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CANADIAN ARCHITECT AND BUILDER,

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

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

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

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TO ADVERTISERS.

For the benefit of Advertisers, a copy of this journal is mailed each week to persons mentioned in the CONTRACT RECORD reports as intending to build, with a request to consult our advertisement pages and write advertisers for material, machinery, etc.

Our New Year Number.

ARRANGEMENTS are well under way for the publication of the New Year Number of the ARCHITECT AND BUILDER for 1898. The general character of these numbers has become so well known that concerning the one on which we are now engaged, it need only be said that we are striving to make it quite as attractive and interesting as its predecessors, and if possible more so. As usual an edition considerable larger than the ordinary one will be printed, and copies will find their way into the hands of many persons outside the list of regular subscribers. The building outlook for 1898 is brighter than for several years past, and those who have announcements to make regarding materials and appliances adapted to the requirements of architects and contractors in all lines should immediately arrange for space in the advertisement pages of this New Year Number. The announcements of yearly advertisers will appear in this number at no extra cost.

An Important Competition.

THE prospectus which has been issued outlining in a general way the requirements in the proposed competition for plans for the University of California, is well calculated to awaken the enthusiasm of architects in the project. The programme containing the details of the competition, prepared by Prof. Gaudet, of the School of Fine Arts, of France, is now overdue, although we have not yet seen a copy. When printed, copies may be obtained from the architectural societies of America and Europe or on application to the Trustees, at No. 217 Sansome street, San Francisco, California. It is intimated in the prospectus that ample prizes will be provided and that "there are to be no definite limitations of cost, materials or style; all is to be left to the unfettered discretion of the designer; he is asked to record his conception of an ideal home for a university, assuming time and resources to be unlimited." It is further stated that "while the method of obtaining the architectural plan has not been decided on in detail, it is thought that it will be done by an international "concours," open to all the architects of the world, with an international jury of five members, who will have full charge of the "concours" and of the award of all the prizes." Without knowing the details of the scheme, it is clearly apparent that it would be useless for any architect to dream of engaging in this competition unless he is possessed of ability of the highest order, backed by large experience and the necessary means to enable him to give ample expenditure of time and money to the project. Such being the case, the best results would seem likely to be achieved by restricting the competition to architects in America and Europe who can meet these requirements.

Effect of Limestone on Metal.

GREAT importance attaches to the statement made by Mr. L. L. Buck at the last meeting of the American Society of Civil Engineers, that deep corrosion results from the contact of limestone in concrete with metal. This fact is said to have become apparent in the anchorage of the railroad suspension bridge at Niagara, the main cables of which are imbedded in a concrete made of limestone. The discovery was recently made that at the points of contact between the spalls and the wires, the latter were badly corroded and in some instances entirely severed.

Signatures of Architects on Buildings.

IN Belgium it has become the practice for architects to inscribe their names in small capitals at the right hand corner of the principal front of their buildings. To the younger members of the profession in that country is ascribed the credit for the introduction of this practice. The interest taken by the Belgians in architecture, and their ability to discriminate between good and bad work, has had much to do with bringing the practice into general use. A prominent Belgian architect wishes that there should be a regulation making it compulsory upon architects to "sign" their buildings, in order that the designer of monstrosities might soon find his occupation gone.

Building Disputes.

FIVE years ago the City Council of Boston appointed a board of appeal, to which disputes arising between architects, owners or contractors and the City Building Department, are referred for settlement. The board is composed of an architect, a builder and a lawyer. Nearly 200 cases have come before it for adjudication. The success which has attended its deliberations and conclusions can be judged by the fact that in only one or two instances have appeals been made to the courts from its findings. The establishment of such a board in every city of importance would be of great advantage to architects and builders who in the absence of such a body must in all cases submit to the Building Inspector, whose decisions may or may not be founded on common sense and a correct knowledge of the building laws. It would also be the means of effecting a considerable yearly saving in law costs, not to speak of the time and worry incident to proceedings in the courts.

Fireproof Construction for Mercantile buildings.

MR. W. L. B. Jenney, the well known architect of Chicago, recently presented a somewhat lengthy paper on this subject before the Chicago Fire Underwriters' Association. Having given due consideration to all available data, including the lessons taught by the recent fire in the Horne and Methodist Book Buildings at Pittsburgh, he suggests as the best method of rendering a mercantile building fireproof, a steel construction with an adequate foundation, the exterior walls of brick with terra cotta trimmings ; the fire proofing and the floors to be of porous terra cotta that has been thoroughly tested, or with concrete strengthened with square rods twisted ; the floors to be of smooth concrete ; the doors to be of metal. These doors can be ornamental or as plain as desired. Mr. Jenney is of the opinion that in such a building the stock can be entirely consumed with but little injury to the building other than smoking the walls and ceilings and the blistering of the paint, and that if the building is protected from external fires by outside shutters then the windows will be destroyed, but if there is no danger from outside fires the shutters can be on the inside of the building, and if closed will save the windows. The author states that when substantial iron window frames and sashes shall be available, as probably they soon will be, the loss to the building will be little more than the glass, the interior painting and calcimining. For the preservation of the contents of the building strictly fireproof division walls, with shutters to all outside openings where there is danger from other buildings, and to light shafts and stairways connecting the different stories of the building, are recommended. It is claimed that if these methods are intelligently applied, they will add but a small percentage to the cost of the usual fireproof building.

The Manufacture of Cement in Canada.

TRADE statistics show that although the production of Portland cement in Canada increased by 154 per cent. between the years 1894 and 1896, there remains a wide gap between total production and demand in the home market. During the fiscal year ending June 30th, 1896, the importations of foreign manufactured cement into Canada amounted to 210,065 barrels, valued at a quarter of a million dollars. The use in recent years of concrete for foundations for street paving, as well as in the construction of sidewalks, basement floors and for many other purposes, has greatly increased the demand for cement. Inasmuch as this increase in demand seems likely to be a permanent one, there appears to be room for a large extension of our cement manufacturing facilities. The annual reports of the United States Geological Survey contain evidence of the exceedingly rapid growth in recent years of the cement manufacturing industry in that country. In 1890 there existed sixteen factories, having a total capacity of 335,500 barrels of Portland cement; in 1894 the number of factories had increased to twenty-four, and the total production to 798,755 barrels ; in 1896 twenty-six factories produced 1,543,023 barrels, showing a greatly enlarged capacity; the number of factories has now reached thirty, and the estimated production for the current year is 2,304,000 barrels. These figures would appear to indicate that home manufacture in the United States has more nearly kept pace with the requirements of the home market than has been the case in Canada. The present companies are entitled to much credit for the courageous manner in which they invested capital in an industry which many averred could not be successfully conducted in this country. These companies have overcome one difficulty after another, until at the present time they are able to produce cement which is in every particular the equal of what can be made abroad. One of the greatest obstacles which they have had to encounter has been the prejudice existing in favor of the foreign made article. The reason of this prejudice is to some extent obvious from the fact that until within the last ten years our total supply of Portland cement was imported from abroad, as up to that time no attempt had been made to manufacture in this country. As everything must have a beginning, it is most unfair to men with enterprise who seek to add to the number of home industries, that they should find such difficulty in securing a fair comparison of the quality of their goods with those of foreign makers. It is greatly to be regretted that the government, acting no doubt on the advice of their engineers, have from year to year specified the use of foreign cement in the construction of public works in the face of the existing evidence that the Canadian article is equally good. Fortunately there is no lack of material in Canada for the manufacture of both Portland and natural cement, and the enterprise of our people should speedily bring our manufacturing capacity up to the point where at least the total demand of the home market can be supplied. When that point shall have been reached, we trust it may be found to be possible to manufacture for export also.

Results of Strikes.

THE recent gigantic strike of workmen connected with the engineering trades in Great Britain serves to show the far-reaching injury which results from conflicts of this character, precipitated in many instances by thoughtless or selfish demagogues in the ranks of the labor unions. Apart from the injury and hardship which have noticeably been the outcome of such conflicts in the past—as, for example, disorganization of trade and privation to the families of the workmen—new and more far-reaching effects have manifested themselves in connection with the recent struggle. The iron manufacturing industry of Great Britain was so paralyzed that foreign orders for machinery, etc., could not be supplied with the required promptitude, and in consequence were in many instances transferred to the manufacturers of the United States and other countries. In all probability many of these orders have gone from the British manufacturer never to return. British manufacturers are also being placed at a serious disadvantage in competition with those of other countries by reason of the working rules imposed by the unions. One of these is, that a workman shall not attend to the operation of more than one machine. In these days of automatic machinery, a workman, if given liberty of action, could easily attend to two or three machines. He is forbidden, however, to give attention to more than one. Should this one occupy but a quarter of his time, he must idle away the remainder. This is the method by which the unions seek to limit production and provide employment for their members. In their anxiety to gain this end they seem to have entirely disregarded the fact that their employers are obliged to meet the competition of the world, and that to do so they must be able to produce their goods as economically as their rivals. If the British manufacturer is obliged to employ three workmen to do the work which the American or German manufacturer gets done by one, the foreign trade which he formerly controlled to so large an extent will pass from him into the hands of his competitors, and the British workman will find his occupation gone. The situation is already a most serious one, and it is to be hoped, before it becomes too late, steps will be taken to apply a remedy. If the labor agitators are unable or unwilling to see how short-sighted is the policy which they are pursuing, legislation should be enacted which would prevent them from bringing ruin upon individual interests and the commerce of the nation. We again express the belief that the promoters of strikes will yet carry their despotism to the point where the public sense of justice will assert itself and deprive them of the power to exercise tyranny over their fellow-workmen and employers to whose enterprise they are indebted for most of the comforts of life which they enjoy.

The Pennsylvania State Capitol Competieion.

REFERENCE was recently made in these pages to the action of the State Commissioners of Pennsylvania in repudiating the recommendations of their expert advisers in the competition for designs for a State Capitol building to be erected at Harrisburgh, Pa. Allusion was also made to the fact that an injunction had been applied for by some of the competing architects to restrain the Commission from carrying out their expressed intention to hold a second competition on conditions of their own choosing. We have now with regret to announce the failure of the legal proceedings to obtain redress for the wronged competitors. The Supreme Court, taking a strictly legal view of the case, and disregarding entirely its moral aspect, has decided that the Commissioners had no authority to enter into agreement with architects as to conditions under which they should submit designs in competition, and that consequently the State cannot be legally bound to recognize and fulfil these conditions. This decision may correctly represent the strictly legal interpretation of the matter, but the competing architects had a right to presume that the conditions of a programme signed by the Governor of the State, the acting Speaker of the Senate, the Speaker of the House of Representatives, the State Treasurer and the Auditor-General would be in no danger of repudiation.

ILLUSTRATIONS.

PLANS SHOWING HEATING, PLUMBING AND VENTILATING SYSTEM, NEW MUNICIPAL BUILDINGS, TORONTO.—E. J. LENNOX, ARCHITECT.

KNOX CHURCH, WOODSTOCK, ONT.—BURKE & HORWOOD, ARCHITECTS.

THE church is built of dark purple Toronto bricks trimmed with brown stone. The window openings are of moulded brown bricks. The auditorium is of amphitheatrical form, with the roof of single span. The school at the rear is polygonal in form, with radiating class rooms. The work was carried out under the superintendence of Mr. Alexander White, of Woodstock, and cost about $45,000.

PERSONAL.

Mr. Robert W. Waddell, C. E., of Kansas, formerly of Cobourg, Ont., was married on November 24th at Peterborough, to Miss Elizabeth Vair, of Belleville.

Mr. H. J. Powell, architect, of Stratford, has recently entered into partnership with Mr. L. C. Wideman, of Guelph. The firm have opened an office in Guelph.

Mr. R. J. Fawcett, architect, has recently removed from Petrolea to Sarnia, where he will make his headquarters in the future. A branch office will be maintained at Petrolea.

Mr. J. A. P. Waddell, C. E., who recently delivered a course of lectures on bridge engineering at McGill University, Montreal, has received the appointment of cousulting engineer of the Boston Elevated Railroad Company.

A London despatch of Nov. 18th announces the death of Sir Henry Doulton, head of the celebrated firm of Doulton & Co., pottery manufacturers. The deceased gentleman initiated the manufacture of sanitary pipe making in 1846, and in 1870 commenced the manufacture of art pottery.

ATTEMPTED BOYCOTT OF CANADIAN JOINERY.

An effort has been made by the Amalgamated Society of Carpenters and Joiners of Great Britain to boycott Canadian and United States joinery. This society recently issued a circular to its members requesting them not to fix or use foreign joinery, and drawing special attention to the importation of doors, windows, etc., from America, which they claimed were manufactured under unfair conditions and by ill-paid labor. Several weeks were granted before the injunction was to be put in operation, but on a certain date the members were, in substance, instructed to band together to prohibit the importation of such joinery.

For many years large quantities of manufactured joinery have been exported from Canada and the United States to Great Britain, and this is, we believe, the first organized effort that has been made to restrict importation. The consequences, however, are not likely to be serious, as the trade has now become too well established to be permanently injured by the selfish and ill-advised action of a trade organization.

Before taking such a step, it would have been well had the society endeavored to ascertain the actual facts and conditions. We will consider only the conditions as they exist in Canada, and in this connection will endeavor to prove that Canadian doors, to which particular reference is made, are manufactured under proper conditions, and not by inferior workmen employed at low wages.

By an act passed by the Ontario Legislature on May 5th, 1894, and which is now in force, provision is made for the appointment of councils of conciliation and arbitration for settling industrial disputes arising out of the price to be paid for labor, disagreement with respect to wages, number of working hours, insufficient or unwholesome food supplied by employers, and ill-ventilated or dangerous workshops or places of accommodation. Whenever a complaint arises these councils visit the locality and obtain all particulars of the case. The Ontario Factories Act provides, among other things, that no girl or boy under fourteen years of age shall be employed in any factory, that every factory shall be kept in first-class condition as regards cleanliness, and that proper ventilation be provided. These provisions are generally complied with, and very few complaints are received by the inspectors.

Regarding the wages in our wood-working factories, we have ascertained the average wage paid by several sash and door manufacturers in Canada. One of the largest exporters to the British market writes that the range of men's wages in the factory is from $1.00 to $2.25 per day of ten hours, according to character of work and skill of workman; another that from $1.50 to $1.75 is the average; and another that $1.50 would be about the correct figure. In addition to the adults employed, there are some apprentices learning the trade whose wages would average from 50 cents to $1.00 per day. This would give an average of nearly $1.60 per day for adults and 75 cents for apprentices. Four other firms who manufacture largely for the local trade, but who have also exported doors to Newfoundland, the West Indies and South America, give the average scale of wages as follows: No. 1—$1.50 to $1.80 per day; No. 2—$1.60, $1.75, $1.80 and $2.00 per day; No. 3—$1.25 to $2.00; No. 4—9 first-class joiners, $12 a week; 37 very good, $11; 63 good, $10; 61 pretty good, $9; 49 common, $8.00 to $8.50; 26 3rd year, $7.50; 31 2nd year, $6.00 to $7.00; 19 1st year and apprentices, $3.00 to $5.00. The above figures give an average of $1.60 per day. It must also be remembered that most of the factories are operated the year round, and consequently the average is lower than would be the case if operated only during the building season. For living accommodation the cost in the localities in which the factories are located is not above three dollars per week.

