowing, so that we may know the first contents. At the finish of the test the heat remaining in this water above the normal will be one of the quantities to consider and add to main results. Our apparatus and the boiler being now full, we will start the fire on a measured quantity of fuel, and make a mark on the time record of the thermometers. When the water in the expansion tank has acquired an ordinary working temperature, the time being automatically noted or othewise, we start the water to circulate through the meter at a rate previously decided on as in proper proportion to the size of the apparatus, and allowing the party interested in the economy of the boiler to fire up to the best of his knowledge or ability. With automatic instruments our work is over until the completion of the test, the recording instruments being under lock and key they cannot be tampered with—it being only necessary to insure further that the fireman is honest in regard to using no fuel but that measured out to him, so that the quantity of fuel burned during the test may be determined in the usual manner.

At the close of the tests we consult the records, which are then the records of what has been performed. Our report therefore will show, backed by the records and evidence referred to, that by the consumption of a certain amount of fuel during a stated time, in a hot water circulating boiler, we have raised the temperature of a stated quantity of water a certain number of degrees, the average being determined from the temperature curves that the thermometers have recorded, thus giving a simple data for obtaining both the efficiency and power of the boiler. The test would also show clearly at what part of the firing the best results were being obtained, and so be a guide in this respect and in determining the best proportions for the fire surface, etc.

From the data recorded as above, it is a comparatively simple matter to determine the number of British Thermal Units that have been abstracted from a stated quantity of fuel during a certain time for comparison with other absolute tests that may have been elsewhere made of other boilers, so giving their relative efficiency and power. Also by reducing the values to what they would be in steam evaporation from and at 212° F, the efficiency and power of a hot water boiler is made comparable with that of a steam boiler. This may seem to be getting into complicated calculations which we desired to avoid, but that depends, like the test itself, on how you take it, whether by frontal attack or by getting round. For instance if you ask a college professor for a rule for determining these values, especially as regards the steam comparisons, if he is unkind at the time he may present you with something like this, stating it has been founded on experiments and is a fairly accurate guide for a frontal attack.

$$\text{Log. p.} = A - \frac{B}{T} - \frac{C}{T^2}$$

Where A = 6.1007
Log. B = 3.43642
Log. C = 5.59873
P. = Pressure
T. = Temperature

But if he is kindly disposed at the time he may tell you that for his part he usually gets around it by consulting a book of tables to determine these values, where the whole thing is figured out for you in a reliable manner.

THE ONTARIO ASSOCIATION OF ARCHITECTS.

CONSIDERATION is being given by the Council and Committees to the educational and other matters to which the Association will direct its attention the coming autumn. It is expected that the new Association rooms will be ready for occupation about the first of September. Meanwhile, it is desired that architects should urge their students to register in accordance with the resolution adopted at the last convention.

Messrs. Beaumont, Jarvis & Co., architects, of Toronto, have receutly opened a branch office at 39 Sparks street, Ottawa.

At the regular meeting of the Toronto Engineer's Club, held on the 13th inst., the topic for discussion was "Freight Traffic on City and Suburban Tramways."

Joint Commitees of the Ontario Association of Architects and the Toronto Builders' Exchange, are considering the terms of the form of contract at present in use in Toronto, with the object of amending some of its provisions, if it should be found advisable to do so.

The following members of the Canadian Society of Civil Engineers have been appointed a committee to conduct tests and establish standards of quality of cement: Prof. Bovey, McGill University, chairman; M. J. Butler, C. B. Smith, T. Munro, C. H. Rust, P. A. Peterson, and G. A. Mountain.

STUDENTS' DEPARTMENT.

ARCHITECTURAL LEAGUE OF AMERICA.

The second annual convention of the above organization was held on the 7th, 8th, and 9th inst., in Fullerton Hall, and the rooms of the Chicago Architectural Club and the Chicago Chapter of the American Institute of Architects, Art Institute Building, Chicago, the following clubs composing the League being represented: The Cleveland Architectural Club, the Chicago Architectural Club, the Cincinnati Chapter, A.I.A.; The Detroit Architectural Club, The Architectural League of New York, The T-Square Club, Philadelphia, Pa.; The Pittsburg Architectural Club, The St. Louis Architectural Club, The Toronto Architectural Eighteen Club, The Washington Architectural Club. There were also present a number of visiting delegates from cities where branches of the League may not have yet been formed. The programme, which was closely adhered to, was as follows:

THURSDAY, JUNE 7.

Rooms of The Chicago Architectural Club, Art Institute.

9 A. M.—Meeting of the Executive Board.

10 A. M.—Committee to confer with Committee from American Institute of Architects.
Committee on Code Governing Competitions.

11 A. M.—Registration of Delegates.

Fullerton Hall—Art Institute.

1. P. M.—Call to Order.
Address of Welcome, J. C. Llewellyn, President of The Chicago Architectural Club.
Response and Address, Albert Kelsey, President of The Architectural League of America.
Roll call of delegates and representatives.
Appointment of Committee on Records and Publicity.
Election of Speaker and Secretary.
Election of Auditors to examine and report upon the Treasurer's accounts.
Reading of Communications.
Annual report of the Executive Board. Henry W. Tomlinson, Secretary.
Treasurer's Report, Herbert B. Briggs, Treasurer.
Reports of Standing Committees.
Club Organization and Management, William B. Ittner, Chairman.
Municipal Improvement, Cass Gilbert, Chairman.
Schedule of Circuit Exhibitions, Henry W. Tomlinson, Chairman.
Reports of Special Committees.
Committee on Co-operation with A. I. A., Dwight Heald Perkins, Chairman.
Code Governing Competitions, Julius F. Harder, Chairman.
Permanent Constitution, Julius F. Harder, Chairman.

5 to 8 P. M.—Informal Reception to The Chicago Architectural Club and its guests by the Builder's Club, fourth floor, Chamber of Commerce Building, S. E. cor. Washington and La Salle streets.

8 P. M.—Joint Meeting of The American Park and Outdoor Art Association and The Architectural League of America,—to which all interested in Municipal Improvements are cordially invited.

8 P. M.—Fullerton Hall, Art Institute.
W. M. R. French, Director of the Art Institute, presiding.
"Municipal Improvement," a paper by Mrs. Edwin D. Mead, of the Twentieth Century Club, of Boston, read by C. M. Loring, President of the American Park and Outdoor Art Association.
Illustrated with stereopticon.
"Municipal Development," Albert Kelsey, President of The Architectural League of America.
Illustrated by stereopticon.

FRIDAY, JUNE 8.

Fullerton Hall—Art Institute.

9 A. M.—Reports from clubs on the year's work and accomplishments.
Report from clubs on circuit schedule and appointment of committee for coming year.
"Philadelphia's Traveling Scholarships," William C. Hays, Philadelphia.
"Indigenous and Inventive Architecture," Elmer Grey, Milwaukee.
"The Education of the Architectural Student," Prof. A. B. Trowbridge, Cornell University, Ithaca. Read by Henry W. Tomlinson.
"The Architect," Frank Lloyd Wri ht, Chicago.

1.30 P. M.—Train leaves Illinois Central station, foot of Van Buren street, for Jackson Park, (57th street,) thence by coaches through Jackson and Washington Parks, Michigan Boulevard and Lake Shore Drive, through Lincoln Park to Bismarck Garden, where supper will be served during concert.

8.30 P. M.—Business Session to take up unfinished work.

SATURDAY, JUNE, 9.

Fullerton Hall—Art Institute.

9 A. M.—"Our Duty," W. Dominick Benes, Cleveland.
"American Architecture as opposed to Architecture in America," Ernest Flagg, New York. Read by Dwight Heald Perkins.
"The Licensing of Architects," A. O. Elzner, Cincinnati. Read by O. W. Drach.
"Progress before Precedent," J. F. Harder, New York.
Unfinished business.
Designation of place and time of next Annual Convention.
Election of Officers of the League and Executive Board.
Adjournment.

RECEPTION AND DINNER GIVEN TO THE DELEGATES AND VISITING FRIENDS BY THE CHICAGO ARCHITECTURAL CLUB, IN THE BANQUET HALL OF THE AUDITORIUM, JUNE 9—8 P. M.

