THE AMERICAN ARCHITECT AND BUILDING NEWS

ADVERTISERS' TRADE SUPPLEMENT.

No. 14. SATURDAY, JULY 7, 1883. VOLUME XIV. No. 393.

ABOUT ELEVATORS. — HYDRAULIC VERSUS STEAM POWER.

In the great majority of modern city buildings the passenger elevator is a necessity. In order to do its work thoroughly such apparatus should have a rapid and smooth motion; it should be intrinsically safe; it should have the best safety appliances; it should be simple in construction; it should be durable; it should not easily get out of order, and it should run at the lowest possible cost.

All modern elevators derive their power from one of two sources, either from the pressure of a column of water acting upon a piston, or from a steam-engine. In the cities of New York and Boston, and in other places where no reliable water pressure can be had from the street mains, or where the use of water from the street mains is undesirable for many reasons, the pressure is obtained from a tank placed upon the roof of a house or in the top story.

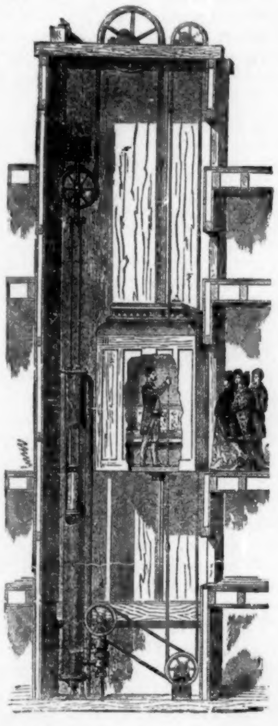
The water is exhausted by the machine into a tank placed in the cellar, and from this lower tank the water is again transferred to the upper tank by means of a pump.

This process involves the use of the water over and over again, and thus practically the water costs nothing.

Up to three or four years ago nearly all elevators erected were of the "steam class;" although hydraulic elevators were known they were used for freight purposes and but rarely for passenger conveyance. The invention of the Standard Hydraulic Elevator by Mr. Baldwin, has effected a revolution in this field, and now nearly all first-class elevators are run by hydraulic power. The Standard Hydraulic Elevator, made by Otis Brothers & Co., has taken a leading position. It has superseded the steam elevators made by Otis Brothers & Co., which were admitted to be perhaps the best in use. This has happened because the Standard Hydraulic Elevator has a more rapid and smoother motion than the steam elevator; because it is actually safer, and because in cases where more than one elevator is used in the same building it runs at a very much less expense.

The superiority of the Standard Hydraulic Elevator is so pronounced that in cases where the question of the merits of different elevators have been examined and passed upon by experts and engineers, the Standard has carried off the palm. For example, Mr. Mason, President of the Taunton Locomotive Works, wher erecting the Mason Building in Liberty Square, Boston, had determined to use a steam elevator, but an examination of the principles governing the construction of the Standard Hydraulic Elevator caused its adoption by him.

The Standard Hydraulic Elevator furnishes the most rapid motion; in this machine the car is by far the most rapid moving part of the whole mechanism; the speed is regulated simply by the size of the pipe conveying the water from the source of supply to the machine; rapidly-moving water, therefore, gives a rapidly-moving car, and the car when moving at high speed requires only moderate speed in all other parts. It is hardly practicable, unless at a very great expense, to construct steam elevators having the same speed as the hydraulic ones made by Otis Brothers



& Co., and put by them into large office-buildings.

To furnish such a speed by a steam elevator would involve the use of an engine running at a very high speed, and at consequent great expense. In the water elevator there are very few rotating parts, and these run with a slow motion. In the case of the steam elevator the motions are very rapid, and the machine is ten times more complicated in its construction, having a multitude of bearings, boxes, belts, shafts, wheels, connections, etc., etc., some rotary, others reciprocating, all requiring incessant care, nice judgment, and constant attention to the lubricating parts by an expert engiaeer. The conditions are such that a slight oversight or neglect, resulting in a disarranged box or wheel, will be communicated in an exaggerated form to the car through the medium of the connecting ropes, which are of necessity more or less elastic in their character.

In steam machines having the screw and worm wheel, it is a well-known fact that not only an excessively rapid rotation of the screws is necessary (running up usually to three or four hundred revolutions a minute) in order to obtain the rate of motion required in the car, but the worm wheels upon which the screws act are also reduced in diameter to about one-half that of the drum, which they cause to revolve, thus greatly increasing the leverage and friction on the teeth of the worm wheels, and so severe is the impact at this point (notwithstanding that double wheels and screws are employed to favor as far as possible the operation) that the machine of this form of construction cannot be run at all except with the screws constantly immersed in oil of the very best lubricating qualities. This excessively rapid motion means rapid wear.