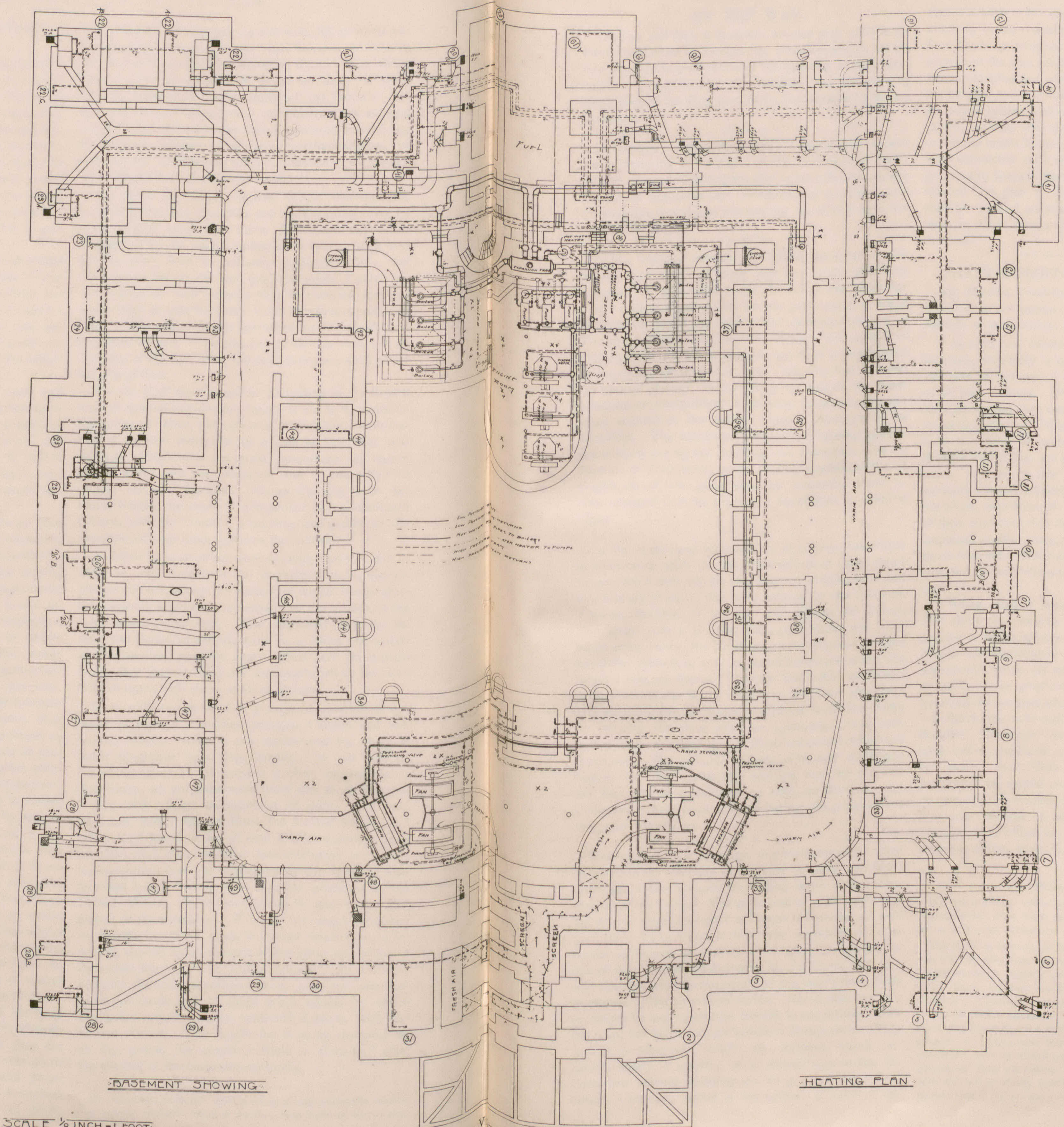
We think the above figures should convince the most skeptical that Canadian doors are manufactured by properly-paid labor and under fair conditions. The average scale of wages compares favorably with that paid in other lines of industry, and we believe that nowhere in the world are laborers given greater remuneration for their services than in Canada, and nowhere does greater harmony exist between capital and labor. The rights of our workmen are respected, and protected by law. The absence of serious strikes is an evidence of the fact that the conditions are such as we have described.

The secret of our success in competing in the British market against home-made joinery is not to be found in the price of labor, but rather in the skilful manipulation of our raw materials by means of improved machinery. England is the great manufacturing nation of the world, but unfortunately she is compelled to import her raw material. Hence Canada, with her forest wealth, becomes a competitor in manufactured joinery, and the country producing the goods at the smallest cost naturally captures the market.

A visitor to some of our woodworking factories will at once be impressed with the marvelous work accomplished by machinery, by means of which the productive capacity is greatly increased and the quality of the work improved as well. This increased capacity enables the Canadian manufacturer to produce the goods at the smallest possible cost. These are the advantages that have enabled our manufacturers to successfully compete with those of Great Britain.

It is unfortunate that a greater distinction is not made in foreign countries between Canada and the United States. Even in our mother country there is much ignorance regarding Canada. In this may be found the cause of the present protest against Canadian doors, as we understand there was much dissatisfaction with a large consignment of doors that were imported into England from the United States, and which were found to be of very inferior quality. It is possible, also, that Canadian manufacturers are suffering somewhat from the reputation for the sweating system that is reported to exist in some portions of the United States, where female labor is said to be employed in door-making. There is also much antipathy in England to goods made in United States prisons for export, as well as on account of the bitter opposition of American employers to trades unions. In Canada, however, no such conditions exist, and our manufacturers would do well to adopt some means by which foreigners would cease to confound Canada with the United States. This might be done by stamping on all our goods the words "Made in Canada," after the manner of German manufacturers.

Mr. Routhier, architect, of Ottawa, is giving a series of instructive lectures on Architecture at the Canadian Institute, in that city.



PLANS SHOWING PLUMBING, HEATING AND VENTILATING SYSTEMS, NEW MUNICIPAL BUILDINGS, TORONTO.
E. J. LENNOX, ARCHITECT.

BY THE WAY.

On the 2nd inst. a Masonic service was held in St. Paul's Cathedral in London in commemoration of the two hundredth anniversary of the opening of that noble edifice. The sermon on the occasion was preached by the Bishop of London, as was the first sermon by Bishop Compton.

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In noticing the numerous effective sketches of ancient work appearing in the pages of the catalogue of the T-Square club, of Philadelphia, the London Builder makes the candid admission that "in the matter of architectural drawing the Americans are beating us, if they have not done so already."

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It is a common practice for thieves to enter vacant houses and carry off lead pipe and other plumbing fixtures. A case came under my notice the other day where a theft of this character was perpetrated in broad daylight on one of the fashionable residential streets of Toronto. Architects, builders, owners and agents of property and others interested may take a lesson from an ingenious contractor of New York who has adopted the plan of placing, each evening, at one of the street windows of his building a dummy watchman, in the same manner as the farmer fixes a scarecrow in his corn field. The watchman is apparently leaning against the window casing and looking into the street. In the daytime he disappears, and a curious inhabitant of that neighborhood, who questioned the contractor about it, was informed that the scarecrow saved him a dollar a night.

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Of the authorized expenditure of 100,000,000 francs in connection with the Paris Exhibition of 1900, about 62,000,000 francs will be absorbed by architectural and engineering works. The two palaces on the Champs-Elysees, devoted to art will cost 20,000,000 francs. The large palace in the Champ-de-Mars will cost 18,000,000 francs, the buildings on the Esplanade of the Invalides 5,000,000, and the small buildings along the quays 1,600,000 francs. Bridges and other communications across the Seine, including the Pont Alexandre III, are put down for 5,000,000 francs, while the works for utilising the river will cost 3,000,000. It is estimated that mechanical and electrical power will need 6,750,000. The circular railway is to cost 1,500,000 francs. In this connection mention may be made of the fact that it is proposed to hold an International Congress of Architects at Paris during the progress of the great Exhibition.

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Happening, a few days ago, to glance out of my office window, in the direction of the new Toronto municipal buildings, I saw a workman sliding down a rope from the top of the tower. The great risk of such a proceeding was so apparent that I could not believe the act was performed by instruction from the architect or contractor in charge of the work. I therefore applied to one of the principal contractors for the facts, and was told that the act was the result of the man's own foolhardiness. The contractor further stated that on two occasions he had taken the trouble to expostulate with the man, but his warnings had been disregarded. This foolish recklessness recalls an incident which occurred nearly a quarter of a century ago at the St. Lawrence market building on King street east, Toronto. A painter, proud of his agility, in spite of the remonstrance of his employer and friends, insisted on climbing to the top of the dome of the building to put a few finishing touches to the flag staff. He safely arrived at the spot where the work was to be performed, but in reaching out with one hand for his paint pot, lost his balance and fell from point to point of the roof until he lodged behind a chimney. When some of the spectators reached the spot from the street below, they found the man's lifeless body. When the unavoidable risks connected with the erection of buildings are so great as to demand special legislation to insure precaution on the part of employers and employees, what shall be said of workmen who deliberately take their lives in their hands in the manner to which I have referred?

UNION INFLUENCE ON PUBLIC BODIES.

Mr. Meathe, President of the National Association of Builders, in his annual address before the recent convention of that society, expressed himself as follows:

"As each year seems to decrease the profits in all business, especially in ours, there seems to be on the opposite an increase of obstacles, mainly those brought on by labor unions. While it is the right of all trades, no matter what they may be, to organize to accomplish something the individual can not accomplish, still they have no right to prevent others from earning their living because they are not members of their organizations. I speak of this to-day because in our fair city we have municipal boards, organized under the laws of the State, who have the audacity to put into the terms of their contracts that none but union labor should be employed on that work, thereby discriminating against those who are citizens and tax payers, whose conscience will not permit them to be members of any orgaaization.

"While such a contract is not valid, yet it shows that there is creeping into our municipal boards a species of demagoguery which bodies organized as ours should take cognizance of, and in justice to ourselves we should enter an earnest protest. How would it sound to those gentlemen who comprise a portion—I am sorry to say they are in the majority on those boards—if those contracts read that none but members of the Builders' Exchange could build their edifices? The labor unions would be up in arms if such were the case, and justly, too. They might as well put in their contracts that we should employ none but red-haired men or men of a particular denomination. It is a pitiable spectacle, indeed, to see men, reputable gentlemen, whose oath of office is to obey the laws of the State, willingly violate them for the purpose of gaining votes."

PUBLICATIONS.

We are indebted to the publisher, Mr. Wm. T. Comstock, 23 Warren street, New York, for a copy of the fourth annual edition of the Architects' Directory. The price of the book is one dollar.

The pictorial calendar of the Toronto Art League, has won its way into the affections of lovers of art to such a degree that its reappearance is eagerly looked for. In the calendar for 1898, which lately reached our table, the high standard of artistic excellence of previous years is well maintained, while the motif of the work differs entirely. The drawings are suggestive of the every day life of the past in Canada, and to the mind of the older generation of Canadians will serve to recall a host of memories connected with pioneer days in this country. To the younger generation they will convey a vivid impression of the obstacles with which their sturdy forefathers had to contend in laying the foundations of our present civilization.

TORONTO MUNICIPAL & COUNTY BUILDINGS
E. J. LENNOX ARCHITECT

THE NEW MUNICIPAL BUILDINGS, TORONTO.

In the CANADIAN ARCHITECT AND BUILDER of October, 1888, was published the first illustration of the new municipal buildings at Toronto. These buildings, which at that time had their only existence in the mind of the architect and on paper, are to-day an almost completed structure, in the Romanesque style, massive and imposing, yet graceful and pleasing in color and design.

Pursuant to a purpose formed several months ago, we present to our readers in the present number, photographic reproductions of the architect's plans, showing in detail the heating and ventilating systems, accompanied by letter press description of the same, and some particulars of the structure as a whole, which we hope to supplement at a later date.

We can do little more than briefly touch upon the history of the enterprise. When the agitation for proper accommodation for the various municipal departments first arose in 1880, the purpose was to put up a building which should meet these requirements only. After the purchase of the site at the head of Bay street at a cost of $210,000, and the acceptance of the competitive design submitted by Mr. E. J. Lennox, the whole question was reconsidered in 1887, and it was then decided to provide a building for joint occupation by the city and county officials. The estimated total cost of the property, based on tenders received from the various trades, and including cost of site, furniture and architect's fees was $1,632,034.

The contracts were signed by the mayor on behalf of the city in August 1889, and in September, following, the contractors for the masonry, Messrs. Elliott & Neelon, took over the building, and remained in charge for three years, when they were dismissed by the architect on the ground that they were using an inferior grade of stone, and in other respects were not fulfilling the terms of their contract. The courts having sustained the action of the architect, the latter then took personal charge and proceeded with the work by day labor.

The buildings front on Queen, James, Albert and Terauley streets, the principal facade being on Queen street, with the chief feature, the tower, in a direct line with Bay street. This tower is 35 feet at the base and will rise to a height of 260 feet.

The main entrance is formed of three large arches, supported by clusters of columns, the whole being elaborately carved. There is a main entrance to both the east and west facades, flanked by small towers 16 feet square and 100 feet high, relieved by windows and ornamented. The north facade, while in keeping with those of the south, east and west, is plainer in character, and contains the entrance to the police court.

The eastern wing will contain the city offices and the western wing the county offices. At each entrance to the ground floor of both wings, and on both sides of the hallways there are handsome staircases, with marble treads and landings, wrought-iron grille balustrading and nickel-plated hand-rails. The main hallways will be finished with marble dados and tile floors, and the remainder trimmed in polished oak. The ceilings are richly panelled.

On the second floor is the city council chamber, 50 × 40 feet, the ceiling of which, in one span, is 30 feet in height, extending through two stories. On the corresponding floor on the county side of the building are four court rooms. The third floor on the city side affords accommodation for the officials of the Public School Department. On the county side this floor will be devoted to reading rooms and law libraries and janitor's quarters.

Since the first inception of these buildings two different sets of plans and specifications have been prepared by the architect, E. J. Lennox, for the heating and ventilation. The first set was prepared in 1887. As there was at that time a strike in progress in the plumbing and heating trade, and it was expected that there would be many developments and improvements in connection with this work by the time the building would be ready for it, the Council wisely decided that it would not be advisable in the interests of the city to take tenders at that time. The complications that were likely to arise, and the large additions that would necessarily require to be made to the original contract, if let at that time, in changing the system to comply with the modern requirements of the times, after the work was let, would not be in the best interests of the city. An approximate estimate was therefore obtained for heating, plumbing and gas fitting, of the best description at that date, which aggregated $80,000, and was for a low pressure gravity system of direct and indirect heating, without provision for steam power of any kind.

After the acceptance of the original tenders, nothing further was done about estimating upon the heating, plumbing, etc., work, until the Fall of 1896, when the architect, Mr. E. J. Lennox, was instructed to prepare new plans and specifications for the very best and most approved system of heating, plumbing, gas-fitting and electric lighting, and other requirements that had come into existence in connection with these branches since the building had been in progress, thus bringing the building up-to-date in these particulars.