TOASTS.

D. H. BURNHAM, Chicago, Toastmaster.

Welcome, - - - - - - - - By the Toastmaster.
Response - - - - - The New President, J. C. LLEWELLYN.

Music.

"The Architectural Club as a Factor in Public Affairs," ADIN B. LACEY, Philadelphia.
Solo - - - - - - - ARTHUR R. DEAN, Chicago.
"The Young Man in Architecture," LOUIS H. SULLIVAN, Chicago.
"Are Architectural Societies and the Architectural Press fulfilling their Whole Mission?" - - ARTHUR D. RODGERS, Boston.
"The Convention," - - - DWIGHT HERALD PERKINS, Chicago.

The papers deserving of special mention, presented at the convention, were as follows: "Indigenous and Inventive Architecture," by Elmer Grey, Milwaukee; "The Architect," by Frank Lloyd Wright, Chicago; "The Young Man in Architecture," by Louis H. Sullivan, Chicago; "The Architectural Club as a Factor in Fublic Affairs," by Adin B. Lacey, Philadelphia; "The Convention," by Dwight H. Perkins, Chicago.

Mr. Sullivan, remarking upon Mr. Grey's paper, said in part:

"The historical styles in themselves are absolutely without value as such and will not bear analysis. They were the expression of certain men who lived at a certain time. If these men, who lived at such times, were noble minded and of noble spirit and heart, their work is noble. If their minds were degenerated, their work is degenerated. All these qualities you will find depicted in the architecture of the past, running from the highest to the lowest, from the most noble to the most degenerate. The form in which these thoughts or feelings, or the lack of thought or feelings as they are disclosed, have nothing to do with the case when fundamentally considered. As Mr. Grey has truly said, the style is the evolution, if there be nothing other than the expression of its personality. If three men happened to think and feel something alike, the work of those three men will appear something alike. The same can be said of a thousand men acting and feeling the same way. That is practically all that can be said relative to the consideration of the national style as applied to the individual work. What counts, what is final and of consequence, is the individual. This has always been true, is true now and always remains true. What the individual thinks and feels makes him either a valuable or valueless member of the age in which he lives. If anyone supposes that by study, however reverent or serious it may be, in the spirit in which the past expresses itself, makes himself such valuable member, he is woefully mistaken. It may be true that he regards those expressions with reverence because he regards all expression of the mind with reverence. It has been suggested by Mr. Grey that by virtually relinquishing all the distinct forms of those styles we might finally reach a definite expression of our own. I see no reason why that would not be the result. There can be nothing else. A form which represents one state of feeling may not apply to another state of feeling. As, for instance, take the style of Francis I, it will not apply to the present age, nor conform to our national feeling. Francis I and the men of his day are dead, and will stay dead. Let us suppose, if it is possible to suppose, an architect, filled with the same spirit, influenced by want of sympathy, and under certain circumstances should build the same house in New Orleans that he builds in St. Paul, the people of New Orleans occupying such a structure would find it to be exceedingly uncomfortable. The first effort should be to adapt it to the comforts of the people with reference to the place where they live. What has style to do with it? This thought may be carried all through the discussion we have before us. What is the use of talking about books or about the styles we have passed? We have before us a simple plan. Examine any ordinary building with a little care and you will find it has the expression of one idea, solely and organically unfolding itself to the smallest detail. Therefore, if I talk about books or style, what will we gain by ignoring the fundamental law of development. A moment's reflection and serious thought will fill you wifh the correctness of the idea contended for. I know of no reason why that should not be the true idea: that architecture is the true expression of our lives."

An interesting paper, wh'ch appears on another page, was also presented on "Architectural Education," by Mr. Eden Smith, President of the Architectural Eighteen Club, of Toronto.

The report of the Chairman of the Committee on Municipal Improvements recommended co-operation on the part of the League with the local organizations already existing in many cities for the purpose of promoting public improvements, such as planting of trees, laying out parks and squares, placing of public monuments, etc.

Philadelphia was selected as the place of meeting next year. Mr. J. C. Llewellyn, of Chicago, was elected president under the constitution which has just been adopted, which permits the committee to elect the president only. The president, with the Executive Board of his Club, must then, within 15 days, appoint the other officers who will form the Committee of Management, these officers to be selected from clubs within a radius of 300 miles of the city to which the president belongs. The object in making this condition is, that the members of the committee shall be within easy call of the president, and be available for business meetings when required.

It was decided that Toronto should have an exhibition in the League circuit, the date being approximately fixed for January 25th to February 5th, 1901. An invitation was also tendered to the League, through Mr. J. P. Hynes, the representative from Toronto, to hold the annual convention of 1901 in that city, but the vote went in favor of Philadelphia, which was more largely represented at the meeting. The invitation from Toronto was, however, most heartily received, with cheers for the Queen and Toronto, and it is probable that should a larger delegation be sent next year, the convention of 1902 may be secured.

THE COLOR OF STONE AND ARCHITECTURE.

The magazine called Stone, prints the papers on the above subject read by Messrs. H. B. Gordon and John Gemmell at the last convention of the Ontario Association of Architects, and comments thereon as follows :—

"Messrs. Gordon and Gemmell are men of wide experience and of excellent reputation in their professions. What they have to say must carry weight. But architecture is not a matter for hard and fast rules, like all of the fine arts, its development comes from the expression of individuality. Every architect insensibly leans toward some individual mode of expression and try as he may to modify his style to suit various purposes, the personal element is, of course, always to be found in his work. Mr. Gordon, among the suggestions that he presented, said : "The colors of building material, if there is any variation in tone, should be darker at the base of a building and lighter as they ascend." No one will dispute this as a general proposition and one that is safe to be followed in most structures, and yet the genius of an architect may produce a most admirable and beautiful effect by the exact reversal of this rule. A striking illustration of this fact is given by one of the latest works of H. H. Richardson, whose death was the greatest loss American architecture has sustained. Few finer buildings arose under the inspiration of his genius than the City Hall, at Albany, N. Y. The building itself occupies a commanding site and yet one that is especially trying to any building. It is at one side of a large open square with a park at each end. Directly opposite is the towering granite pile of the State Capitol. At one side is the white marble State House of severely classical design. Diagonally across the square is the Albany Academy, a beautiful structure of brownstone in the Renaissance style, a fine example of the architecture of the early part of the century. Mr. Richardson, in his design for the City Hall, followed out his characteristic style, but introduced a daring innovation as pleasing as it was unexpected. The lower part of the building and all of the main walls are of light colored stone, while the trim and the entire upper portion of the beautiful campanile tower are of dark brown sand stone. One has only to look at such a building to see how impossible it is to fix hard and fast rules such as Mr. Gordon gives. To a genius like Richardson, ordinary rules were playthings.

Mr. Gemmell's paper is worthy of every consideration and yet the final word with regard to it can only be that it is merely an expression of his own personal preferences. Perhaps every one will agree that the architecture of our cities in the years gone by was depressing, from its lack of variety in the materials employed. The long rows of brownstone houses, about which he complains, can find few defenders not because the brownstone was an unsuitable material or lacked in beauty, but wholly because there was nothing to relieve the monotony of block after block of such buildings. The same may be said of different blocks of red brick buildings. We doubt if any stone ever quarried is beautiful enough to be used exclusively, without trying the eye and displeasing the aesthetic sense. The argument from the classical cities of antiquity in favor of nothing but light colored building material, counts for little in view of the entirely different conditions of modern life and architecture. In proof that a dark colored stone produces a beautiful effect when properly used with due regard to the style of the building and the surroundings, one has only to point to Trinity Church, New York. Few would have the hardihood to claim that Old Trinity would be improved if a light colored stone were used instead of the dark one that was employed, or that the edifice will not, at the very least, bear comparison with Grace Church or St. Patrick's Cathedral, in New York.