One revolution of the engine effects far less motion in the platform of the car than the same amount of steam used in lifting water for hydraulic elevators, therefore the steam elevator is by far the most expensive to run. This difference in cost of running may be indicated by one or two instances: —

Elevators having the screw engine as the means of power may be seen in the Stevens Building, in Wall Street, New York. There are two elevators in that structure of as good a quality as can perhaps be found of that kind. The work performed is as follows: Rise of car, ninety-five feet; speed, about one hundred and twenty feet per minute; when last examined each car was making a round trip in $\frac{255}{100}$ minutes; quantity of coal consumed per day, 1,500 pounds.

In the United Bank Building, at the corner of Wall Street and Broadway, New York, there are two Standard Hydraulic Elevators. The rise of car is 112 feet; the speed of car averages 318 feet per minute; each car makes thirty-five round trips per hour, and the total consumption of coal per day is somewhat less than 900 pounds.

To do the same service as this by steam elevators would be practically impossible, but if it were done at all it would cost not less than three times as much coal per day. These comparisons are made by those who have carefully examined the matter.

It is not practicable to use more than two lifting ropes on steam elevators. There is no limit to the number which can be used on the Standard Hydraulic Elevators. In buildings of the highest class six ropes are generally employed on each car, thus furnishing a tremendous margin of safety in the ropes alone. The safety appliances used on the Standard are a late invention of Otis Brothers & Co., and are independent of all other parts of the machinery. They are operated solely by speed in the car, so that whenever the downward motion of the car exceeds the proper rate of speed, the safety fixtures are immedidiately called into action and instantaneously stop the car. Furthermore, if the car, when descending, has its motion arrested by some unlooked-for cause, all other parts of the machinery stop at the same instant, and thus by reason of the stoppage of the car, independent of any action on the part of the conductor, there are no ropes unwinding and no possibility of disarrangement in the machinery.

In large buildings of the highest class, where more than one elevator is used, a compound pumping-engine can be used, and thus effect a great saving in the cost of running. The comparison as to the cost of running made herein, in the cases of the United Bank Building and the Stevens Building will hold good in the cases of any other buildings, and can be verified in any other places in which the compound pump is used. We will cite here the Morse Building, which has two elevators running at high speed, and using 750 pounds of coal per day; the Seamen's Bank, with two elevators, running 616 pounds of coal per day, and the Boreel Building, with four elevators, using 1,450 pounds per day, all in New York City.

The Standard Hydraulic Elevator has proved its superiority in the following particulars: 1. Intrinsic simplicity of construction and action; 2. Inherent safety, independent of the safety appliances; 3. Safety appliances, superior as such to anything heretofore devised or now existing. 4. Facility in replacing or duplicating parts any number of times if at all necessary. 5. Durability and economy in operation; 6. Rapidity in motion of car; 7. Completeness of control by the operator; 8. Freedom from liability to accident, or injury to either passengers or to the machine, arising from inattention or faithlessness on the part of the engineer.

The following propositions are also submitted: 1. In the use of passenger elevators, where the safety of human life is involved the decision should be in favor of the safest, irrespective of price, and in determining the question of relative safety regard must be paid to the result of past experience and also to the degree of inherent safety made evident by careful examination and correct judgment. 2. It is wrong to trust in safety appliances shown to be unreliable, when safety fixtures can be had which have not failed and of which failure cannot reasonably be predicted. 3. The question of cost should be determined by the contract price in combination with the cost of maintenance, and the cost of maintenance must be decided by the results of experience, and (because experience is as yet limited) by the decision of experts as to what the cost of maintenance must necessarily be. 4. The fact that many of the first-class contracts have been and are awarded to Otis Brothers & Co., must be taken to show the concurrent conviction of architects, consulting-engineers and building owners, in the face of difference in price operating against awards, and a judgment or course of action in opposition to this concurrent conviction may be fairly called in question. 5. Better materials, workmanship and results may be expected from a contractor who is a life-long engineer, having a large factory furnished with special tools, than from one having no such facilities, and obliged to have his work done by sub-contractors.

Messrs. Peabody & Stearns, architects, of Boston, who erected the United Bank Building at Wall Street and Broadway, New York, were strongly predisposed in favor of a steam elevator. The Standard Hydraulic Elevators were chosen, however, and were erected in that building. After they had been in use some months, those gentlemen wrote as follows:—

NEW YORK, October 6, 1881.

MESSRS. OTIS BROTHERS:—

Dear Sirs,—We wish to say that your two hydraulic elevators put into the United Bank Building are working with the greatest satisfaction, and that we think that for an office-building, where speed and economy of running is of the greatest moment, they are unequalled by any elevators we have ever used. Yours very truly,

PEABODY & STEARNS, ARCHITECTS,
60 DEVONSHIRE ST., BOSTON,
2 WALL ST., NEW YORK.