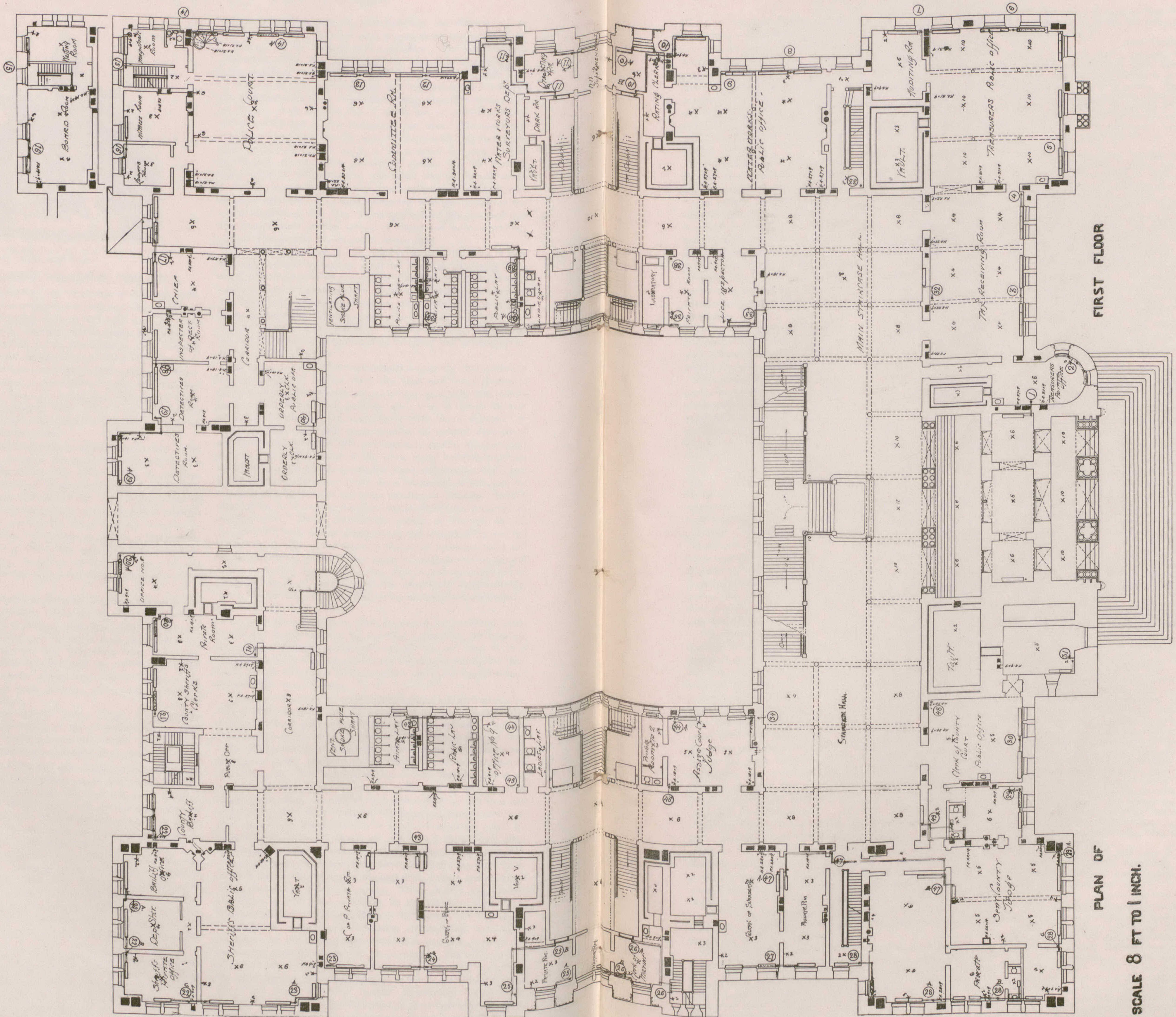
The preparation of plans and specifications for this work in a large building such as the New City Hall and Court House, to combine all the latest improvements in heating, ventilation, plumbing gas-fitting and electric lighting, etc., so as to reduce the cost of operation to a minimum, was a work of no small moment. It meant to say the least many months of careful calculation and investigation, and in this connection it should be said that, judging from an inspection of the work at the building and from the drawings and specifications, the plans and specifications published in this number have never been surpassed, if equalled, for completeness by those of any large building in Canada. Indeed they appear to be as near perfection as possible for contractors to estimate upon. This is conclusively proved by the fact that although the lowest tender amounted to the sum of $187,000, the highest acceptable tender was only five or six thousand more, and it has been stated time and time again by contractors who figured on the work that the plans were the most complete, accurate and easily figured on of any they had ever seen, facts which certainly speak well for the care exercised by the architect in their preparation.

We propose to give here a short resumé of the plans and specifications as finally adopted by the City Council for the heating, plumbing, ventilation, gas and electric wiring, and other work of the building as now being carried out under contract by the Bennet & Wright Company, Limited, under the direct supervision of the architect, E. J. Lennox.

A glance at the plans in our illustration pages will give a fair conception of the magnitude of the work, but a far more explicit idea could be given if space could be spared to fully set out the specifications in as comprehensive a manner as the plans would indicate.

For this system there have been constructed large boiler and machinery rooms situated below the level of the ground in the court yard. The location of these rooms was decided upon, the architect informs us, for several reasons—first, on account of fumes, gases, dust, etc., which rise from a plant of this size, and which, if the plant were located in the basement, would work their way up through the building. It is also considered better for light, the prevention of noises, etc.; in fact a great many other reasons might be given to show the advantages of this location.

Two batteries of boilers have been provided; one battery located in the east boiler house, consists of four large Heine boilers with a capacity of 700 horse-power. These boilers are provided and fitted up with what is known as the Hawley Down Draft. This battery, practically speaking, is the battery that will supply all power for heating and ventilating the building, running all appliances in connection with same and furnishing power for generating electric current for all purposes. The other battery of boilers which is called a "supplementary battery" has been placed in the west house, and consists of four large tubular boilers. These are fitted with the "Jones' Mechanical Under Feed Stokers." There are also contained in these boiler and machine rooms, the pumps, exhaust tanks, feed water heater, oil separators, blow off tanks, steam distributing tank, hot water heater, electric light switch boards, and the apparatus in connection with



PLAN OF FIRST FLOOR

SCALE 8 FT TO 1 INCH.

PLANS SHOWING PLUMBING, HEATING AND VENTILATING SYSTEMS, NEW MUNICIPAL BUILDINGS, TORONTO.

E. J. LENNOX, ARCHITECT.

Paul and Johnson systems, which will be more particularly referred to at a later stage in this description, also many other appliances which space forbids mention of. Accommodation is also provided for the electric dynamos to generate current for the purpose of lighting the building, running the elevators, etc.; in fact an inspection of the plans and the work as far as it has gone in connection with these apartments shows them to be most complete even to the hydraulic appliance for lifting ashes up to the level of the court yard above and a dumping trolley that is provided to convey the coal from coal-house and deposit same in front of the boilers.

Extending off the boiler-houses is the coal-house, also under ground, so conveniently arranged that the coal can be carted into the yard and dumped directly into the storing bins. The "supplementary battery" of boilers in the west side has been provided in case the city and county should see fit to separate in the matter of running expenses of the building; in such case the city and county would each have their own heating appliances, to be managed and run according to their own wish and direction, and in case of accident to one battery the other may be used by operating the valves provided for that purpose. It will thus be seen that by no possible chance or accident will the building be left without necessary power for heating or supply of steam for all appliances.

The heating and ventilating plant is so far completed that the architect is now utilizing the same for heating the building, and although not completed, it gives every assurance of being a very perfect working plant when finished.

The system of heating as adopted is what is known as the One Pipe Overhead Low Pressure System, the steam being conducted through large mains 15 ins. diameter running right and left from the boiler house and extending up to the top of the building and there connecting to the horizontal circulating mains which supply the drop feed mains to the Safford Patent Radiators which are fitted up exclusively throughout these buildings. These drop feed mains are continued to the sub-basement where they are connected to the return mains which convey the condensation back to the receiving tank, where it is automatically supplemented with the required quantity of hot water and pumped back into boilers, the pumps being regulated by a self-acting governor. The steam used for heating the building consists of the exhaust steam from the engines and pumps, etc., which, after being passed through a receiving tank which is known as The Excelsior Combined Feed Water Heater, Purifier, Tilter, Oil Separator, Expansion and Receiving Tank, to exhaust all oil and grease, etc., from same, is passed into the heating mains and automatically supplemented through a pressure reducing valve with live steam as required.

The objection to this method formerly was that the pressure required in the heating mains to force the steam through all the radiators was sufficient to cause considerable back pressure on the engines and pumps, thereby reducing their efficiency and consequently wasting fuel. This drawback has been entirely overcome by the architect, who has adopted the "Paul Vacuum Exhaust System," which system exhausts the air from all the radiators and mains and maintains a vacuum, thereby enabling them to be filled with steam without any back pressure whatever. The great advantage and saving by this method is evident. This system has gone beyond the experimental stage, and is being installed in most of the important buildings recently constructed. In every case it is said to have proved a great economizer and was adopted by the architect only after numerous and careful investigations of its value.

Another important addition to this plant is what is known as the "Johnson System of Automatic Heat Control." This system regulates the heating of the apartments and maintains any desired temperature that may be required. Thermostats are placed in the most suitable positions in the rooms or halls; these thermostats are connected with the automatic steam valves attached to the radiators, and are so sensitive that they will open or close the valves at a variation of one degree, so that the temperature of an apartment equipped with these contrivances will not vary more than one degree in a day.

The saving in the adoption of this system must be apparent, inasmuch as the steam is only on the radiators when heat is required, and is automatically shut off when the apartment is warm enough; and further, it does away with the trouble, annoyance and expense of regulating the valves by hand. This in itself must be of great value from the standpoint of economy, as well as in avoiding the necessity of opening and closing of windows on account of an apartment being overheated, with consequent draughts. This is not an experiment with the architect, but is one that has been adopted by him in other large buildings in the city of Toronto within the last few years, and which in every case has given satisfaction.

VENTILATION.

Ventilation, as a branch of sanitary science, has within the last five or six years received much attention, with the result that more progress has been made in providing healthful conditions than in any 25 preceding years. The amount of ventilation obtained by the old style direct and indirect heating system is not constant, but is subject to outside conditions, such as direction and velocity of external air currents, etc., and it is impossible to plan or construct such a system to supply a volume of ventilation based on known requirements that would be constant and controllable.

The system adopted in this building is what is known as the Plenum method of mechanical ventilation. The fresh air is brought down in the tower and after being passed through cleansing screens and all impurities removed, is blown by large fans through the heated surfaces in the fan chamber and distributed throughout the building. The warming of this air is also regulated by the Johnson System of Heat Control, the air being automatically subjected to just sufficient of the heated surface to maintain the desired temperature—the air being forced in, and its quality, quantity and temperature are completely under control; all spaces are filled with air under a slight pressure, the leakage being outward, prevent the drawing of polluted air into the rooms from any source. The removal of the foul air is amply provided for by the construction of special flues in connection with the system, arranged so as to produce the best results. This ventilating apparatus will completely change the air in all offices, council chamber, court rooms, judges' rooms and other apartments, every ten minutes. Any one who has sat in the present City Council chamber or in any of the present court rooms for any length of time will readily understand the great advantage of such a system.

THE ELECTRIC LIGHT WIRING.

The electric wiring is another important addition to this part of the work. After careful investigation by the architect to ascertain the best and safest method to install, he decided to adopt the iron armored conduit system throughout the building. This system possesses so many important features that it is worthy of special mention. It consists of highly insulated water-proof steel tubing connecting to all outlets, junction boxes, etc., through which the electric wires are run. These tubes are all concealed, nothing being shown but the outlets and junction boxes. At any one of these outlets a fishing wire can be inserted into the conduits and readily pushed through to the next outlet. The electrical conductor can then be attached and drawn through at any time. This can be repeated from outlet to outlet until the end of each circuit is reached, the conduit all being completed and the wires drawn in afterwards. These wires are always accessible thereafter for renewal or examination, rendering it unnecessary to destroy walls or ceilings or disturb flooring, or, as is generally the case with the ordinary plan of wiring, to abandon entirely the concealed conductor that has become deranged and resort to surface wiring; there is also no danger of nails being driven through the insulation, as is often the case, with serious results, where this system is not used.

This system, although comparatively new in this country, has been and it being adopted in all large and important buildings in the United States, it being regarded as being absolutely safe against fire under all conditions.

THE PLUMBING.

The great developments and improvements in the science of plumbing within the last few years are fully demonstrated in the work on this job, which is the most complete and perfect from a sanitary point of view that can very well be imagined. All the most modern ideas for securing perfect ventilation and a complete sanitary job have been employed. The plumbing fixtures of the different best known makers were put to a thorough and careful sanitary test by the architect, both as to strength of materials and perfect working qualities, before being adopted; only those of the highest class being selected. The piping and fittings used are all of extra heavy weight and are arranged so as to be accessible in case repairs are needed.

The plumbing fixtures are all left open, and all partitions, linings, etc., are constructed of marble supported on metal legs, the use of woodwork in the lavatories or any other materials that would absorb moisture being entirely done away with.

The Bennett & Wright Company, Limited, of this city, are the contractors for the heating, ventilating plumbing, gas-fitting and electric light wiring.

Not until we review this work in all its many trades and details can we understand the magnitude of the undertaking, and the immense amount of architectural skill and labor necessary to carry it to completion.

At the Caledonia iron works in Montreal recently, was given a practical demonstration of a new process of jointing pipes. The process of making and fixing the ring joint is an entirely new departure from the customary methods employed in jointing pipes, and overcomes the difficulties incidental to pouring and caulking lead into pipe joints in wet trenches. The ring joint is made with cold sheet lead, which is circumferentially contracted and indented by the pressure of a contractible tapering wedge and an external compression ring. The experiments were witnessed by a number of pipe manufacturers, contractors and other interested persons, and created a most favorable impression. The invention is protected in twenty-four countries, Messrs. James W. Pyke & Company being sole agents for Canada.

TEST OF BLOWING FANS. *

Two years ago, in connection with the subject of ventilation, we commenced, at Cornell University, a study of different fans in order to find not only the efficiency of the various fans made but also to find what shapes gave the best results and what were the conditions necessary to be fulfilled in order to produce the best results. When we undertook this investigation, I thought it would be a very easy matter to carry it out. We have been at it now for three years, and I think we have tested some seven or eight fans. We have tested an experimental fan which we built in various ways and shapes, and we still find that there is very much more to be done before we can make a complete report. I think the question is of a great deal of importance to us all, and I believe there is no machine built anywhere in the world that is of as much importance as the blowing fan that has been so little investigated, and regarding which there is so little known. It is of special importance, since, if we are in the dim future or in the near future to ventilate our buildings, we must do it by some sort of fans, and hence it becomes necessary to get exact knowledge regarding them. I think if you have erected fans and have taken data from the catalogues published by the various makers, that you have found the results actually obtained practically were quite different from those stated in the catalogue; at least, that has become so trite a saying that I suppose the statement will pass unchallenged. In fact, I think you will find—and this I do not know to be certain in regard to all fan catalogues, because I did not investigate all of them—that the figures in the fan catalogues which show the capacity of the fans, and how much air can be moved, require a fan of 100 per cent. efficiency—a perfect fan. I might say that not only never has such a fan been built, but it is impossible to build one, from theoretical reasons, too, as well as practical ones. Hence it is absolutely impossible to attain the results which are given in certain fan catalogues, and possibly in all of them. But, on the other hand, I do not want you to think that the fan people do not know that. Consequently, when they sell you a fan they usually give you private information, which is much more accurate than that which is published.