At present everything is in a transitional state and no one believes that the final word as to city architecture has yet been spoken. The finest effects in the future we firmly believe will be produced by skilful massing of different colors in stone and brick work, with an idea to general effect as well as to the effect in the individual buildings. The rich warm tone of some of the sandstones will produce beautiful harmonies when offset by the granites, marbles and limestones and we shall welcome the time when they are all freely used in the large business and public structures of a city. As an illustration of what may be accomplished by the skilful use of color in building material, we wish to quote the experience of a very successful builder and contractor in one of the large cities of this country. This man has built row after row of stone dwellings and apartment houses and he has had unusual success in selling them all rapidly and at satisfactory prices. He attributes his success to the fact that he has confined himself to no one building material but has made free use of every suitable stone. He does not build an entire block of brick, or limestone, or marble, or granite, or sandstone, but employs them all freely. He does not alternate them with checker-board effect, but masses the color so that each house shows to the best advantage and acts as a foil to its neighbor. When all of our builders and architects learn this lesson American architecture will take on a new meaning and importance. At the present time, when a great office building is erected of a certain stone and the effect presented is pleasing, the owner of the adjacent block is apt to erect a building of the same material, with the result that each mars the beauty of the other. If contrast instead of similarity were attempted, the beauty and consequent value of each structure might be enhanced."

QUESTIONS AND ANSWERS.

BUILDER, Ont., writes :—Would you kindly answer the following questions : 1. How is mason-work measured, as regards openings? Is it lawful to deduct all openings from the solid work? 2. When brick is laid at so much per M. to be measured in wall, on kiln count, does the builder lose all openings?

ANSWER.—Replying to the above, we may say that the first question is generally a matter of agreement before the work begins. If arrangements have not been made, then local custom rules, whatever that may be. If the bricklayer furnishes the bricks, he should have half the openings to cover waste and extra cutting. If the owner furnishes bricks and mortar, then the bricklayer only measures the solid wall, but should charge enough per M., to cover extra work about openings. Answering the second question : Bricks laid by the thousand, should be paid for by the thousand only, regardless of openings. This of course would be kiln count. Where a bricklayer contracts to lay bricks by the M., he is supposed to make his estimate big enough to cover any extra work on openings, cornices or string courses.

THE BUILDER

[THIS DEPARTMENT IS DESIGNED TO FURNISH INFORMATION SUITED TO THE REQUIREMENTS OF THE BUILDING TRADES. READERS ARE INVITED TO ASSIST IN MAKING IT AS HELPFUL AS POSSIBLE BY CONTRIBUTING OF THEIR EXPERIENCE, AND BY ASKING FOR PARTICULAR INFORMATION WHICH THEY MAY AT ANY TIME REQUIRE.]

Color in Rooms.

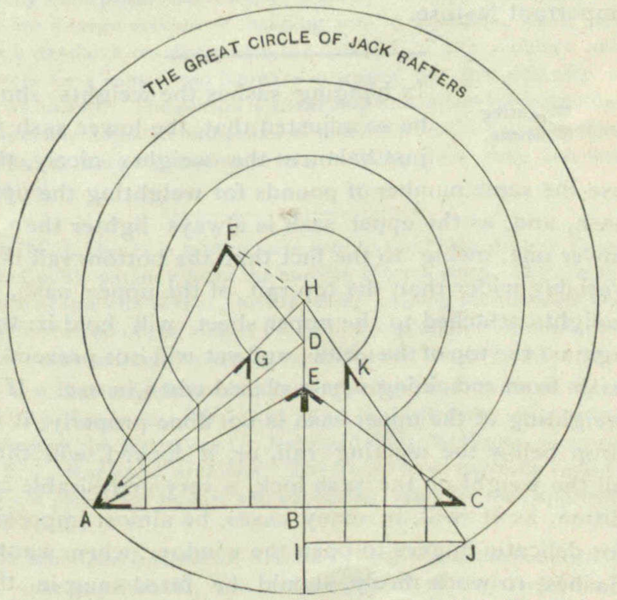
FEW matters in the finishing of interior of dwellings cause more concern than that of color. The tendency of opinion with regard to finishing the woodwork and walls in a house, is to have "variety," some rooms finished dark, others in light shades. While it may be true that "variety is charming," it is not exactly true that good taste demands that one room should be finished in dark colors, and the next one to it finished in white or light buffs; the best effects are made where rooms are all finished in middle tints. These tints need not be all in one color, but should be chosen with a knowledge of the relations they bear to one another, if harmony is desired. Dining rooms may be made somewhat darker than other rooms, for where a table is set it certainly looks better if the surroundings are of a receding character. Citrine, or blue of medium depth and with greyish hue, looks well for the wall of a dining room, and a maroon dado is very suitable. It is desirable that the spread table andthe viands have prominence given to them by the shade of the walls. Our table-cloths, however, are too strong in effect; instead of being white, they should be of a cream tint, for the general repose would not then be disturbed, and yet the table would have sufficient prominence given to it. The emblems of a feast, fish birds and beast, may sometimes be incorporated with decorations, particularly in the windows, if colored glass is used, but the drawings should be of a conventional character. Parlors or drawing-rooms may be decorated in lighter tints, but it must be remembered that white is always a very chilly color, and furniture cannot look well against a very light wall. Here light tints of a warm hue may be indulged in with good effect, it taste is displayed in harmonizing the tints which, when properly done, induces cheerfulness and promotes conversation. Bed-rooms should be made to look cheerful and cosy, and for this purpose should be finished in the same color, having red as a motive, but pinks should be avoided. Terra-cotta or light brown with a reddish cast may be used with good effect, and sometimes, for a young lady's bed-room, a dark lilac, with terra-cotta trimmings may be used, but this latter will require handling with skill. A smoking den is the one room where the grotesque and humorous may be allowed, but the grotesque, both in color and decoration, must be clever and vigorous, to be effective. In all rooms the appearance of effort should be avoided, and there should be no display of wealth beyond the capacity of the owner, yet, there should be a feeling of "competency" in every room. If special richness is to be indulged in, bestow it upon the library, where all the surroundings may be made to harmonize with the costly bindings of the books.

Staining White Pine.

THE fashion of staining white pine in imitation of more expensive woods does not seem to be in good taste, unless the work is exceedingly well done. The sham is at once apparent, and the effect is garish and vulgar. White pine itself is a beautiful wood for interior finish if properly treated, but the soft, silky texture of the grain is spoiled by the attempt to imitate walnut or cherry. Where other than the natural color of the wood is desired, artistic effects may be produced by making use of some of the aniline dyes, and staining in the various tones of green, light brown and yellow, which preserve the grain and texture of the wood, and may be made to harmonize with the surroundings. Of course, the dye, no matter what the color, must be put on lightly and evenly. No sandpaper must be used, and the whole work should be finished in white shellac, which may be rubbed down after the whole is dry and hard.

Lengths of Jack Rafters.

IN the formation of hip-roofs, two difficulties generally confront the young workman—first, the finding of the length, bevels and cuts of the hips, and second, the finding of the lengths and bevels of the "jacks," or cripple rafters. The first difficulty has been dealt with in these columns a year or so ago, so we will confine ourselves in this item exclusively to jack rafters. Let us examine the diagram shown herewith, and which



FOR GETTING LENGTHS AND BEVELS FOR JACK-RAFTERS.

was invented by Mr. J. P. Hicks some years ago, and which he has named "The great circle of jack rafters." If A B represents the long run of the common rafter, B E the rise, and A E the length, then a bevel set on E and A will give the down bevel, and A will be the flat-foot cut. B C is the short cut of the common rafter, B E the rise and C E the length; a bevel set at E on the line C E will give the down bevel, and at C the bottom bevel. B D is the short run of the common rafter and the same as B C; then A D is the run of the hip, D F the rise, and A F the length of the hip rafter. The bevel at F is the downbevel, and at A the bottom bevel. A H shows the hip rafter dropped down to position. To find the length and bevel of the jacks for the side of roof having the short run of common rafter, space the jacks on the line A B and draw perpendicular lines joining the hip line A H for the length of jacks. A bevel set on the angle at G will give the bevel across the back. The down bevel is the same as that of the common rafter for the short run, and is shown at E on the line C E. H is the apex of the triangle formed on the side of the roof having the short run of common rafter. It is evident that the apex of the triangle formed on the side of the roof having the long run of common rafter must be at the same point, therefore H is the apex of the hip and of the common rafters from either side of the hip. Now, to find the lengths and bevels of the jacks on the side of the roof having the long run of the common rafter, measure down from H to I the length of the common rafter on the long run, which is the same as A E. From I set off the short run of common rafter to J, connect J with H, which places the hip rafter in position for finding the lengths and bevels of jacks on the side of the roof having the long run of common rafter. Space the jacks on the line I J and draw perpendicular lines joining the hip line J H, which gives the lengths of jacks. A bevel set in the angle at K will give the bevel across the back. The down bevel is the same as that of the common rafter for the long run, and is shown at E on the line A E. The circular lines show that taking H as a centre the triangle H I J will swing around opposite the triangle A B H, and bring every jack opposite its mate on the hip line A H, thus proving the correctness of the method, as well as showing how to space the jacks correspondingly. It will be noticed that this system can be adapted to unequal roofs as well as to those that are uniform, or of equal pitch, a very important feature.