TWO TYPES OF FANS.

If you have looked into the subject of fans you will have noticed, of course, that there are two very distinct types sold. These are sold, I believe, for distinct purposes, and rarely come into competition. One we will call the disc fan, in which the air is received at one side and carried right through the fan and discharged in parallel directions with the axis. The other is more commonly called the blower or centrifugal fan, in which the air is discharged from the edges of the blades and then carried off by pipes or some other arrangement. The disc fans are, I think, never put in for pressure fans—that is, they are not used in places where air under pressure is required. They are generally used in places where air needs to be moved from a room and discharged into the open air—exhausting purposes principally—and this work they do very nicely. The other class of fans is used both for exhausting air and for discharging air into pipes—that is, for moving air under pressure.

The air in the centrifugal fan is received at the centre of the blades, and by their motion it is thrown to the outside of the fan and discharged outward. This was ascertained some years ago regarding suction fans, I think by Gibbeau, a Frenchman—namely, that if he attached a chimney to his exhaust fan he increased the efficiency very much, almost doubling it; that is, if you take an exhaust fan and discharge the air, it would require a certain amount of work to move a certain amount of air. If, on the other hand, you construct from that fan a tapering chimney, you will discharge with the same amount of work very nearly double the amount of air. This principle, as it was stated by Gibbeau, has been verified and is known to be true. It applies only to suction fans. It shows that the chimney is a very useful adjunct indeed to such a fan.

In this country I believe the chimney has not been used, except, it may be, in fans constructed for ventilating purposes; and, by the way, you should all know that the mining engineers are the men who have had the most experience with fans. They have had to use fans to ventilate mines, and it was from their practice that this fact was learned.

PRESSURE FANS.

In regard to pressure fans—that is, the fans which deliver the air from the tips of the blades—it was found that the efficiency was very much increased if the casing was made considerably larger than the fan. If you run a fan with a casing very close to the blades, you will find that it requires very much more work to move a certain amount of air than if that casing be some considerable distance from the fan, and this has been found to be true in regard to centrifugal pumps for pumping water. The reason for this is that the air is thrown out entirely by centrifugal force. The particles of air strike the blade and are projected. If there be not room at the end of the blades not only for the air to be stored, but to get rid of its whirling motion, there will be a considerable loss of efficiency, and it has been found that in order to give the best result the area at the end of the casing should be about equal in length to the length of the blade of the fan.

In regard to our experiments, I will say that we started out two years ago, first by testing one of the commercial fans, afterwards by constructing an experimental fan, and then putting the greater portion of our work on the experimental fan. The experimental fan was in some respects very much like the commercial fan, but we built it in such a manner that we could vary the shape and size of the blades, and also the form and size of the casings, these being the important things. Then we made various experiments under different conditions, in order to ascertain under what conditions we obtained the best efficiencies, and then we verified some of the things we found out later. I will not trouble you with all the details, but I may mention that we found that a fan with straight radial blades would perhaps move the most air for a given diameter. That is, a 48″ fan, with the blades slightly bent at the inner sides, would move the most air; but we found that when we curved the tips of the blades backward, with the inner edges running a little forward, we got the highest efficiency. That is, for the same amount of power applied we got the most air moved, although for the same diameter the other style of fan would move the most air.

We also found, in regard to the casing, what I have practically announced as a general principle—the casing, at the end of the fan, in order to give the best results, must be away fully the length of the blade, otherwise it will affect the result seriously. One other thing we found is this—which differs from what has generally been announced regarding fans, at least in the different makers' catalogues, and I feel very certain that it is true, because it was not only true in respect to our experimental fan, but it has been found to be true of commercial fans that we tested—that the efficiency increased with the speed of the fan up to a certain size and up to a speed which gave us a pressure of about 2½ inches of water measured by the manometer. There was a falling off in efficiency below that. That speed corresponds in all fans to a speed of about 6200 feet per minute of the tip of the fan, and if we ran any of the fans slower or much faster than that there was a falling off in efficiency.

If you will look in fan makers' catalogues, I think you will find that you can move a great deal more air with a great deal less power if you run the fans at a much lower speed than I have given. Their statement does not seem to me correct. We found that by increasing the speed of the fan we moved more air with less power up to that point, and we found, further, that it was more economical to keep a considerable pressure and let the fan work against a pressure corresponding to something over an ounce, or, say 2¼″ of water, than to work freely against the air.

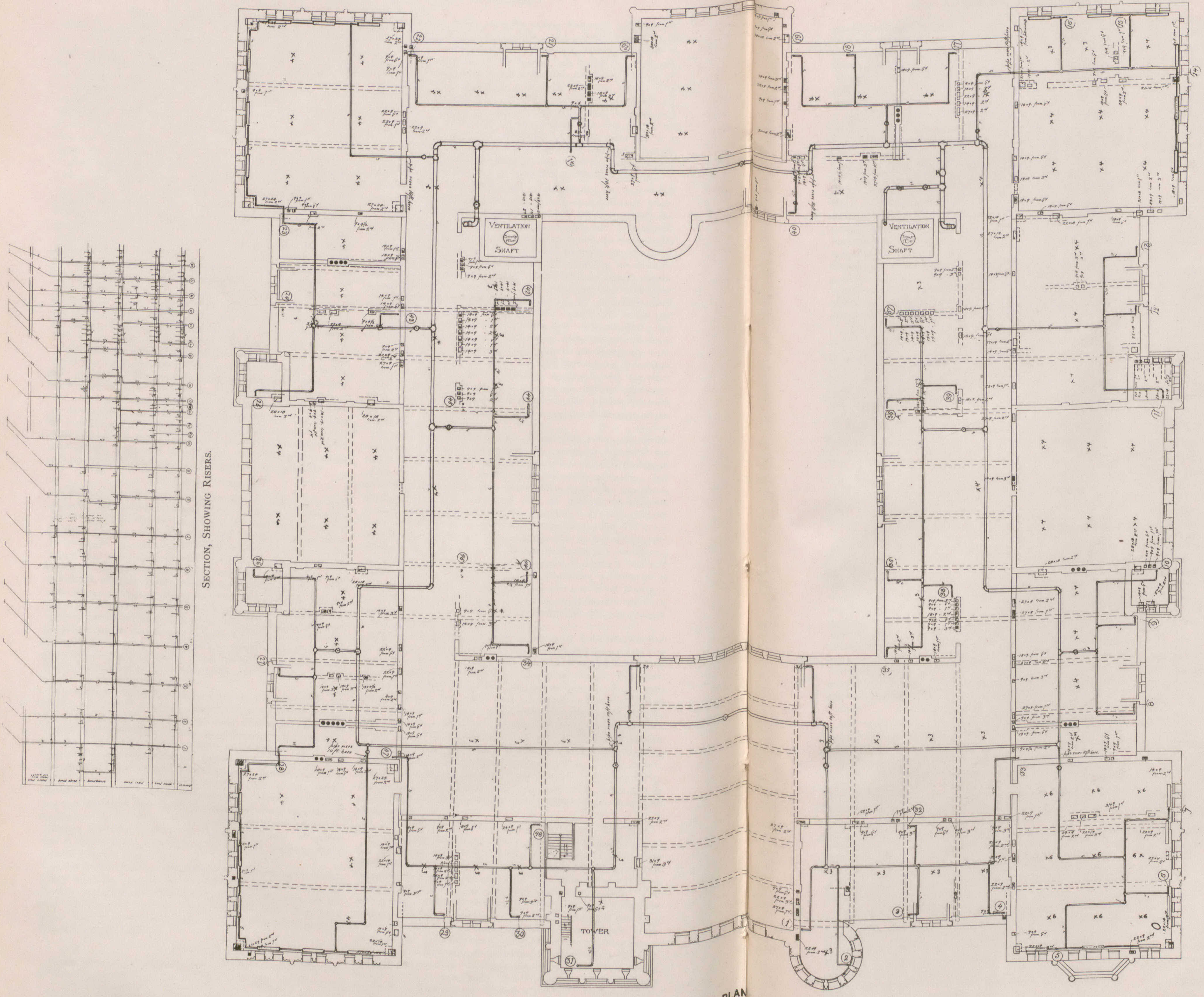
I speak of these points because they are points which have not been considered good practice; and, too, in the putting in of a forced-blast system it has been thought best to keep the velocity and pressure down very low. Consequently, this shows that in this respect our practice has not been leading to the very best efficiency.

MEASURING VELOCITIES.

In connection with efficiencies, I should like to say a word or two about measuring the velocities of air. If you take up this system of ventilation, as perhaps you all may very soon, you must know how to measure air, and I tell you it is the most difficult thing to measure that you ever had anything to do with. You may get a great deal of practice in measuring it, and, from the very fact that we cannot see it, you will find that it is very hard stuff to handle. It does not move with uniform velocity in the pipe, and that has made more trouble for us than anything else.

I have been looking over some old fan tests where the efficiency ran over 120 per cent.—that is, where the actual work of moving the air was 20 per cent. higher than that done by the engine driving the fan. This test was made in a report by Professor Trowbridge. Now, what does this mean? It means that he made a mistake in measuring the air. If you will use some instrument

*Address by Professor R. C. Carpenter at the Convention of the American Society of Heating and Ventilating Engineers.



SCALE 8 FT TO 1 IN.

PLANS SHOWING PLUMBING, HEATING AND VENTILATING SYSTEMS, NEW MUNICIPAL BUILDINGS, TORONTO.

E. J. LENNOX, ARCHITECT.

you will find that the air is moving five or six times faster in some places in the pipe than it is in other places in the pipe, and if you stick in your measuring tube in that spot where it is moving faster, and figure on that, you will have a remarkably good efficiency. On the other hand, if you will take care and put your anemometer successively in all portions of the pipe, the result will not come out anywhere near that.

There was another thing which troubled us—viz., the anemometers. We have three of them, one a brand new one which came to us fully certified that it was perfectly correct, but I found on comparing it with the one we called standard last year that there was about 40 per cent. difference, and between it and that we called standard the year before, 20 per cent. So there was trouble right away. Then we set out to standardize the instruments ourselves, and, I might say, the result showed that they were all wrong. The method we used to standardize the instruments was to swing them around through the air on a long pole. Knowing the circumference of the circle, and the number of revolutions made, you have the distance it travels, and, if it moves through perfectly still air, the supposition is that the air would produce the same result in every case. This is the method usually adopted, to which, of course, there are some theoretical objections. Moving the anemometer through the air is not really the same as having the air moved through the anemometer.

Another method which was used for calculating the anemometer, and which was finally adopted as giving the best results, was to check its readings by blowing the air through a large tube, in which a steam pipe was so arranged that all the heat given off by the steam pipe must be taken up by the air; in which case, if the number of heat units calculated as having been absorbed by the air (temperature, volume and velocity being the three factors of the calculation) was the same as the amount determined as having been emitted by the condensed steam, the reading of the anemometer was taken as being correct.

EFFICIENCY OF FANS.

I might say that the highest possible efficiency of a fan delivering air without a casing is not over 50 per cent.—that is, theoretically—because there are theoretical losses which are equal to 50 per cent. of the work put in. Consequently, we know that we cannot get very high results. By putting on a casing and putting on a chimney, it may possibly be brought up to 75 or 80 per cent., although it is very doubtful, I think, if anything has passed 80 per cent.

With the pressure blowers, we got quite uniformly the same results with all the different types. That is, with three different fans, and at the speed of which I spoke, we got an efficiency that ran from 32 to 47 per cent., varying with the conditions, 47 per cent. being the very best. In order to get that we had to construct our experimental fan with square blades, almost exactly like the commercial fan of that diameter, and we gave it a single inlet (22 inches in diameter), taking in all the air from one side and delivering it at the other side. With that condition, the best efficiency we could get, even at the best speed, was about 35 per cent.

Afterwards we made a double inlet—that is, put an inlet on the opposite side of the fan—and simply the changing of the inlet increased the efficiency of the fan from 35 to 47 per cent., which shows that the rectangular fan supplied by air at the center on a single side cannot get a sufficient supply to keep the casing and all the parts full; and it would also point as a probable improvement on fans, that if we were to make the fan slightly conical—that is, make it larger near the centre than at the outside, by means of which we could admit more air through a given sized hole; that is, if our entrance in proportion to our discharge orifice was made larger—it would no doubt increase the efficiency. This was ascertained some years ago, but I think it has been overlooked by our manufacturers generally, because I know of no American fans built with the conical case, although some foreign fans have been built that way.

I think that from 35 to 47 per cent. is just about the commercial efficiency of fans run under the best conditions. In proof of this proposition I might say that I have looked over a large number of tests, and I believe in hardly any case did I find that the efficiency had been higher. It has gone as high as 47 per cent. only in such cases where the inlet was double or the passage for the entrance of air was made very large indeed. Practically this wonld mean that if the catalogue tables are based on the 100 per cent. efficiency, we must multiply the air by just about 3, in order to find the power necessary to drive a given fan as printed in a given catalogue.

We went further than this and tested a few fans that were running in buildings and which were used in connection with hot blast, or the hot and cold blast system of heating and ventilating. In all these cases we found the fan efficiencies very much lower than those which I have given you, or, in other words, we found that the fans were not working under the best conditions. We found in every case that the fans were running very much too slow, and the efficiency, instead of running up around 25 per cent. ran under 20 per cent, and yet the fans were perfectly capable of returning a very great deal more for the power put into them.

SPEED.

It seems to me from our investigations that there can be no very great objection to increased speed, except in such cases where noise is objectionable; of course you understand that the noise will always increase with the speed. I think we should all endeavor to ascertain at what speed a fan gives the very best results.

In addition, I might say that we found the following propositions to be true:

(1) That the amount of air moved by a given fan would vary directly with its speed—that is, if you turn it over twice as fast, it will throw out twice as much air.

(2) We found that the work required to move the fan varied with the cube of the speed.

(3) We also found, as an interesting fact, that if we took and formed an equation, of which the peripheral speed in feet per second—that is, the speed of the tips of the fans—was put on one side, that number was equal, in practically all of our experiments, to forty-seven times the square root of the highest pressure, expressed in inches of water—that is, about three-quarters of the peripheral. In other words, we found that the highest pressure we could produce was about three-quarters of the theoretical, and the highest pressure can always be produced when there is no air being discharged from the fan. When there is no air being discharged from the fan there will always be a less pressure than the highest, because two things together constitute the total work of the fan.

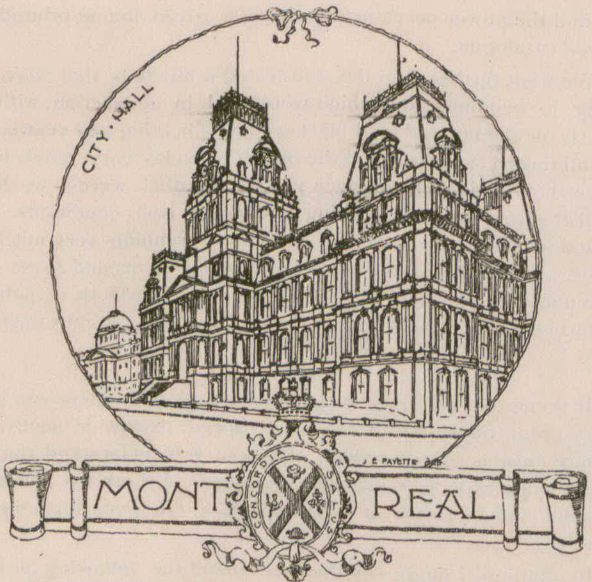
Then there was one other useful point, which, from the fact of its being of some interest, we noticed—viz., the relation of the velocity of the tips of the fan to the velocity of the air that was driven off. I want to tell you that there is no relation between them. The whole matter rests upon this fact: If you allow a pressure to accumulate in front of your fan, as you may do by holding the air back and then let that air discharge freely afterwards, it will go downhill at any rate whatever, and may travel three or four times as fast as the tips of the fan.

DISC FANS.

In regard to disc fans the efficiency runs lower. We did not get as high an efficiency in a single case with a disc fan. I think they must necessarily run lower. More than that, just as soon as we got them working against any pressure, the efficiency almost entirely fell off—that is, we were turning the fan round and moving very little air. Yet the disc fan is very much better suited for certain classes of work. In making this statement, of course, it is not to be understood as at all derogatory to the disc fan. They are two classes by themselves, one used for one purpose and the other for another purpose.

Practically, then, the way our investigation stands at the present time is that about the best efficiency we can get out of the blower fan is about 35 per cent. with the single inlet, or, through a double inlet, about 10 per cent. better. That may seem to you to be more extravagant than ventilation by means of chimneys. I think we discussed that at our meeting last winter, and the table I gave you then was figured out on a supposed fan efficiency of 25 per cent., and perhaps you may remember that the fan then came out, even when I used a very wasteful engine, 50 times as economical as a chimney 1,000 feet high. If, instead of the fan being 25 per cent., it is 33 per cent., of course our fan then becomes 75 times, instead of 50 times, cheaper than a chimney.

In other words, we cannot afford, even though our fan is inefficient, to ventilate by heat. We must afford to ventilate by power. Mechanical ventilation is the ventilation which is coming and which we must learn to handle; and it is coming because it is more efficient, because it is cheaper, because it is more positive, because it is more certain and sure to give the very best results.



(Correspondence of the CANADIAN ARCHITECT AND BUILDER.)

ORGANIZATION OF A BUILDERS' EXCHANGE.

It is gratifying to learn that the necessity for organization on the part of the building industry of this city has at last been recognized. At a meeting recently held in the club room of the Windsor Hotel to consider the subject, Mr. James Simpson, of Simpson & Peel, was voted to the chair, and Mr. G. J. Shepherd appointed secretary pro tem. The secretary stated the object of the meeting to be to consider the advisability of organizing a Builders' Exchange for the city of Montreal, on the lines of similar organizations in the principal cities of the United States. Such an organization should afford opportunity for an interchange of views on matters affecting the building trades, and through the medium of a representative Board of Directors, having power to arbitrate, would be of great assistance in the adjustment of differences between employers and workmen. Further than this the idea of the promoters of the Exchange was that the headquarters should be in a central location where members desirous of doing business with one another or with outsiders could meet at certain hours of the day for that purpose. In addition to these objects the organization of a Builders' Exchange would place the building industry on a footing consistent with the growth of the city.

After an expression of opinion had been obtained from several of those present at the meeting, it was unanimously resolved on motion of Mr. Peter Lyall, that the meeting be organized into a Builders' Exchange. On motion by Mr. Stephenson, a provisional board, consisting of Messrs. Simpson, Lyall, Fournier, McLean, Cowan and G. J. Shepherd, was appointed to obtain information regarding a charter and suitable rooms, and to report at a meeting to be called for that purpose, as well as for the purpose of appointing a permanent board of directors. If the charter of the former Builders' and Contractors' Association shall be found to be yet in existence, there will not be the necessity of applying for a new one.

The following firms have expressed their intention of co-operating in the movement for the establishment of a Builders' Exchange, and thus the bulk of the funds required for expenses are at the outset guaranteed: Messrs. E. Fournier, Peter Lyall, W. A. Stephenson & Co., Peter C. Wand, Castle & Son, Jno. Murphy, Wm. McNally & Co., The Montreal Roofing Co., T. A. Morrison & Co., Geo. R. Locker, Oliver Deguise, Alexander Bremner, Geo. W. Reed & Co., Wm. Rutherford & Sons, Miller Bros & Toms, Jas. Walker & Co., H. R. Ives & Co.. Jno. A. Boomer & Co., Dominion Bridge Co., E. F. Dartnell, A. E. Wand, Wm. Swan, G. A. Grier, John McLean, Montreal Lime Co., Geo. J. Sheppard, A. P. McLaurin, Jno. Morrison, Jr., & Son, Simpson & Peel, Heggie & Stewart, A. Cowen, W. W. Scott & Co., Laird, Paton & Son, J. W. Hughes, J. E. Bulmer, J. H. Huchison, James Cochrane, Thomas Forde, W. P. Scott, Wm. Briggs, Wighton & Morrison, Beckham & Scott, Isaac Lewis, McLaurin Bros., The Jas. Shearer Co., McArthur & Co., J. N. Hickey, Knott & Gardiner, Charles Sheppard, Wm. McArthur & Sons, John Watson and the Laprairie Brick Co.

ARCHITECTURAL COMPETITIONS.

The following circular was recently sent, by direction of the Council, to each member of the Province of Quebec Association of Architects:

DEAR SIR,—Several complaints of grave abuses existing in the practice of our respected profession having recently been brought before the Council, it has resolved, so far as it is in its power, to continue to protect the interests, and especially to use every endeavor to maintain the integrity and honor of the profession.

It has come to the knowledge of the Council that there are members of the Association who do not scruple to take part in competition with self constituted architects on the most humiliating conditions for honorable men; agreeing to make designs and obtain tenders for work without any assurance of an expert report and without any promise of remuneration.

The Council would earnestly remind the members that the cure is in their own hands, for as long as the public can get reputable members of the profession to join in competitions on such an unsatisfactory and unworthy basis, so long will they continue to make such conditions.

Such self-depreciation on the part of the members of the Association can only have one result, viz., that of lowering the status of the profession generally, and bringing it into contempt in the eyes of the business men of the community.

The Council trusts that each member will refrain from having anything to do with such competitions, and do all in his power to have competitions arranged on a fair and equitable basis and such as will be honorable alike to the public and the profession.

By order,

(Signed) JOS. VENNE, Secretary.

AN IMPORTANT DECISION.

Following is the decision in full of the Recorder in the action brought by the Building Inspector of Montreal against Contractor Paquette for alleged violation of the City Building By-law, brief reference to which was made in the CANADIAN ARCHITECT AND BUILDER for November:

"The defendant is prosecuted for having, on the 21st of August, neglected to conform to a notice of the Building Inspector, Montreal, ordering him to demolish some division walls in a building on Cherrier street, the property of the Tourville Estate, said walls not being of brick or stone, as required by sections 12 and 14 of By-Law 107, but of terra cotta.

"Section 12 of By-Law 107 says that 'in the case of a row of tenements, stores or warehouses, each tenement, store or warehouse shall be divided by a wall of brick or stone.' Now section 14 says: 'Brick are supposed to measure 8 inches in length by 4 inches in width and 2½ inches in thickness.'

"Sections 11 and 13 of said by-law say, 'brick or stone or other incombustible material,' and the city does not complain of the substance, which is incombustible, but contends that it is not strong enough to support the load placed upon it. Furthermore, this terra cotta is commonly called brick, and is incombustible, so it answers the requirements of the by-law as far as that goes. The whole question now rests in the fact of its strength and resistance. Many witnesses have been heard on both sides. I will only consider those who have based their evidence upon scientific and practical experiments. Tests of this terra cotta were made at McGill College in 1894 and 1897. The last test took place September 9th, 1897, on two different pieces—one crushed at 46,000 lbs., equal to 479 lbs. to the sq. inch; the other crushed at 67,000 lbs., equal to 677 lbs. per sq. inch. Architect Taylor has figured the weight the walls had to carry, but did not believe they were strong enough.

"Jos. Beland, contractor, said he had not seen the walls, but was of opinion they were not strong enough, and was prepared to condemn them.

"M. Huberdeau said he had seen terra cotta used for walls and other purposes in many buildings. When asked by the building inspector if he did not know of a case where terra cotta had crushed under a beam, he said in one case in a building for the Masson Estate the end of a steel beam resting on the lining instead of on the wall, the block being on edge, had failed, but this was no fault of the terra cotta, as a beam resting in the same condition upon the solid brick would have brought similar results; the fault was in the construction and not in the material.

"M. Brunet produced tests of pressed brick, showing it was much stronger than terra cotta, etc.

"Mr. Lacroix, the City Building Inspector, admitted that there were many buildings in Montreal in which terra cotta was used, such as the Canada Life and others, but that they carried no load, being protected by steel construction, etc. Mr. Lacroix says that judging from McGill College tests the brick is not strong enough, having crushed under a load of 46,000 lbs. upon a surface of 96 square inches, giving a factor of safety of only 239 lbs. Multiplying this factor by 12 inches, the square of the brick, gives 2868 lbs. as the weight it can safely carry. According to this estimate this brick will not carry the weight placed upon it. The floors are supposed to weigh 160 lbs. per square inch as a factor of safety. The house being 25 feet wide, the joists are 24 feet long, each wall carrying one-half. The joists being 3 feet apart

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gives a surface of 36 square feet to be carried by the wall, multiplied by 160 lbs. gives 5,760 lbs. to be carried by a strength of only 2868 lbs.

Mr. James Nelson, architect, has visited the building and examined the walls and reports as follows:

Area of floor carried by joists—	22 ft. x 16 ft. =	352	sq. ft.
	13½ ft. x 21 ft. =	283½	" "
Area of roof carried by wall	15 ft. x 37 ft. =	555	" "
Total area of floor and roof carried by wall		1190½	" "

Allowing 150 lbs. per square foot for the above case, the total load carried by the wall would be 1190½ x 150 = 178,575 lbs. Area of cross section of wall carrying this load is 37 ft. x 8 ins. = 3552 sq. ins.

The above load of 178,575 lbs. distributed over the above area of 3552 sq. ins., gives a pressure of 50¼ lbs. per sq. inch. The area of a terra cotta brick laid on the flat is 96 sq. inches. The load on one brick is therefore 50¼ lbs. x 96 sq. inches = 4,324 lbs. per brick.

According to Prof. Bovey's test the weakest specimen crushed under a load of 46,000 lbs., being 479 lbs. per sq. inch, whilst the load on the wall as above shown would only amount to 50¼ lbs. per sq. inch, thus giving a factor of safety of 9½. A factor of safety of 8, which amply provides for weight of the wall itself, is sufficient according to Trautwine and other authorities. Kidder, a standard authority, in his latest edition (1895) gives as the loading for ordinary dwellings, including the weight of floor beams and plaster, 62 lbs. per sq. foot. If we adopt this view, then the factor of safety for the terra cotta walls in this case would be raised from 9½ to 24.

Mr. Hector Lapierre, architect, has visited the walls in question, and finds them sufficiently strong to carry the weight placed upon them and his figures agree with those of Mr. James Nelson. He says further that they have built such walls at different times and they have proved satisfactory, etc.

"Mr. A Fowler, architect, says he has used terra cotta walls for the last 8 years and that they carry floors and are solid.

"Mr. Chas. Chausse, the architect of the houses in question, says he has used this terra cotta for division walls for the last 8 or 9 years in many buildings and in cases where the load upon them was much heavier than in this case, and the walls in the present case are perfectly safe. He says he knows by experience just what they will stand.

Messrs. James Wright and Maurice Perrault, who acted jointly with Mr. Nelson as experts, corroborated Mr. Nelson's report. Mr. Bulman has also used it for division walls and found it good; he also produced a sample of a very poor quality of brick which is being used in a building in this city.

"M. Joseph Brouillette, a contractor, says while he was putting up some buildings last summer in which the division walls were of terra cotta, a large quantity of brick and mortar fell upon one of the floors, crashing through the joists, and the terra cotta wall remained intact.

"Other witnesses appeared, and all declared the walls safe.

"Mr. Gagnon, the secretary of the Montreal Terra Cotta Co., said that the difference in the crushing strength of the material is due to the fact that more or less sawdust is put into the mixture as required for different purposes, and that in the last few years there have been great improvements in the manufacturing of the material owing to better facilities and improved machinery and appliances.

"Apart from all the foregoing evidence I have before me letters from architects and others recommending the use of the material; also a long list of buildings in which it has been used. All these buildings were erected with the knowledge of the Building Inspector, who on the 12th of March, 1896, gave the company a letter of recommendation.

"In the face of all the foregoing evidence I could not condemn the defendant in this case, and the action is dismissed."

TO ARCHITECTURAL STUDENTS IN TORONTO.

It is proposed to organize for architectural students in Toronto a class in wood carving. It is thought that such a class would be very helpful to students.

The class would not be an expensive affair, as there would be no tools to buy and the lessons would be very low if a class of eight or ten were formed.

It is hoped that such a class can be commenced about the early part of January, 1898.

If any of the architectural students of the city would care to join such a class, their communications to D. N. S. Nichols, care Burke & Horwood, would facilitate matters.

COMMON SENSE IN HOUSE PLANNING.

It seems to me that a few remarks and suggestions in the way of general house planning might prove interesting, particularly to those interested in house plans, writes J. P. Hicks in the National Builder. First, I wish to call attention to the front halls, which in many cottages, as planned at the present time, are entirely too small. It seems that some plans appear crowded. For example, some of the space that should be in the hall is taken for a front bed-room. Closets are very convenient and useful, and, in short, seem to be almost indispensable, yet it is a great mistake to cut a front hall down in size to about 3 x 5 feet. Such halls are a nuisance, as there is barely room to stand inside and open the front door. The side door, of course, opens at right angles to the front door, which makes it extremely difficult to pass in and out with furniture. This kind of hall may suit some people, and may seem to meet all the requirements of a hall, as they pass in and out empty-handed camparatively easily. It is in moving furniture that the great disadvantage of small halls becomes apparent. If there is a piano, organ, book-case, extension table, or any large piece of furniture, the chances are that it will not go through the doors, and if it will barely go through it generally comes out with scratches and bruises, as well as the casings in the hallway looking the worse for wear and tear.