Weighting Windows.

In hanging sashes the weights should be so adjusted that the lower sash will just balance the weights nicely, then use the same number of pounds for weighting the upper sash, and, as the upper sash is always lighter than the lower one, owing to the fact that the bottom rail is invariably wider than the top rail of the upper sash, the weights attached to the upper sheet will hold it tight against the top of the frame, and yet will not prevent the sash from remaining where placed when in use. If the weighting of the upper sash is not done properly, it will drop below the meeting rail, or, if locked, will throw all the weight on the sash lock, a very undesirable condition, as it will, in many cases, be almost impossible for delicate fingers to open the window when wanted. Sashes, to work nicely, should be fitted snug in their runways, not so tight, however that paint or moisture will prevent their working. Good cotton cord is better to use for hanging than hemp or manilla, as it works smoother, and, if lightly coated with hard mutton tallow when put in place, will last a long time and run quite smoothly. Of course, very little tallow must be used.

EXTRAS AND OMISSIONS IN BUILDING CONTRACTS.*

By E. H. Blake.

Building contracts had, said the author, been described as "the most complicated and most difficult, and, in many respects, the most unjust contracts that commercial enterprise had ever been able to achieve." But the words, spoken some fourteen years ago, were hardly so applicable now. A contract to erect a building could never be a simple one, being arranged between two parties by a person who was no party to it, and yet had large powers under it, and being subject to a whole schedule of conditions. The contract might be unjust to either party. The builder might suffer from having to estimate for matters which were either in ignorance or by design left uncertain, with a view to getting com-competing tenders; and, again plans and specifications from which a builder is expected to "erect a complete building" might in themselves be incomplete or impracticable. It was true that most architects or engineers would not shirk their own share of responsibility for imperfect plans; but there were important cases which showed that, where they did, the law was with them. The risks to which the two parties were liable might be summed up as in the case of the building owner—excess of cost over contract price, failure of builder, and delay through weather, strikes, etc.; in the case of the builder, strikes variations in price of labor and materials, failure of owner, accidents to workmen, faulty plans and quantities and penalties. A reasonable contract reduced the element of risk to either party to a minimum. One of the most difficult matters to settle was the question of extras and omissions. The knowledge of the employer on such matters was limited, and his intentions were often not very clearly defined, even in his own mind. The architect could only advise, and act as the employer's agent; but he had no implicit authority to alter the terms of the contract, even though the owner generally by his contract conferred large powers on him. There was sometimes a lack of confidence between architect and builder, and the contract conditions must, therefore be exactly defined.

All extras should be subject to a signed order from the architect, and the price be based on a previously deposited schedule. The avoidance of any misunderstanding should be secured before signing the contract, preferably by the care of the surveyor in taking off the quantities. The quantity surveyor's work must be exact, and could not be matter of opinion, so far as labors and materials went. There was so much to be done and used or there was not; but insufficient descriptions were often responsible for inaccuracies. The question of liability of the surveyor for inaccuracies depended much on his position and mode of appointment. The case of "Priestly v. Stone" was well known. The quantities were taken out from unfinished drawings, and the architect afterward altered the drawings and specification and submitted them with the original quantities as a basis for tendering. It was held that there was no privity of contract between quantity surveyor and builder, although in spite of this judgment it was still customary to hold the surveyor morally liable to the builder for inaceuracies. The moral aspect of the case as regards the owner who might receive work for which he had not paid, must also be considered. Quantities should, of course, be prepared by a qualified man, and time shonld be allowed for their careful completion. The author recommended that they should be made part of the contract. It was unfair to issue bills of quantities for the purpose of tendering while repudiating all responsibility for their accuracy, merely allowing a week or so for the contractor to verify them. This practice was happily dying out. It was very important that in all stages of the proceeding the employer should be kept informed of his liabilities to the quantity surveyor and to the builder. A strong opinion had recently, in the case of "Torrome v. Scott," been expressed by the Lord Chief Justice, that quantities should be taken out by an independent person. The essence of a just contract was exchange, in strict equity, of cash for kind. "Extras" were all works not included in a contract, for which instructions were given. "Omissions" might occur where quantities formed part of the contract. "Extras" might arise through exigencies not previously known to exist. Where they do not form part of the contract, works necessary to complete were not extras, though not shown or specified. In this connection the author would refer members interested to the cases of "Sharp v. San Panto," "Thorn v. London Corporation," and "Bottoms v. York," which were all instructive from various points of view. It has been held again and again and again by the Courts, that the plans, specifications, etc., were in the nature of information enabling the builder to

* Abstract of paper read before the Surveyors' Institution, London.

tender, but no warranty of accuracy or practicability was implied. The cases seemed to indicate that some amendment of the law was necessary, and that meanwhile contracts must be very carefully drawn. The best way was, the author held, to make quantities the basis of the contracts, the contractor then being liable only to do work for which he had tendered a price, and the owner only entitled to receive value for which he had agreed to pay. A contract for a complete work included everything necessary to the completion thereof, it being immaterial that such works were omitted from the drawings or specifications, or that certain things were impracticable, or understated or miscalculated. In the case of impracticable plans, where quantities were not part of the contract, authority given to the architect to order extras did not empower him to order work necessary to make plans practicable. Should he order as an extra anything indispensably necessary to the contract, unless his certificate was a final and conclusive one, neither he nor the employer was liable to the builder, who was held to know that the matter was necessary to the completion of the contract. If a contractor had no confidence in an architect, he should avoid a contract which gave the architect sole power to interpret the meaning of all points under the same, for in case of impracticability there might be a difference as to the mode of completion. If the contract contained an arbitration clause, it would be a matter for reference whether the proposed mode of completion came within the contract. An architect, if not generally empowered to order extras, must obtain the employer's instructions. If the contract demanded his written order, he must be careful not to certify for anything done without such order. If quantities did not form part of the contract he must not order as extras, or certify for as extras, anything indispensably necessary to completion. There was apparently no implied authority to an architect to order extras. He must be expressly authorized, and the question of his authority was one for a jury. It was, however, the custom to regard the architect as the employer's agent in the fullest sense of the word. Although a contract required written orders for extras, a final and conclusive certificate including amounts in respect of extras would render the employer liable. A verbal promise to pay for extras was valueless. All orders should be transmitted to the builder through the architect in every case. It had been decided that even where interim certificates described and included additional work such certificates did not dispense with the necessity for written orders. It was to be noted that the measuring surveyor had no authority with respect to performance under the contract. He had to deal with facts and matters placed before him by the architect. The granting of a final certificate required great care. If the architect certified as to extra work which had not been done, or was indispensable, the employer must pay unless he could prove negligence, or fraud, or collusion. The case of "Rogers v. James" was quoted in this connection, as well as that of "Tullis v. Jackson." To come under the heading of extras, additional work must be done under orders issued during the execution of the contract, all subsequent orders coming as a matter of fresh transaction. In the case of considerable variations during the execution of the contract, the work must be considered "extra," provided there was evidence that the parties agreed to its being subject to contract terms. Where departure from plans involved a fresh class of work or material, such extra work was beyond the contract altogether. It was, however, customary to stipulate that no variations should vitiate the contract; but that all authorized extras and omissions should be measured and valued. An architect had no power to substitute one class of work or materials for another without adjustment in the final settlement. All dealings between builder and employer should, as he had said, be conducted through the medium of the architect. If, from any cause, it were necessary to substitute other material or work for those specified, the architect must be apprised of any extra cost, and sanction must be obtained in the manner provided in the contract. If, however, the contract were one involving a necessity to complete, within a definite time, for a certain sum of money, it would be at the contractor's expense that other materials or work were substituted, subject to the sanction of the architect. If the cost to the contractor were less, the employer could not claim a reduction. The architect should have full power to reasonably extend the time for carrying out a contract if the delay were due to extras ordered. The important case of "Dodd v. Churton," decided, with reference to the case of liquidated damages for failing to complete within a certain time, that if the delay were consequent on orders for additional work, the contractor was exonerated from payment of damages, unless there were an express agreement to the contrary. Great difficulty frequently arose from the adoption of old forms of contract with added clauses which overlapped the main clauses, especially in the clause referring all matters in dispute to an arbitrator, and the clauses making the architect's decision final. The author, in conclusion, dealt with the adjustment of accounts, which he said was generally left to the surveyor who prepared the quantities, who had a priced copy of the bill of quantities deposited with him at the beginning of the contract. The question of incorporating the quantities as part of the contract must be determined by the circumstances in each case, and the decision in "Priestly v. Stone" should be carefully considered as governing the law at present under the particular conditions obtaining in that case. Above all, fairness to all parties was the essence of a sound contract. No enmity should be allowed to influence the dealings between contractors and employers, and the proper duty of the surveyor was to eliminate as far as possible all uncertainties and points of dispute before the signing of the contract.

PRIZES FOR ESSAYS.

The National Educational Association of the United States offer the following prizes :—For the best essay submitted on each of the following topics : The seating, the lighting, the heating, and the ventilating of school buildings, $200.

For the second best essay submitted on each topic, $100.

Each essay shall be limited to 10,000 words and shall be submitted in printed or typewritten copy without signature, but with name of author enclosed with it in sealed envelope and addressed to the chairman of the committee at Emporia, Kansas. Three copies of each essay shall be submitted. They must be mailed not later than February 1, 1901. The essays and envelopes will be properly numbered for identification and the former forwarded to three experts to be hereafter appointed by this committee. Each expert will be ignorant of the appointment of the others and their combined judgment shall determine award. Should no essay on any topic be found worthy of an award and publication, the committee reserve the right to withhold the same.

The council reserve the exclusive right for the National Educational Association to copyright the prize essays and to publish the same for general distribution.

The essay on ventilation should include full suggestions concerning the use of disinfectants.

Should the awards on two or more essays be made to the same person, he will be permitted to revise and unify the manuscript before publication by the committee.

BUILDING CONDITIONS.

The unusually high price of most classes of building materials, more particularly lumber and metal goods, coupled with the demands of workmen for increased wages, is affecting unfavorably building enterprise. At Ottawa, where in consequence of the recent fire a large volume of building was in prospect, there has been a deadlock resulting from the demand of the builders and laborers for a substantial increase in wages, bnt the difficulty is now at an end. The season is advancing and unless labor troubles are speedily adjusted and prices of materials shall rule lower than at present, there will be much less building done than was anticipated.

Mr. M. J. Hynes is said to have sold to the Perth Amboy Terra Cotta Co. his patent kiln for the burning of terra cotta. The special feature of this kiln is that the fire, after passing up through the walls to the top of the kiln, is brought down again through the centre, thus heating the kiln more uniformly throughout.

A new Plumbing Board has been appointed at Ottawa, of which the City Engineer, Mr. John Galt, is chairman. The other members of the Board are Dr. Robillard. Wm. McKinley, plumber, and E. L. Horwood, architect. The Board have carefully revised the local plumbing by-law and submitted same for the approval of the council.

The American Institute of Architects have begun the publication of a quarterly Bulletin, the first number of which is before us. It comprises fifty pages, 7×9½ inches in size, devoted to chapter notes, a list of competitions for government buildings, a list of publications received during the quarter, and an index of literature from the publications of Architectural Societies and Periodicals on Architecture and allied subjects which are sent in exchange to the Institute. The Bulletin is edited and compiled by the secretary of the Institute, Mr. Glenn Brown.

MASONRY STRESSES.

THE most valuable lessons and principles in structural science are derived from failures when intelligently investigated, says a writer in the Contract Journal. The range of duties imposed upon structures not being always sufficiently anticipated often leads to failure. Materials not weathering according to reasonable anticipations is likewise a source of failure. A frequent cause is the execution of the work of a class inferior to that upon which computations of strength are based, seemingly ignoring the weakening effect of weather and local exposures to which structures may be subject. It is here to be observed that very few tests are made of the strength remaining in old materials, which have been in service in particular lines of duty. The information to be derived from this class of tests is not less important than that of new materials. It reveals the probable decrease of strength which all new materials of the like kind, to do duty in like conditions, must be expected to undergo, and which should be duly allowed for. The proper factor of safety to be allowed in structures is in some instances more a matter of following authorities than the result of a due investigation of the vital conditions which are inseparable from the problems of the case.

It may be a simple enough affair to compute certain generally recognized stresses in masonry structures according to ordinary rules and in the general modes in which they are set forth and discussed, say, in text-books. But to have to realise that you must be individually responsible for the sufficiency of the computations reaching to and covering all the conditions practically involved makes it a serious matter. Anticipating all the conditions and factors which may be actually involved in masonry stresses often requires searching investigation. No text-book example can be expected to anticipate local exigencies, and it is these which the practitioner must find out and investigate for each case according to its needs.

In usual methods of computation the full section is treated as if the whole area were available for sustaining the load. Suppose a masonry pier, for instance as it is the most tried type of structure, and its statical stresses are regarded as the most precise. All masonry, we know, consists of facework, backing, and filling, whether it be ashlar, block in course work, coursed or uncoursed rubble, the latter sometimes called random rubble. Each of these four kinds of masonry vary, according to circumstances, as to size of blocks of stone, quality of dressing, care in laying in pier, selection of stone, quality of mortar, nature of the filling, and so forth. The filling in even of ashlar or block in course work is invariably of rubble, and of an inferior class according as the filling space affords room for large rubble stone or spawls and chips only. Even when rubble stones are filled in, much spawls and chips are thickly bedded in mortar, so that although it occupies a large part of the sectional area, it can take but little of the stress until the facing shell with closer bed joints yields sufficiently to bring the filling into bearing duty. The large proportion of mortar in the filling when of lime will shrink more or less and remain soft for a long time, hence the capacity of the filling to take a share of the pier load is not of a promising nature. With cement mortar, when properly indurated, the case would be different, depending on its quality. Most of the failures of piers of Norman and Gothic cathedrals are due to the inferior masonry of the filling. The shell of facing stones carried all the load that was assumed to be distributed over the entire cross-section of the pier. Since there are very wide differences in every description of masonry in the four types already named, not only in achitectural work, but to a greater extent in engineering masonry, there should be discrimination in their adaptable loads. For instance, ashlar masonry, assuming it for argument to be all ashlar throughout the section, would have different bearing capacity for different size blocks. Thus blocks containing but a quarter of a cubic yard, would have much less bearing strength than blocks of a cubic yard to 1½ cubic yards—i. e., 40 cubic feet. This assumes that the blocks, large and small, are all solidly bedded throughout the entire area of the bed, but in the larger beds this is difficult if not impossible in ordinary conditions of stone setting, except the contact beds are all dressed to true corresponding planes. Though large masses of stone have greater unit strength than the small cubes used in testing, from which the data of crushing loads are obtained, compound structures are not so strong as monoliths. The ratios of the respective strengths is not a constant quantity for general use, and therefore difficult to apply. In the case of piers that have great height as compared with their least thickness, some diminution of strength must be allowed for. In many descriptions of masonry piers the loads are not applied axially, so that the resultant cannot pass through the centre of the section. This disparity may cause a diminution of strength up to a third in a homogeneous structure, but much greater disproportion when only the pier shell takes the full load stresses.