I know that many will argue that large halls are expensive, and that they can better afford to put up with the inconvenience in moving than to pay the difference in the cost of construction. Then again it may be that they don't just see how to enlarge the hall in the plan they are building after. It can usually be accomplished easily and with but little additional expense, in the following manner: Build the hall out on the front porch octagon shape, and large enough to give the desired amount of room, and, if desired, extend the porch in the same manner; it will add to the outside appearance of the house, and inside will give a large and commodious hall. The front room might have an octagon corner next to the hall, and the entrance from hall through this corner will make the house easy of access and the moving of furniture in and out will be an easy matter, besides almost everybody will remark what a nice large hall yon have.

There are various ways to enlarge upon the hall room after the manner just described. Every plan might not require just the same style and shape in the enlargement, but where the hall is small and more room is wanted, I would suggest a little study in the way of enlarging, as there is a variety of ways to add to the beauty and convenience of a residence in this respect.

The kitchen is another part of the house that should be roomy, but on the contrary we find many of them exceedingly small, with only room enough for a cook stove, a table and a chair or two. These kitchens in size are usually 8 x 10 feet, which must necessarily be a source of great annoyance to the housewife. There is nothing like plenty of room, especially where the most of the time has to be spent in doing the ordinary household work. Everybody knows how hard and inconvenient it is to work in a cramped up place and everybody growls at it. Give the women plenty of room in in the kitchen, also in the pantry; they will appreciate it, and in nine cases out of ten it will make them better natured, and the husband can congratulate himself on the fact that he has given his better half plenty of space in the great workroom of the house, the kitchen.

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.]

High or Low Ceilings?

IT is not many years since it was given out as a canon of health by architects, doctors, and sanitary engineers, that high ceilings were absolutely necessary. The arguments in support of a generous space were numerous, some of them referring to the exterior effect of the structure, but mostly referring to the healthfulness of the room itself. Recently, however, it seems that scientific arguments are being offered in favor of low ceilings. Low walls to rooms, it is said, are being advocated in England as really affording better ventilation throughout, in preventing the formation of upper strata of all but immovable foul air, and tending to prevent draft. A room with a low ceiling is more easily kept warm than one with a high ceiling, and in this country this is quite a consideration. There is an artistic value in the low ceiling that is not found in the higher one, besides a cosiness that is impossible with the more pretentious room. In the time of Good Queen Bess, the ceilings were low and the walls wainscotted. More comfortable houses were never built, and while the exterior may not have been as striking as the dwellings of later times, their interiors were artistic and better suited to the wants of the occupants than were the interiors of the houses erected 150 years later, when high ceilings became the fashion. For country dwellings ten feet should be the maximum height, and for cottages nine feet, and in some cases even less than that would be plenty high enough. As a matter of economy, low ceilings should be preferred, for every foot in the height of a building, be it wood, brick or stone, means quite an addition to the cost thereof.

Interior Finish.

THERE is no disguising the fact that the medium and hardwoods are rapidly crowding out the soft woods for inside finish. Pine, which is the most useful of woods, is scarcely used in finishing the better class of buildings to-day. Maple, birch, cherry, when available, ash, red oak and elm are the woods now in use, the latter being used for wainscot, mouldings, panellings and similar work. Speaking to a builder of experience the other day, who also owns a woodworking factory, he insisted that a house can be finished in plain red oak as cheaply as in pine when the latter is of good quality. This comparison is made of course when hand finish is contemplated. He added, that when the work is completed the superiority of the oak is so obvious that nothing more need be said in its favor. Red oak doors, if made solid, will twist out of shape, but if veneered on a pine or white cedar core, they will stand well, and if the oak be quartered, and properly finished, they become very handsome, and they may, if desired, be made to imitate antique oak with very little trouble or expense. It does not add much to the beauty of the wood, however, to make it darker. A natural color seems to give the best effect with red oak. With birch and cherry the case is somewhat different; these woods stain mahogany color readily, and for finish, look the better for it. Canadian cherry is of a kindly nature, is straight grained and works freely, and has the quality of staying where it is put, therefore makes good doors and sashes, worked from the solid, but better of course if cut into veneers and glued on to pine or cedar cores. In flooring the Canadian hard maple has no superior. It is better than the best of oak, as it is firmer in grain, less porous and less liable to splinter or wear to a fray grain; it will wear longer, and if kept dry will last as long. Next to maple for flooring comes birch; indeed, there is but little difference if conditions are the same. Birch will not last quite as long as maple, but is equally firm and will stand as much wear. Red beech is a very handsome wood, and when properly seasoned, makes a fine finish and requires no stain as the color is rich and mellow, and when properly polished, the surface gives off an effect similar to shot silk. For stair treads birch is preferred. It is not so slippery as maple and appears to be more yielding to the feet. For balusters, newels, hand-rails, and similar work birch does handsomely, but, of course, if other work in same room or hall is of oak, or other wood, rail and whole of balusters and newels should be formed of the same wood.

Strength of Walls.

A BALLOON frame with 2″ × 4″ studding set two feet apart, and boarded on both sides of the studding with one inch boarding, will sustain any weight it may be forced to bear, if the structure is used only for domestic purposes. For small churches, chapels, or even schools of small sizes, this sort of a wall may be found ample if the roof is properly constructed; but where buildings are intended to be used for manufacturing and storage purposes, a square timber frame, stone or brick should be employed in forming the outside and bearing walls. The strength of a wall is dependent on a number of conditions, the first being the materials employed; second, the way of combining them; third, the shape and dimensions of the wall. Walls of brick or dressed stones may be made thinner than if uncut materials were used. Practice has taught that when a wall of brick is to be nine inches, or one brick thick, the stone foundation carrying it must be over twelve inches thick; and a fourteen inch, or one and a half brick wall must have foundation of quarried stone not less than eighteen inches thick resting on footings fully two feet wide. With ordinary walls, the height of which does not exceed twelve times their thickness, and that are not over one hundred feet in length without a partition, it will only be necessary to consider the resistance to pressure. To determine this a number of experiments have been made by practical engineers with the following results:

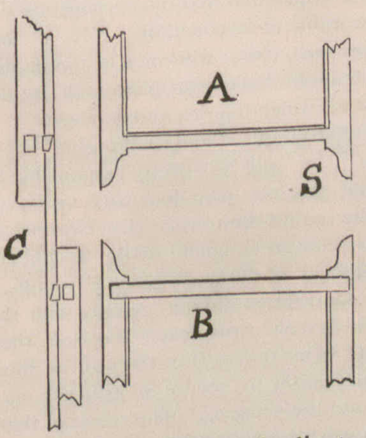
Kind of stone.	Pressure necessary to crush the stone.		
Granite	8,000 to 12,000 lbs. to square inch.		
Limestone	2,000 " 8,000	"	"
Marble	4,000 " 8,000	"	"
Sandstone	2,000 " 5,000	"	"
Good brick	1,200 " 1,500	"	"
Ordinary brick	600 " 650	"	"
Portland cement, neat	3,000 " 3,600	"	"
Portland cement 1, sand 3	1,200 " 1,600	"	"
Lime mortar	125 " 250	"	"

One tenth of the crushing weight should be the full extent of pressure allowed, for nearly all materials are more or less faulty, and this allowance of ten per cent. will be ample to meet all ordinary, and most extra-ordinary requirements. The ultimate strength of common bricks laid in lime mortar is about 1,500 pounds to the square inch, but if laid in Portland cement the power of resistance is increased to 2,500 pounds to the square inch; so to crush the lowest courses in a pier laid in lime mortar would require a height of brickwork of 2,000 feet, and if the bricks are laid in cement the pier will require to be 3,600 feet high to crush the lower courses. "Mahan's Civil Engineering" contains the following table, which shows the pressure on the lower courses of several noted buildings, and the percentage of the resisting power employed:

	Permanent strain in pounds per sq. inch	Crushing weight in pounds per sq. inch.	Factor of safety.
Pillars of the dome of St. Peters, Rome	230	3722	16
" " " St. Pauls, London	274	3733	13
" " " St. Genevieve, Paris	116	3167	8
" " " Toussaint, Angers	788	7880	10

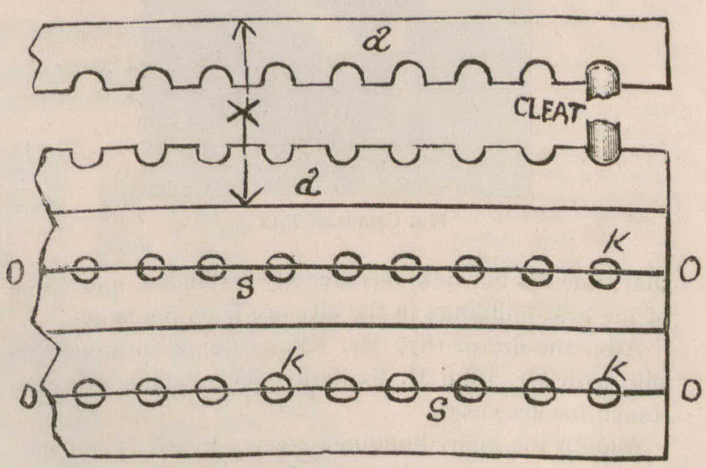
The stone used in all the buildings named in the table is a limsetone of some kind or other.

An English Method. In many parts of England there is a custom of making sashes with the stiles projecting beyond the meeting rail, and having their ends ornamented with an ogee end, as shown in sketch herewith presented. By this method a stronger sash is secured, as the tenon of the rail may pass through the stile its full width, or without relish, a very important feature. The bevel on the



meeting rail laps over the stile and adjusts itself to the parting head just the same as if the rail was dove-tailed into the stile. This style of sash is called in England "joggled sash," and the ogee moulding on the end of the stile adds considerably to the appearance of the work. The joggle (S) is left about two and a half inches past the meeting rail. A and B show the upper and lower sashes, and C shows the same in section. Joggled sashes should only be used where the top sheet or both sheets are hung; though the inside sash might be joggled, even if the sashes were held in place by stops, as is often the case in country houses.

Shop Wrinkles. It frequently happens that the country builder is called upon to erect "shop-fixtures," such as counters, shelving, drawers and the like work. In the making of shelving the old-fashioned way of "dadoing" or grooving the standards is in a measure obsolete, as when the shelves were once placed there could be no change made afterwards as to their position. The better way is to fit the standards with notched racks about one and a half inches wide, one being placed on each end of the standard on the sides receiving the shelves. These racks may be made with a dog-tooth notch on one edge to take in a cleat, or the notches may be semi-circular, the latter being by far the easiest made, and one much handier to adjust. The quickest way to make these is to prepare half-inch stuff three inches wide and the length required. Prepare as many as are wanted, remembering that one piece will make enough for one side of a standard. Clamp two, three or four of these strips together with hand-screws or other device, run a gauge line down the centre, as shown at SS in the accompanying diagram. On this line space off the regular distances, say two, three or four inches from centres.



With these points as centres, bore one-inch holes, as at K, K, K, K. Having gone the whole length of the strips, making clean holes with a centre bit, or, better still, with an expansion bit, saw the strips through on the lines O, O, O, O. Take off the hand-screws, and you have a number of pieces for racks similar to A, A. The cleats for carrying the shelves should be made of half-inch stuff, one inch wide, with the ends rounded to fit the half-circle in the racks, the shelf, of course, fitting on this cleat when in place. The distance shown at X is the width of the standards. Shelves are made the same width, and are notched out on the ends to accommodate the two racks. This method is much less costly than the saw-tooth rack, and is just as good. This method will be found useful in fitting up pantries or store-rooms, where shelving often has to be changed to get proper distances between them. It is frequently used in cabinet work, for book-cases, cupboards and china-closets.

Our readers will notice the re-appearance in our advertisement pages of the announcement of Messrs. Merchant & Co., of Philadelphia. They call the attention of Canadian architects and builders to the merits of their metal "Spanish" tiles and "Gothic" shingles.

PROMINENT CANADIAN CONTRACTORS.

VII.

MR. CHARLES TILLEY.

THERE are few men in the Maritime provices engaged in the contracting line who are better known in the trade and by the public generally than Mr. Charles Tilley, of St. John.

Since early in the sixties Mr. Tilley has been engaged in contracting and building, and during that time has put up a large percentage of the buildings in his native city. He was born in 1839, and at the age of 15 years entered as apprentice the employ of Messrs. Crosby & Small, who were then the largest mason contractors in the city. After serving an apprenticeship of four years, he left Crosby & Small and went to Halifax, where he worked at the trade for a year.

He started in business for himself in 1863, his first contract being for the Hampton court-house. Since

MR. CHARLES TILLEY.

that time his business has steadily extended, and some of the best buildings in the city are from his hands.

After the fire of 1877 Mr. Tilley entered into partnership with Mr. John M. Redfern. This partnership continued for six years.

Among the many buildings erected by Mr. Tilley may be mentioned the market (cost $130,000), the Wygoody building, the Dock street electric light building (which has since been altered), and the Queen's Hotel, Fredericton.

PAVING BRICKS FOR BUILDING FRONTS.

THE pictures which we give of the building for the Home of the Friendless, in Chicago, are interesting not alone for their general artistic merit, says the Clay-worker, but as well on account of the means employed to accomplish an artistic result. As will be seen from the description, this building is faced with paving brick (seconds) from Galesburg, Illinois. The decorative parts are terra cotta. The natural color of the brick develops a rich brown and a variation in tint which is more and more sought for by the best architects. There was a time when it was supposed that for fronts each brick should be exactly the same color as every other brick. But in examining some of the brickwork of earlier centuries, where time and circumstances have made changes in color, it has been noticed by artists that the variation in color, when not too great, has been the means of producing highly artistic results. The architect of one of the most imposing houses in New York went to a terra cotta establishment some years ago and said: "I want to look over some of your cast-off clay products." In going through the yard he saw some blue mottled fire brick which were used for lining kilns. He bargained for them and they were used to face one of Gotham's finest houses, and mottled brick became a fad. This was about the first use that was made of this kind of brick for fine fronts in this country. While it has been carried to extremes in some instances on the whole the result has been very good. In connection with the brick used for the Home of the Friendless we are taught a lesson in regard to the size of brick made for paving purposes. These brick being of the same size and form of the ordinary building brick, it was possible to use them on this work. We have noticed in this city that in some instances the hardest of paving brick have been used for facing above grade to the line of the first-floor because of their non-absorbent qualities. Out of this accidental use of paving brick we may expect to see an increased market for this character of product. Then paving brick manufacturers will wish they had been content to make standard size brick instead of the large block.

LEGAL.

MCCANN v. CITY OF TORONTO.—Judgment by Mr. Justice Street, upon question of liability of third parties to defendants. The plaintiff recovered judgment against defendants for $600 for damages sustained by her owing to their negligence in not having fastened a trap door in the roof of the tower of a fire hall in Dundas street, in the City of Toronto. The door was blown off as the plaintiff was passing along the highway, and, striking her on the head, inflicted the injuries of which she complained. The jury found that the plaintiff had been injured by the negligence of defendants in not properly securing the trap door. THEY ALSO FOUND, in answer to questions put to them at the request of the counsel for defendants (who disputed the liability of defendants for acts of negligence on the part of the contractors, Messrs. Phillips, the third parties, who had undertaken to erect and complete the building), THAT THE SPECIFICATIONS WERE SATISFIED WITHOUT THE PLACING OF FASTENINGS UPON THE TRAP-DOOR. The building had not been taken over from the contractors at the time the accident happened. The specifications required the contractors to leave a trap-door in the tower of the building, and to "provide trap and flagpole." The contract embodied the specifications by reference, and required the contractors to "find and provide such good, proper and sufficient materials of all kinds whatsoever as shall be proper and sufficient for completing and furnishing all the above mentioned works of said building shown on the said plans and mentioned in said specifications," and to furnish and perform all the work called for in a good workmanlike manner. There was also a stipulation that the corporation "will not in any manner be answerable or accountable . . . for the injury to any person or persons, either workmen or the public, . . from any cause which might have been prevented by the contractors . . . against all which injuries and damages . . . the contractors must properly guard and make good all damages from whatever cause . . and be strictly responsible for the same." The plan showed that the trap-door was to be placed upon a steep slope in the roof of the tower. By express agreement the learned judge was not to be bound by the findings of the jury except as to the amount of the damages. He finds, upon the evidence, that the contractors did not comply with their contract to complete and finish their work when they left the trap-door unsecured. It was as much a part of the roof as were the shingles, and it was as necessary to secure it properly as it was to put sufficient nails into the shingles. The result of this finding is that the corporation were not negligent and that the contractors were. The jury found the converse, and upon their finding that the corporation had net stipulated for the securing of the trap-door they were held liable and judgment was recovered against them. The result of the case is that they would not have been liable if the negligence which caused the accident had been that of the contractors. They were the land-owners, it is true, and the accident happened to one of the public upon the highway adjoining their land, and in the course of construction of a building being erected for them. But the corporation, having employed competent contractors to do the work, and having stipulated for its being properly done, the work itself being a lawful one, and not intrinsically dangerous to anyone, and not being in the nature of a nuisance, were not liable for an accident arising from the negligence of the contractors in carrying out their contract: Reedie v. London and Northwestern R. W. Co., 4 Ex. 244. The corporation are confronted with a dilemma. If the finding of the jury was right, the corporation cannot ask that the result of its own negligence should be visited upon the innocent contractors. If the finding of the jury was wrong, and the accident was due to the negligence of the contractors, then the corporation never was liable to the plaintiff at all, the contractors alone were liable, and therefore the corporation cannot recover over against them. Claim of defendants against third parties dismissed with costs. Fullerton, Q. C., for defendants.

TREMAINE VS. SUTCLIFFE.—This case, which recently came before the courts at Halifax, Nova Scotia, is one in which both architects and contractors will be interested. We therefore print in full the decision of Mr. Justice Weatherbe and his remarks bearing on the case, as follows:

This cause came on for trial before me at chambers. Part of the evidence was taken before me, and for the convenience of the parties and their counsel several adjournments took place and evidence was taken before a commissioner, who was the stenographer appointed in the case. After the evidence was completed written arguments were submitted by counsel.

The action is brought to recover remuneration for the plaintiff's services as architect on an agreement to pay two per cent. for plans and specifications and two per cent. for superintending the work.

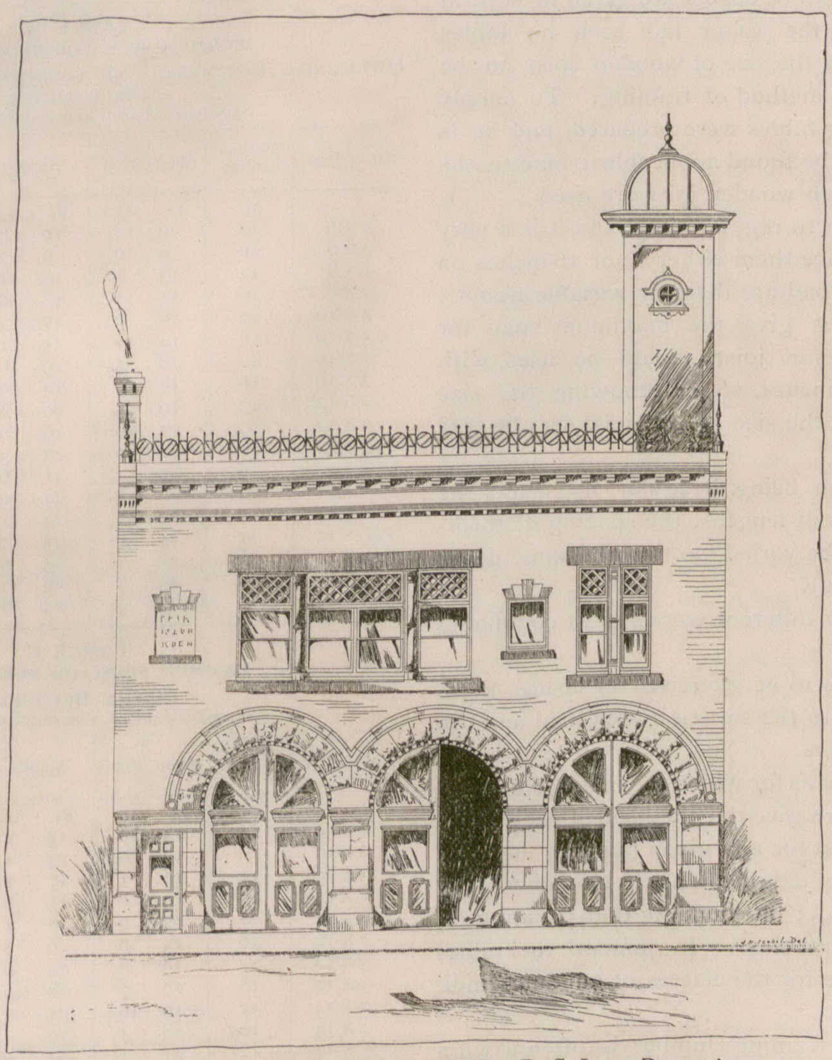
More than 150 pages of typewritten evidence has been taken, and a large portion of which deals with questions of opinion rather than of fact. The contention of defendant's counsel, which he endeavors industriously to support by numerous references to the evidence, is that the work of the plaintiff was unskillfully and negligently done both in preparing plans and specifications, and in superintending the work. Superintending the work would, I understand, embrace the properly and promptly advising the defendant in any difference of opinion between him and a contractor. It is argued for defendant that according to the plaintiff's own evidence carelessness and indifference are manifest from the very brief time spent at supervision as well as from the evidence of necessity of defendant's attendance to the supervision to prevent departure from the plans and specifications as also from what resulted during prosecution of the work. Defendant's counsel further contends that the agreement for commissions cannot be construed as plaintiff maintains to cover the whole outlay of defendant, and that, in fact, the amount upon which commission is claimed covers damages paid by defendant which resulted to an adjoining building during the prosecution of the work in question on rent paid for another building by defendants, on shelving in another building with which plaintiff had nothing to do, and never saw, on extras for which plaintiff did not prepare the plans nor supervise the work, and on the cost of vault doors, which latter would be treated on a different principle I suppose from the other items mentioned in this sentence. Defendant claims by way of counter-claim for the negligence, default and breach of contract specified above, and in addition complains that $300 or more were lost by the improper method of construction, approved of by the architect, of a glass house on top of the building, and also that plaintiff has certified for work not done or improperly done and for work in excess of what should have been certified and for his conduct in relation to what is alleged to be the unskillful and improper equipment of the building with electrical wiring, the subject in controversy to which the greater portion of the evidence is directed. Defendant claims that the wire itself is dangerous and therefore useless and that rewiring will cost over $500. It is obvious that though the wire is not dangerous, and even though the evidence brings it within the specifications this does not necessarily dispose of the question of negligence of the architect as to his duty in relation thereto.

I have reviewed not only the special evidence on which the defendant relies, but the whole of the voluminous mass of testimony and I have carefully examined plaintiff's counsel's statements by which he seeks to controvert the defendant's argument, and I cannot wholly agree with either of the counsel. I am called upon to apply and pass upon a large number of facts and conflicting opinions in the capacity of a juror and to form a conclusion upon the whole case, including the counter-claim. Though I am much impressed with the observation of defendant's counsel as to the character of the wire, and though I cannot avoid doubt, I am not able to pronounce it not in accordance with the contract.

Counsel refers to the indifference of the architect in the conflict between the defendant and the contractor on this subject. I was much struck with the evidence of Mr. Brookfield. The architect seems to have permitted a very experienced and persistent contractor to almost usurp his functions in collecting information and advising the defendant not only in regard to the wiring but in respect of other subjects where controversy and difference of opinion arose. Indeed this indifference or rather want of firmness and promptitude, perhaps the not unnatural result of inexperience, this lack of firmness or whatever it may be termed, which has evidently caused defendant a great amount of annoyance and trouble, is so prominent in the evidence as to have raised doubts whether I should not have wholly disallowed the plaintiff's claim. I regard this as a matter which might have been before a jury wholly within their province.

In, however, deciding for plaintiff I do not so decide upon the construction of the contract to the extent urged on his behalf for the amount of commissions on the sum on which plaintiff's claim is based. Upon the view left open to me to take I award him in addition to the $100 paid into court $351, or $451 in all, instead of the sum claimed (526.-68). There remains the question of costs in connection with the circumstances attending the conduct of the plaintiff already referred to. I cannot escape the conviction that the defence set up, and the counter-claim arose out of circumstances all attributable to the attitude and conduct of plaintiff, and therefore there should be no costs.

In view of my decision, at which I have arrived with so much hesitation, being reviewed at the instance of either party, I wish to add that there was nothing in the demeanor of the parties to the suit or those witnesses who gave their evidence in court which afforded me any advantage over a judge who may have to rely alone on the perusal of the evidence.



NORTH END FIRE ENGINE HOUSE, ST. JOHN, N.B.—R. C. JOHN DUNN, ARCHITECT.

The new building designed by Mr. F. M. Rattenbury, architect, for the Bank of Montreal, at Victoria, B. C., is now ready for occupation. The banking room measures 60 x 40 feet, with an 18 foot ceiling. The walls are pannelled with Tennessee marble in a variety of shades. The woodwork is of walnut, enriched by excellent carving. The floors are laid with mosaic. The contractors were all local men, the stonework being executed by Messrs. McGregor & Jeeves, the plastering by Mr. Richard Drake, the interior walnut fittings by Weiler Bros., the tiles supplied by Mr. Anderson, and the leaded glass work by Mr. E. W. Morris.

SAFE SPANS FOR WOODEN FLOOR JOISTS, CEILING JOISTS AND RAFTERS IN BUILDINGS.*

REALIZING the important part played by labor-saving devices in the economy of the industries of this age, the writer has for several years given much thought to the preparation of tables for the strength of building materials, which, while safe and reliable, can also be readily understood and used by any architect or intelligent builder.

Even to those who are familiar with the formulæ and data used in determining the strength of materials, such tables are of great help, as they enable one not only to determine more quickly the size required, but also to see at a glance the size which can most economically be used.

Tables for the strength of beams are given in several handbooks, but as yet the writer has seen no tables which show at a glance the size of wooden joist to be used with the ordinary method of framing. To supply this want the following tables were prepared, and it is believed that they will be found applicable to nine-tenths of the buildings in which wooden joist are used.

As the joist are sawn to regular sizes, and it is a very common custom to space them either 12 or 16 inches on centres, the span and load are the only variable terms.

The following tables give the maximum span for which the different sizes of joist should be used with spacings of 12 and 16 inches, so that knowing the size of room to be covered, the size of the joist can be told at a glance.

If, owing to the room being irregular in shape, the joists must be of different lengths, the spacing or thickness of the joists may be varied, so that the same depth may be used throughout.

Values for the four different woods most commonly used are also given.

The only precautions to be exercised in using these tables are in regard to the superimposed load and the actual size of the timbers.

The superimposed loads for which the maximum spans have been computed are given at the head of each table. The load to be assumed for any given building is to a large extent a matter of judgment, as circumstances may demand a higher limit for one building than for another, even of the same general class. In general the tables may be considered safe for the classes of buildings indicated.

In some localities framing lumber is often sawn a little scant in both thickness and depth, and wherever such is the case a corresponding reduction must be made in the safe span. A reduction should also be made for any cutting of the joist that may be required.

Tables A to E, inclusive, were computed by the formula for stiffness, on the assumption that the deflection should not exceed 1-30 of an inch per foot of span. Tables F, G and H were computed by the formula for strength.

No allowance has been made for partitions, and when they are to be supported by the floor joist additional joist should be used, or the span reduced according to the relative direction or position of the partition and joists.

The spans given in these tables come within the requirements of the New York and Buffalo building laws, and tables A, C, D, E, G and H comply with the Chicago law, but to comply with the Boston law (which the writer considers very unreasonable) a reduction of about one-sixth must be made from the spans given.

By Georgia pine is meant the long-leaf, yellow or hard pine.

TABLE A.

MAXIMUM SPAN FOR CEILING JOISTS.

Superimposed load, 5 pounds per square foot.

Size of Joist.	Dist. on Centres.	White Pine.		Spruce.		Oregon Pine.		Georgia Pine.	
	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
2 x 4	12	9	11	10	7	10	11	11	10
2 x 4	16	9	0	9	7	9	11	11	1
2 x 6	12	14	7	15	7	16	1	17	3
2 x 6	16	13	3	14	2	14	7	15	10
2 x 8	12	19	0	20	6	21	1	22	8
2 x 8	16	17	5	18	8	19	3	20	8
2 x 10	12	23	6	25	2	26	0	27	11
2 x 10	16	21	7	23	0	23	10	25	7
2 x 12	12	27	0	28	10	29	8	32	0
2 x 12	16	25	0	26	8	27	6	29	7

TABLE B.

MAXIMUM SPAN FOR FLOOR JOISTS.

DWELLINGS, TENEMENTS AND GRAMMAR SCHOOL ROOMS WITH FIXED DESKS.

Superimposed load, 40 pounds per square foot.

Size of Joist.	Dist. on Centres.	White Pine		Spruce.		Oregon Pine.		Georgia Pine.	
	In.	Ft.	In.	Ft	In.	Ft.	In.	Ft.	In.
2 x 6	12	9	10	10	6	10	10	11	8
2 x 6	16	9	0	9	7	9	11	10	8
2 x 8	12	13	0	13	11	14	5	15	6
2 x 8	16	11	11	12	10	13	2	14	2
2 x 10	12	16	2	17	3	17	11	19	0
2 x 10	16	14	11	15	11	16	5	17	6
3 x 10	12	18	3	19	6	20	2	21	5
3 x 10	16	16	10	18	0	18	7	19	8
2 x 12	12	19	5	20	8	21	5	22	8
2 x 12	16	17	10	19	0	19	7	20	11
3 x 12	12	21	10	23	3	24	1	25	6
3 x 12	16	20	1	21	6	22	2	23	7
2 x 14	12	22	6	24	0	24	10	26	3
2 x 14	16	20	8	22	1	22	10	24	2
2½ x 14	12	24	0	25	7	26	5	28	0
2½ x 14	16	22	1	23	7	24	5	25	11
3 x 14	12	25	2	26	11	27	10	29	6
3 x 14	16	23	3	24	11	25	8	27	3

TABLE C.