In recent years many practitioners prefer to take the "cracking" instead of the "crushing" strength of materials as the real criterion of strength. They argue that in practice crushing of a structure should never be approached, and that cracks indicate the full permissible extent of failure to which it can be allowed to go before being protected. The additional load necessary to crush a specimen after being cracked varies with different materials. Mr. W. G. Kirkaldy published some specimen tests, which included the "cracking" and "crushing" forces for various kinds of stone under their quarry names for the London and North-Western Railway engineer. In a few cases the cracking and crushing was simultaneous, and in others up to about one-sixth less load was required to crack than to crush the specimen. The specimens were in many instances from one to four diameters high, the higher prisms giving less resistance than the lower ones, which were 6 in. cubes. The difference in these also varied up to about one-sixth of the cube results less for cracking than for crushing.

The stresses which may disturb the stability of a pier are exposure to heat and cold, causing expansion and contraction, of sub-structure and super-structure, live or varying loads, in the case of roads, railways, stores, etc., strong winds. The failure of the towers of the Niagara Suspension Bridge, which were completed in 1855, and replaced a few years ago by iron structures, is instructive. They were 90 ft. high on American side and 80 ft. on Canadian side, and were of compact limestone ashlar, laid in cement. The load was 36 tons per square foot of section. The towers were bedded on the country rock of the Niagara gorge, and were full of cracks in all directions, when examined by Mr. L. L. Buck the engineer, in 1887, the most serious being vertical fissures caused by pressure. The stone was the compact limestone of the neighborhood; the upper stones of the quarry were laid in the base of the towers, about 20 ft. high on the Canadian side and 10 ft. higher on American side. The stone from the lower quarry beds were laid in the upper portion of the structures which was found most perishable. There were a pair of towers at each end between which the railway and the highway road underneath it passed. The superstructure of the towers was in the form of the frustrum of a pyramid 15 ft. square at the base and 8 ft. square at the top, where the iron saddle with the roller bed is bedded upon the masonry. When the masonry towers were taken down many of the stones were found to be only half bedded, which gave rise to complex stresses in the towers, and was one cause of failure.

Having briefly reviewed the most prominent disparities which occur in practical instances to more or less extent, it evidently becomes a question of supreme importance in each case to determine the value of these factors as far as they apply. The suitable factor of safety cannot be determined intelligently without such investigation, but when they can be satisfactorily ascertained a more economical factor of safety can be used to cover what still remains doubtful. Sir Benjamin Baker in 1884 stated that "the factor of safety of 4 will be obtained as regards all shearing, tensile, and compressive stresses to which the masonry may be conceived to be liable under any reasonable hypothesis which can be framed." Doubtless the circumstances of the Niagara masonry suspension towers are quite outside any reasonable hypothesis conceived at the time by Sir Benjamin Baker, because (1) the climatic extremes were abnormal, (2) the suspension bending stress due to contraction and expansion of over 2 in. horizontal in winter, and (3) the railway line load stresses on a suspension structure induce bending moments. To these should be added the rigidity of massive country rock foundation, which intensified the stresses, and the height of the masonry was above average. However since the load was 36 tons per foot of cross-section and the compressive resistance of compact limestone is usually given at 500 tons per square foot, then 500/36 = 14 nearly as the factor of safety taken by the builders of these masonry towers. On the other hand, Prof. Unwin recommends 20 as the factor of safety for dead loads and 30 for live. Stoney suggests 20 for arches for dead load. Prof. Rankine names 10 for dead loads under various conditions. It is not surprising that authorities should differ so widely in this important matter, for each had in view at the time a particular range of conditions which was intended to be covered by the factor of safety which they respectively recommended.

There is individuality with practitioners in all branches, each for a special reason adopting his own method in matters of detail. Some architects and engineers adopt bond blocks in brick piers, which are well loaded, with the view of equalising the stresses and rendering the pier more homogeneous. Other architects again will prefer to trust to the bond of the brickwork, as they consider that the bond stones throw all the load upon the shell of the face, because of the difficulty found in obtaining sound bedding of the block in its centre area upon the brickwork. It may here be noted that there would be the same objection to having a template and base block upon the top and bottom of the pier to receive its load. These latter blocks cannot well be dispensed with, and the bedding has to be relied upon for transferring and distributing the load stresses. Of course, it has been found in many instances that stone blocks of an area of, say, 5 ft. or 6 ft. superficial in the bed requires careful bedding to have it solid throughout its centre. In many cases grouting is resorted to for filling up not only bed-joints, but for bonding work together with cement. If the grout has sand in its composition, the sand and the cement having different specific gravities, the heavier (sand) will naturally be most in the lower levels, while the lighter cement will be in excess in the upper levels.

In abutments for arches and retaining walls there is always a varyingly large proportion of horizontal component in the thrusts. In the case of the abutment the amount of the horizontal component is increased as the arch is flattened. Abutments in some cases act also as retaining walls, having horizontal components acting in opposition to those of the arch. Such cases occur in ravines, cuttings, high river banks, and such like positions. The theories respecting the stresses in arches are various, according to the assumptions made by the investigators, each of whom believes that his method frees the problems from indeterminate results. Unfortunately some of these theories differ seriously from each other. There is a similar diversity of theories respecting the stresses in retaining walls. All rules for the solution of the problems for obtaining the direction and intensity of the masonry stresses encountered by retaining walls rely on certain foundamental principles and assumptions respecting the action of the earth at the back: (1) as to the nature of the surface of earth rupture; (2) as to the concentrated point of application of the earth force; (3) as to the direction which the earth pressure assumes. All earth or soil differs more or less from any generally assumed convenient classification, and they also differ in condition, and the condition varies according to season and the effects of the weather, recent and present.

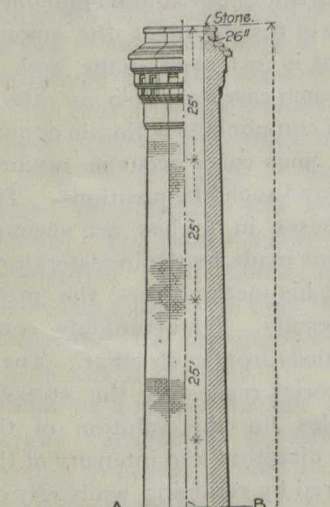
ITALIAN BRICKWORK.

Italian bricks are by no means of very fine quality save where moulded bricks are used, but the Italian architects, says the British Clayworker, differ from others in the extent to which they made use of stone intermixed with the brickwork of their buildings. The arrangement refers not only to the occasional introduction of stone voussoirs in the arches, but to the commonly recurring system of horizontal courses of stone alternating with courses of brick in the walling. Sometimes this is regularly carried all over a wall, sometimes only a course of stone is introduced here and there to mark some line or feature which appeared to require considerable emphasis. Sometimes again, as in the Romanesque apses of San Fermo Maggiore, Verona, a single course of brick is introduced between all the courses of stone, and the effect of this is delicate and good. The same church contains many examples of very ingenious mixture of stone and brick, and, on the whole, few examples are altogether more valuable. Sometimes we find, as in a wall in San Stefano, Bologna, the wall diapered regularly in brick. Here the diaper is made with thin red bricks arranged in diagonal lines all over its surface, the squares contained within them being all of yellow brick. This kind of work is never pleasant, save for the filling in of a spandrel, or some such place where no strength is required. It gives, of course, the impression of being a veil to the wall and not the wall itself.

COLLAPSE OF A CHIMNEY AT HAMILTON, ONT.

At one o'clock on the morning of the 19th of April a brick chimney 200 feet in height, constructed at Hamilton, Ont., for the Hoefner Refining Co., collapsed. The structure had only been completed on the afternoon of the previous day. We reproduce from the Engineering Record the accompanying illustration and particulars of the chimney, and the circumstances under which the accident occurred :

A sectional elevation of the chimney is given in an accompanying drawing, from which it may be noted it was a single shaft resting on a stone masonry foundation on concrete. It rose to a height of 200 feet, and the cross-section of its flue was apparently a regular octagon, the diameter of the inscribed circle being 8 feet. The brickwork varied from 5 feet 6 inches in thickness at the base to 26 inches at the top. There were no offsets on the inside of the shafts, as are common in such structures. The tunnel connecting with the chimney flue, it will be noticed, entered through the footing, on top of the two lower courses.



CHIMNEY FAILURE, HAMILTON, ONT.

The ground on which the stack stood is blue clay. Beach sand was used in the outside masonry and the sand for the inside was taken from a building site in the city which had been pronounced good. In the cold weather the mortar was used hot. It is stated that when the stack was up about 170 feet, it showed signs of crushing on all four sides, just above the stonework, bricks chipping off in many places. Attention was drawn to the circumstance at the time, but the chimney was completed, with the result that when the 30 feet were added the collapse came. The chimney fell in a direction north by east, and on the same side as the tunnel. The ragged line across the drawing near the base of the chimney shows the stump left standing, which has several fissures or cracks running diagonally across it as much as an inch wide.

A calculation was made to determine the probable static unit stress of the brickwork on the bearing area of the stone masonry, where, it will be remembered, signs of crushing were observed. Assuming the chimney to be square on the outside for 25 feet of its height, or from the 5-foot elevation to the 30-foot elevation, and to be the frustrum of a pyramid from this level to its top, the cubical contents, subtracting the 195-foot octagonal flue space, were found to be about 36,500 cubic feet. The brick masonry was assumed to weigh 125 pounds per cubic foot, so that the total weight of the brickwork would amount to 2,285 tons. The bearing area being 308 square feet, the pressure per square foot due to the dead weight would, therefore, be 7.4 tons.

Later information states that several large stones were found embedded in the first or lower 25 feet of the shaft, where the wall was 5 feet 6 inches thick ; and all along the line where the shaft slid off, these stones were exposed to view. The contractor claims he was instructed to put the stones in, while the architect charges the contractor with this construction. Some of ot the stones came to within four inches of the outside face and were irregular in shape and as much as 1 foot 11 inches in depth. A first-class brick was used in ordinary lime mortar. At the time of the accident a slight southerly wind was blowing.

In reply to enquiries we are informed that the chimney is being rebuilt by the same contractor, under an inspector, but we have not learned who is to bear the loss resulting from the accident.

CONCRETE FLOOR CONSTRUCTION.

RULES for concrete floor construction were recently given by Mr. Frank Caws, in a paper in the Journal of the Royal Institute of British Architects, as follows :

1. To take pains to obtain old cement. 2. To use good broken-brick aggregate, and not sand, in the proportion of four of brick to one of cement for the body of the slab, and fine crushed granite without sand for the surface coating, having about three of granite to one of cement. (I may say I have found that when the surface coat is gauged two of granite to one of cement, it sets too soon, while the continued expansion of the body beneath is still going on, and this causes minute cracks, tending to deface and spoil the surface.) 3. To adopt, as precautionary provision, sheep-wire netting as the base, and steel angle or tee bars weighing not more than 1½ pounds per lineal foot, spaced about 3 feet apart on the netting. 4. To consider a slab 10 feet square by 4 inches thick as capable of sustaining a load of 9 hundred-weight per foot, including its own weight, and to reckon that every slab will bear per square foot more or less than 9 hundredweight directly in proportion to the square of its thickness, and inversely in proportion to the cube of its span. When the slab is rectangular the minimum span has to be considered the span. 5. To avoid casting slabs in frosty weather. 6. To insist upon organizing the gangs of workmen so as to cast as large an area of slabs as possible in one heat, and never to allow a slab to be left over night with its area only partially cast. 7. To insist upon strong centering, and to keep it all standing not less than five weeks after the last slab of the series of one flat is cast, and absolutely to forbid and prevent the sudden and careless removal of the centering.

PROPOSED NEW CEMENT MANUFACTURING COMPANY.

A public meeting of the citizens of the town of Durham, Ont., was held recently to consider what steps should be taken to establish there a Portland cement manufactory. It was stated that the conditions were most favorable, an abundant supply of the required mud and clay being available, with excellent shipping facilities. The following gentlemen were appointed a committee to secure a charter for a joint stock company to carry out the project : Messrs. Neil McKechnie, Gilbert McKechnie, Wm. Laidlaw, Chas. McKinnon, Charter Smith and Dr. Jamieson.

THE STRENGTH OF GLASS.

By C. H. C. Wright, B.A. Sc.

The following experiments were performed in the laboratories of the School of Practical Science under the direction of Principal Galbraith. The results are republished by permission from the Transactions of the Engineering Society of the School.

One of the lower sashes was taken out of a western window of the assembly hall of the school (top floor) and its single light of glass loaded and broken as indicated below. The glass had been exposed to the action of the weather for the past ten years, was well bedded, and the putty was quite sound and hard.

The sash was placed with its weather side up on a carefully prepared box 8 inches high laid horizontally. Sides 12 inches high fastened well together were placed on top of the sash and then paper scales divided into half inches were pasted on each side. Light graduated pointers with their cardboard bases were placed on the surface of the glass. The whole made an arrangement as indicated in the accompanyiny sketch.

Portland cement was then sifted very gently over the surface of the glass care being taken to keep it of uniform depth, for which purpose the graduated pointers and scales already mentioned answered admirably.

The glass measured 36 inches by 36.75 inches and a bag of cement (88 lbs. net) was sifted over its surface, then a barrel (347 lbs.) was gradually added, this was followed by a box of cement of 78 lbs., this by a second of 54.5 lbs., and finally a layer of bricks of 88.5 lbs. was added to the superimposed load. The failure occurred while the second lot of bricks were being weighed.

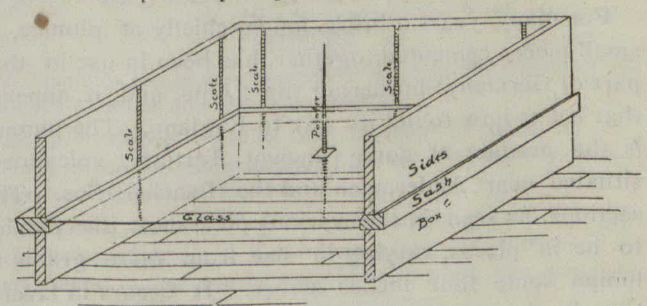
The deflection was approximately 7 / 16 inches under a load of 420 lbs.

After the experiment the cement was passed through a sieve, the pieces of glass were collected and weighed, and from their appearance the glass was what is known to the trade as 26 oz. It was certainly thicker than double diamond and not so heavy as 32 oz.

A sheet of double diamond was next placed in the sash but was not bedded nor puttied, and the load applied as before. This was followed by sheets of 16 oz. and 32 oz. weight respectively.

OLD WINDOW.

With glass probably 26 oz.
Size of glass—36 inces by 36.75 inches.
Weight of glass—15 lbs.
Failed under a uniformly distributed load of—656+15=671 lbs.
Pressure in pounds per square foot—74.55.



DOUBLE DIAMOND.

Size of glass—36 inches by 36.75 inches.
Weight of glass—13.5 lbs.
Failed under a uniformly distributed load of—262+13.5=275.5 lbs.
N. B. This sheet of glass in its unstrained condition was badly warped.

16 OZ. GLASS.

Size of glass—36 inches by 36.75 inches.
Weight of glass—10 lbs.
Failed under a uniformly distributed load of 322+10=332.
Pressure in pounds per square foot—37.

32 OZ. GLASS.

Size of glass—36 inches by 36.75 inches.
Weight of glass—17 lbs.
Failed under a uniformly distributed load of 611.5+17=628.5 lbs.
Pressure in pounds per square foot—69.8.

NOVEL METHOD OF SHORING.