MAXIMUM SPAN FOR FLOOR JOISTS.

OFFICE BUILDINGS.

Superimposed load, 70 pounds per square foot.

Size of Joist.	Dist. on C ntres.	White Pine.		Spruce.		Oregon Pine.		Georgia Pine.	
	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In
2 x 10	12	14	2	15	2	15	7	16	10
2 x 10	16	13	0	13	11	14	3	15	5
3 x 10	12	16	1	17	2	17	8	19	1
3 x 10	16	14	8	15	8	16	2	17	6
2 x 12	12	17	0	18	1	18	8	20	1
2 x 12	16	15	6	16	7	17	1	18	5
3 x 12	12	19	2	20	6	21	2	22	10
3 x 12	16	17	7	18	10	19	6	20	11
2 x 14	12	19	10	21	1	21	10	23	5
2 x 14	16	18	1	19	3	19	11	21	6
2½ x 14	12	21	1	22	7	23	3	24	11
2½ x 14	16	19	5	20	8	21	5	22	11
3 x 14	12	22	5	23	10	24	7	26	3
3 x 14	16	20	6	21	11	22	7	24	1

TABLE D.

MAXIMUM SPAN FOR FLOOR JOISTS.

CHURCHES AND THEATRES WITH FIXED SEATS.

Superimposed Load, 80 lbs. per square foot.

Size of Joist.	Dist. on Centres.	White Pine.		Spruce.		Oregon Pine.		Georgia Pine.	
	In.	Ft.	In.	Ft.	In.	Ft.	In	Ft.	In.
2 x 10	12	13	8	14	7	15	1	16	2
2 x 10	16	12	6	13	5	13	10	14	11
3 x 10	12	15	6	16	7	17	1	18	3
3 x 10	16	14	2	15	2	15	8	16	10
2 x 12	12	16	5	17	6	18	1	19	3
2 x 12	16	15	0	16	0	16	6	17	8
3 x 12	12	18	5	19	11	20	6	21	11
3 x 12	16	17	0	18	2	18	10	20	1
2 x 14	12	19	1	20	5	21	0	22	5
2 x 14	16	17	5	18	7	19	2	20	6
2½ x 14	12	20	5	21	10	22	6	24	0
2½ x 14	16	18	8	20	0	20	7	22	1
3 x 14	12	21	7	23	1	23	10	25	5
3 x 14	16	19	10	21	1	21	10	23	3

* F. E. Kidder, in Architecture and Building.

TABLE E.

MAXIMUM SPAN FOR FLOOR JOISTS.

ASSEMBLY HALLS AND CORRIDORS.

Superimposed load, 100 pounds per square foot.

Size of Joist.	Dist. on Centres.	White Pine		Spruce.		Oregon Pine.		Georgia Pine.	
	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
2 x 10	12	12	11	13	10	14	2	15	3
2 x 10	16	11	10	12	7	13	0	14	0
3 x 10	12	14	7	15	8	16	2	17	3
3 x 10	16	13	5	14	3	14	10	15	11
2 x 12	12	15	5	16	6	17	0	18	3
2 x 12	16	14	1	15	1	15	7	16	8
3 x 12	12	17	6	18	8	19	3	20	8
3 x 12	16	16	1	17	2	17	8	19	0
2 x 14	12	18	0	19	2	19	10	21	2
2 x 14	16	16	5	17	7	18	1	19	5
2½ x 14	12	19	3	20	7	21	2	22	8
2½ x 14	16	17	7	18	10	19	5	20	10
3 x 14	12	20	5	21	10	22	6	24	0
3 x 14	16	18	8	20	0	20	7	22	0

TABLE F.

MAXIMUM SPAN FOR FLOOR JOISTS.

RETAIL STORES.

Superimposed load, 150 pounds per square foot.

Size of Joist.	Dist. on Centres.	White Pine		Spruce.		Oregon Pine.		Georgia Plne.	
	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
2 x 10	12	12	3	12	8	14	6	15	2
2 x 10	16	10	8	11	1	12	7	13	2
3 x 10	12	14	11	15	6	17	7	18	11
3 x 10	16	13	0	13	6	15	3	16	1
2 x 12	12	14	8	15	3	17	3	18	2
2 x 12	16	12	10	13	3	15	1	15	10
3 x 12	12	17	10	18	6	21	0	22	0
3 x 12	16	15	7	16	2	18	3	19	2
2 x 14	12	17	1	17	10	20	1	21	1
2 x 14	16	14	11	15	6	17	6	18	5
2½ x 14	12	19	0	19	10	22	4	23	5
2½ x 14	16	16	7	17	2	19	6	20	6
3 x 14	12	20	8	21	6	24	5	25	6
3 x 14	16	18	1	18	10	21	2	22	3

TABLE G.

MAXIMUM SPAN FOR RAFTERS.

PITCHED ROOFS, SHINGLED.

External load, 40 pounds per square foot.

Size cf Joist.	Dist. on Centres.	White Pine.		Spruce.		Oregon Pine.		Georgia Pine.	
	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
2 x 4	16	8	1	8	5	9	6	10	0
2 x 4	20	7	3	7	7	8	6	9	0
2 x 6	16	12	0	12	6	14	2	14	11
2 x 6	20	10	10	11	3	12	10	13	6
2 x 8	16	16	0	16	7	18	10	19	5
2 x 8	20	14	5	14	11	16	11	17	11
2 x 8	24	13	1	13	7	15	6	16	3
2 x 10	16	19	10	20	7	23	3	24	7
2 x 10	20	17	11	18	7	21	0	22	2
2 x 10	24	16	5	16	11	19	2	20	3

TABLE H.

MAXIMUM SPAN FOR RAFTERS.

SLATE ROOFS AND FLAT ROOFS.

External load, 40 pounds per square foot.

Size of Joist.	Dist. on Centres.	White Pine.		Spruce.		Oregon Pine.		Georgia Pine.	
	In.	Ft.	In.	Ft.	In.	Ft	In.	Ft.	In.
2 x 4	16	7	7	7	11	9	0	9	6
2 x 4	20	6	10	7	1	8	0	8	6
2 x 6	16	11	5	11	8	13	5	14	1
2 x 6	20	10	2	10	7	12	0	12	8
2 x 8	16	15	1	15	7	17	8	18	8
2 x 8	20	13	7	14	1	16	0	16	10
2 x 8	24	12	5	12	10	14	7	15	5
2 x 10	16	18	8	19	5	22	0	23	2
2 x 10	20	16	6	17	6	19	10	20	11
2 x 10	24	15	5	16	0	18	1	19	1

The Toronto Evening Star remarks that by some strange oversight the Toronto Trades and Labor Council has neglected to condemn the management of the six-day bicycle race for working the men over-time.

There is quite a knack in filling open grain woods right, such as ash and oak, and species of mahogany. The average painter rubs off the filler in any way. It should be rubbed across the grain, and then in a careful manner, so as not to rub it out again.

THE PLUMBERS' AND STEAMFITTERS' SUPPLY ASSOCIATION.

THE annual meeting of the above association was held in Toronto on the 8th inst., and was well attended. Owing to the death of his brother, Mr. John McMichael, the president, Mr. A. A. McMichael, of the James Robertson Company, was unable to be present, and in his absence Mr. A. J. Somerville acted as chairman. A resolution of sympathy with Mr. McMichael was passed and ordered to be forwarded to him. The annual statement of the association was read, which showed the finances to be in a very healthy state. The election of officers for the ensuing year resulted as follows: President, Mr. James Morrison, of the James Morrison Brass Mfg. Co.; vice-president, Mr. A. J. Somerville, of the Ontario Lead and Barb Wire Company; secretary-treasurer, Mr. A. G. Booth, of the Steel-Clad Bath Company. Several matters of general interest were discussed at length, and one new member was proposed and accepted.

After the business had been finally disposed of, an adjournment was made to another room, where lunch had been provided by Mr. Williams, of the Bodega. After brief speeches the meeting dispersed.

STRENGTH OF STONES UNDER PRESSURE.

STUDENTS of geology who are no longer young may remember the interest excited when they first read of the experiments of Gregory Watt on basalt, says the London Architect. He melted some blocks. Those which were cooled quickly formed a sort of glass resembling slag. Those which were cooled more slowly assumed at first the form of globules, which increased in size and became balls of equal sizes. A layer of the balls was subjected to pressure in every direction, and it was found that every ball became squeezed into a regular hexagon. It was concluded that the columnar structure of basalt was due to immense forces operating similarly. Experiments no less interesting have been conducted by Messrs. Adams and Nicholson in McGill University, and some of the results were brought under the notice of the meeting of the British Association at Toronto. The object was to ascertain whether it is possible, by subjecting rocks artificially to pressure under the conditions which obtain in the deeper parts of the earth's crust, to produce in them the deformation and cataclastic structures exhibited by the folded rocks of the interior of mountain ranges or of the older formations of the earth. The experiments have been made chiefly with pure Carrara marble. Columns of the marble 2 centimeters and 2½ centimeters in diameter and about 4 centimeters in length were very accurately turned and polished. Heavy wrought-iron tubes were then made, imitating the plan adopted in the construction of ordnance, by rolling long strips of Swedish iron around a bar of soft wrought-iron, and welding the strips to the bar as they were rolled around it. The core of soft iron composing the bar was then drilled out, leaving a tube of welded Swedish iron 6 millimeters thick, so constructed that the fibers of the iron run around the tube, instead of being parallel to its length. This tube was then very accurately fitted onto the column of marble. This was accomplished by giving a very slight taper to both the column and the interior of the tube, and so arranging it that the marble would pass only about half way into the tube when cold. The tube was then expanded by heating, so as to allow the marble to pass completely into it, and leave about three centimeters of the tube free at either end. On allowing the tube to cool a perfect contact between the iron and marble was obtained, and it was no longer possible to withdraw the latter. Into either end of the tube containing the small column an accurately fitting sliding steel plug was inserted, and by means of these the marble was submitted to a pressure far above that which would be sufficint to crush it if not so enclosed. Under the pressure, which was applied gradually and in some cases continued for several weeks, the tube was found to slowly bulge until a very marked enlargement of the portion surrounding the marble had taken place. The tube was then cut through longitudinally by means of a milling machine along two lines opposite to one another. The marble within, however, was still firm, and held the respective sides of the iron tube, now completely separated, so tightly together that it was impossible without mechanical aids to tear these apart. By means of a wedge, however, they could be separated, splitting the marble through longitudinally. The column in one experiment was reduced from 40 millimeters to 21 millimeters in height. The deformed marble differs from the original rock in having a dead white color, the glistening cleavage faces of calcite being no longer visible, and although not so hard as the original rock, it is still firm and compact, and especially so when its deformation has been carried out very slowly. The experiments show that limestone, even when dry and at ordinary temperatures, does possess a certain degree of plasticity, and can be made to "flow," the movements set up developing many structures which are characteristic of rocks which have been squeezed or folded in the deeper portions of our earth's crust. It is to be hoped Messrs. Adams and Nicholson will continue their experiments, for in addition to their geological interest they suggest that much remains to be known about the strength of marble under constant pressure, and, it may be, about other materials also.

POLISHING MARBLE.

POLISHING includes five operations. Smoothing the roughness left on the surface is done by rubbing the marble with a piece of moist sandstone ; for mouldings either wooden or iron mullers are used, crushed and wet sandstone, or sand, more or less fine, according to the degree of polish required, being thrown under them. The second process is continued rubbing with pieces of pottery without enamel, which have only been baked once, also wet. If a brilliant polish is required, Gothland stone instead of pottery is used, and potters' clay or fullers' earth is placed beneath the muller. This operation is performed upon granites and porphyry with emery and a lead muller, the upper part of which is encrusted with the mixture until reduced by friction to clay or impalpable powder. As the polish depends almost entirely upon these two operations, care must be taken that they are performed with a regular and steady movement. When the marble has received the first polish, the flaws, cavities, and soft spots are sought out and filled with mastic of a suitable color. This mastic is usually composed of a mixture of yellow wax resin and Burgundy pitch, mixed with a little sulphur and plaster passed through a fine sieve, which gives it the consistency of a thick paste ; to color this paste to a tone analogous to the ground tints or natural cement of the material upon which it is placed, lampblack and rouge, with a little of the prevailing color of the material, are added. For green and red marbles, this mastic is sometimes made of gum lac, mixed with Spanish sealing wax of the color of the marble. It is applied with pincers, and these parts are polished with the rest. Sometimes crushed fragments of the marble worked are introduced into the cement, but for fine marbles, the same colors are employed which are used in painting, and which will produce the same tone as the ground ; the gum lac is added to give it body and brilliancy. The third operation in polishing consists in rubbing it again with a hard pumice stone, under which water is being constantly poured, unmixed with sand. For the fourth process, called softening the ground, lead filings are mixed with the emery mud produced by the polishing of mirrors, or the working of precious stones, and the marble is rubbed by a compact linen cushion well saturated with this mixture ; rouge is also used for this polish. For some outside works, and for hearths and paving tiles, marble workers confine themselves to this polish. When the marbles have holes or grains, a lead muller is substituted for the linen cushion. In order to give a perfect brilliancy to the polish the gloss is applied. Well wash the prepared surfaces and leave them until perfectly dry, then take a linen cushion, moistened only with water, and a little powder of calcined tin of the first quality. After rubbing with this for some time, take another cushion of dry rags, rub with it lightly, brush away any foreign substance which might scratch the marble, and a perfect polish will be obtained. A little alum mixed with the water used penetrates the pores of the marble, and gives it a speedier polish. This polish spots very easily, and is soon tarnished and destroyed by dampness. It is necessary when purchasing articles of polished marbles to subject them to the test of water ; if there is too much alum the marble absorbs the water and a whitish spot is left.

MANUFACTURES AND MATERIALS

Mr. Thomas Whittaker, of Toronto, is reported to have discovered a large deposit of fire clay on lands owned by him in the Nipissing district. The material is said to have undergone analysis by the government expert, and is declared to be genuine. A company is said to be in process of formatiou to utilize the material.

The Ontario Peat Fuel Company, of Welland, have recently patented a method for the manufacture of artificial marble from gypsum. There is said to be an abundant supply of the mineral on the Grand River. A factory is now being fitted up in Toronto for the manufacture of the new material, regarding which further particulars will shortly be given.

Messrs. Henry Maurer & Son, of New York, have patented in Canada and other countries a brick which is said to be absolutely fire-proof, and, though dense in appearance, has the quality of allowing nails to be driven into it without causing chipping and the further quality of "holding" the nails so that it is with much difficulty that they can be withdrawn.

The Sprague Elevator Co., of New York, represented in Canada by Jack & Robertson, of Montreal, are reported to have recently received from the Central London Railway of London, Eng., the largest elevator contract on record. It includes 49 elevators erected in twenty-five different underground shafts, and distributed over six miles of route.

Teacher (to pupils)—"Who was Moses?" Truthful Tommy, at the back end of the class, signals eagerly. Teacher—"Well?" T. T.—"He was the man wot told the brickmakers to go on strike when Pharaoh wanted to sweat 'em."

PAGES

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