An interesting method of supporting a building while the foundations of an adjoining structure were being laid was recently illustrated in Chicago. An eight-storey building was about to be erected for light manufacturing purposes, the structure being L shaped, and designed to occupy, with the exception of a plot 50 x 80 feet, upon which stood an old three-storey building, the entire area of a lot 150 x 100 feet. The owner of the old building refused to make any agreement for a party wall, and the only alternative left by custom was to support it either by cantilevers or caissons, while the piles were driven for the foundation of the new structure. For various reasons the architect decided to support the adjoining walls of the building on beams resting on bearings which would be 10 feet from the trench where the piles were to be driven. The foundation of the new building contained some 400 piles, 100 of which were driven in a double row around the two adjoining walls of the old building. The walls were cut off below the first floor and supported at intervals of 6 feet on three 20-inch steel beams, resting on bearings 10 feet from the trench. The work was commenced by digging a trench about 6 feet below the basement of the old building, in order to eliminate vibration, then the piles were driven, the first row being within four inches of the wall, and so close that the hammer of the driver at times scraped the bricks of the old wall. Readings were frequently taken, but at no point was the displacement of the building greater than ¼ inch. It is stated that this is the first time this method has ever been used in Chicago under such circumstances.

MANUFACTURES AND MATERIALS

PUMICE BRICKS.

For many years a brick made chiefly of pumice, in small pieces cemented together, has been in use in that part of Germany bordering the Rhine, and it appears that it has now found its way to England. The pumice is the product of some ancient Tertiary volcanoes, situated near Andermach and the Laacher See. The sections, as seen in the various pits, show the pumice to be in pieces, varying in size from mere grains to lumps some four inches across. It occurs in layers, but is frequently interrupted by small cuticular patches of more solid fragments of lava. The bricks are made from screened pumice, the larger pieces being broken to pass through a sieve having about ½ inch meshes. These screened pieces are then covered by a thin coating of cement, and the brick is moulded. It will be observed that the cement is not mixed with the pumice so as to form solid cement blocks, but by the fragments being coated first ; the brick is obtained by these coatings adhering to one another. The result is a very light and viscular brick. Although used largely, even for exterior walls, in Germany, it is not very strong. These bricks seem specially adapted for light partition walls, for which purposes they are now being used.

PECULIARITIES OF CEMENT.

The annual report of Mr. A. W. Dow, inspector of asphalts and cements, to Captain Lansing H. Beach, Engineer Commissioner of the District of Columbia, refers to tests now in progress at Washington to discover the reasons of what might be termed abnormal behavior of cement. The points under investigation are: (1) The great strength obtained by some samples of Portland cement. That is to say, a certain brand of Portland cement will be running quite uniformly, the seven-day neat tests will average about 600 lb., and the seven day tests with one of cement to three of sand will average 250 lb. Then a carload will be received that will pull over 1,000 lb, for the seven day neat, and over 500 lb., when mixed with sand. The data for the investigation of this point are very meagre as yet. Such cements do not show any weakening with age and appear sound in every respect. On chemical analysis they are found to run 1 to 2 per cent higher in lime than the average of the same brand, while in all other respects they are about the same. They differ so little in the ordinary chemical analysis from normal cement that it is considered evident their normal strength is due not to the quantity of the ingredients, but as to how they are combined. (2) A shipment of natural cement is received at time which, in testing, passes the requirements of the one-day test, but after being in water for a few days the pats and briquettes, both neat and with sand, begin swelling and cracking. This disintregation generally commences on the fourth day, and in some cases a little earlier. It has never been known to appear after the fifth day. The results, so far, are insufficient to furnish ground for much of an opinion as to their cause. (3) Some natural cements showing nothing abnormal when tested in the laboratory at the usual temperature, are very much retarded in strengthening in practical work by cool weather—much more so than cement of the same or other brands. Such cements were found to be lower in lime and higher in silica than normal cements. (4) Some natural cements are found which give greater strength at seven days when mixed with two parts of sand than when made up neat for the same time.

STONE-CUTTING SAWS.

An obvious improvement in the manufacture of circular saws for cutting stone has been patented by Mr. Geo. Anderson, Taymouth Engineering Works, Carnoustie. A great drawback hitherto felt in connection with these saws, which have their cutting edges fortified with diamonds, has been the expense involved by the loosening and loss of the diamonds. Mr. Anderson has devised a means whereby the precious stones are fixed so securely as to render their loss, by dropping out of their setting, almost impossible. The principle adopted is that of fixing by electricity. The diamonds are fitted into small holes drilled into the steel, and the parts so fitted are subjected to electric welding, or fusing, so that the diamonds are gripped by a compact mass of steel sealed around them. The blade of the saw is five feet in diameter, and in the periphery of the blade are inserted, at intervals of an inch and a half, 126 sockets, 42 being in the middle of the periphery and 42 at each side. At the speed of 560 revolutions per minute the saw cuts a stone 4 ft. 8 in. long in eleven minutes, although a much higher speed can be employed.

NOTES.

A liquidator has been appointed to wind up the affairs of the Danville Asbestos and Slate Co., Limited.

Mr. J. M. Kilburn is asking from the town of Lakefield, Ont., a bonus of $10,000 and exemption from taxes towards the establishment of cement works.

The Pedlar Metal Roofing Company, of Oshawa, are mailing to their customers proofs of illustrations of the interior of the Seminary Chapel at Quebec, the metal work of which was manufactured and placed in position by this company.

The production of gypsum in Nova Scotia for 1899 was 140,000 tons, against 131,000 tons in 1898. A large part of this found its way to the United States. Limestone showed a total production of 32,000 tons, against 24,000 tons in 1898. Grindstones and similar quarry products were produced to the amount of 12,989 tons, as against 38,000 tons in 1898.

A new method of slaking lime and cements, which has just been patented in France, and which is said to secure great speed and uniformity in the tempering of the solid, consists in treating the mass in a closed vessel with high-pressure steam. It is said that the slaked products, being formed at high temperatures, are specially able to resist high temperatures afterwards.

The cement manufacturing business formerly carried on by the Rathbun Company at Napanee Mills, Ont., the Beaver Portland Cement Company, at Marlbank, Ont., and the St. Lawrence Portland Cement Company, of Montreal, Que., has been merged into a new concern incorporated under the name of the Canadian Portland Cement Co. The new company is capitalized at $1,500,000. The president is Mr. E. W. Rathburn, of Deseronto, Ont., and the managing director is Mr. E. G. B. Allan, of Napanee Mills, Ont. The head office will be in Toronto.

PUBLICATIONS.

"The Technic of Mechanical Draughting," by C. W. Reinhardt, price one dollar. A copy of this work has been received from the publishers, The Engineering News Publishing Company, of 220 Broadway, New York. The author states that he has endeavored to give to the busy draftsman a thorough practical, common sense guide to good mechanical draughting, and an examination of the book proves that he has been successful in his efforts. The illustrations are numerous and neatly printed.

We have been interested in a book recently received from The Painters' Magazine, 100 William Street, New York. In it is given a system of measurements adopted by the National Association of Master House Painters and Decorators of the United States, which should be very useful to the architect as well as to the painter and decorator. It gives the report of the committee appointed by the National Association to formulate a system of measurements for painters' work which should be thoroughly accurate in every particular, thereby endeavoring to obviate so much of the unfair competition which arises from ignorance of the principle of correct estimating rather than from any desire to take work for less than it is really worth. Besides numerous drawings, examples are given of measurements, plans of procedure, tools necessary, etc., together with a glossary of terms used in building. The book contains 66 pages 9 × 12 inches, and sells for one dollar.

A settlement was recently effected between the master builders and union bricklayers of London, Ont., by which the bricklayers receive an increase of four cents an hour, making the scale of wages three dollars for a day of eight hours. The agreement is for two years and went into effect on June 1st.

A novel business in London is that of dealer in second-hand plate glass. Large plates of glass are insured when placed in a window, and when any of them are broken the owner of the injured glass usually prefers that the insurance company should replace the broken plate, rather than pay its value. The insurance companies dispose of the injured plates to dealers in second-hand plate glass, who utilize what remains of the unbroken plate, cutting it into panes of smaller size and disposing of them to various firms.

PAGES

MISSING