J. E. Pulsford, Manager of the Liverpool & London & Globe Insurance Co., under date of August 18, 1881, writes:—

OTIS BROTHERS & CO.:—

Gentlemen,—We have pleasure in stating that the elevators erected by you in this building have proven in every way satisfactory to us. The freight and passenger elevator has been severely tested by many safes of great weight, some stated to have exceeded 5,000 pounds, without any difficulty or injury. On the question of speed these elevators are unequalled by any other make.

Mr. L. B. Gay, proprietor of the Hotel Huntington, Boston, writes as follows:—

MESSRS. OTIS BROTHERS & CO., NEW YORK:—

Gentlemen,—In answer to your request for information as to the working of the elevator erected for me, I have to say that one of your elevators has been in use in my building, Hotel Huntington, for about four years, and my experience has been such as to give me the most unqualified satisfaction. The elevator has done its duty perfectly, every day, and all day; it has never been off duty at all. The only cost for maintenance has been an occasional packing; the packings have been furnished by you, and have been put in by my own janitor, and the total cost of all these repairs has not in any case been more than ten dollars per annum. I cannot conceive how an elevator could more perfectly fulfil its purpose, or be made to give any better satisfaction than this has done.

Very truly yours,

LEVI B. GAY.

Otis Brothers & Co. are represented in the New England States by Q. N. Evans & Co., of 30 Oliver Street, Boston, Mass., and through these gentlemen a considerable number of hydraulic elevators have been erected in Boston and other cities in New England.

Among the elevators placed in New England by these gentlemen the following are of the most prominence: Bangor, Me.; Rice & Skinner. Boston, Mass.; Boston Post-Office and Sub-Treasury, City Exchange Building, Harvard Medical School, H. A. Gould, 17 and 19 Pearl Street, H. A. Gould, 99 Milk Street, Homan's Estate, Hotel Cluny, Hotel Glendon, Hotel Huntington, Hotel Pierrepont, Mason Building, Mrs. E. C. Keller, Jamaica Plain; Quincy Market Cold Storage Warehouse, 40 State Street, 114 State Street. Meriden, Ct.; Bradley & Hubbard Manufacturing Co., hotel for Mr. Hubbard. Gardner, Mass.; Heywood Bros. & Co. Pawtucket, R. I.; Music Hall Block. Portland, Me.; Cousens & Tomlinsen, Portland Packing Co., Storer Bros. Providence, R. I.; A. C. Barstow, Hopkins & Sears. New Hampshire; Maplewood Hotel, Bethlehem. Rutland, Vt.; Rutland Bank Building.

OTIS BROS. & CO.,
92 AND 94 LIBERTY ST., NEW YORK.

BOILER COVERINGS.

AT the late National Exhibition of Railway Appliances, Messrs. Shields & Brown, of 78 and 80 Lake Street, Chicago, made a very handsome display of steam-pipe and boiler coverings, which attracted much attention.

They also covered over a thousand feet of pipe in the exhibition building, thus illustrating the merit and value of their coverings to all interested visitors.

The firm was awarded by the exhibition the silver medal which was offered for the best boiler and pipe covering. There were five other exhibitors present in the same line, and the fact that Shields & Brown carried off the honors demonstrates conclusively that their goods are what they claim, viz.: the best non-conducting, the most durable, the easiest applied, and the neatest coverings in the market.

Their patrons are the best-known corporations and business houses in the country, such as Pullman's Palace Car Co., the C. B. Q. Railway, the Edison Electric-Light Co., and many others.

SHIELDS & BROWN,
78 AND 80 LAKE ST., CHICAGO.

ANTIQUE GLASS.

ENGLAND for many years justly claimed the credit of manufacturing the best quality of stained glass, but Germany has of late decidedly come to the front. In Munich there are large houses for the sale of stained glass, and with the usual persistence and thoroughness of the German worker the true appearance of the antique has been admirably reproduced. The factory at Schliersee, near Munich, Bavaria, is particularly noticeable in its productions, making plates that are so varied in their tints and shades as to obviate to a considerable extent the necessity for using paints in the carrying out of any design; every color and shade required appears to be at hand. This factory excels also in the quality of roundels or bull's eyes, which are gaining largely in favor, and are so freely introduced into glass windows and so-called mosaic-work. These roundels are very bright, show excellent colors, and as they are comparatively low-priced, are particularly adapted to produce pleasing and artistic effects in windows, where a more costly glass painting, or finer mosaic-work would, for various reasons, be less desirable or out of place. For church windows these bull's eyes are well adapted, causing a mellow and subdued light.

The sole agency for this country of the products of the glass factory at Schliersee, as mentioned above, has been placed in the hands of the well-known firm of J. Marsching & Co., 27 Park Place, New York, where samples of a full line of both the antique glass and the roundels are on exhibition. They also carry a full stock of all colors and materials for painting and decorating glass, and for interior decoration in general.

J. MARSCHING & CO.,
27 PARK PLACE, NEW YORK.

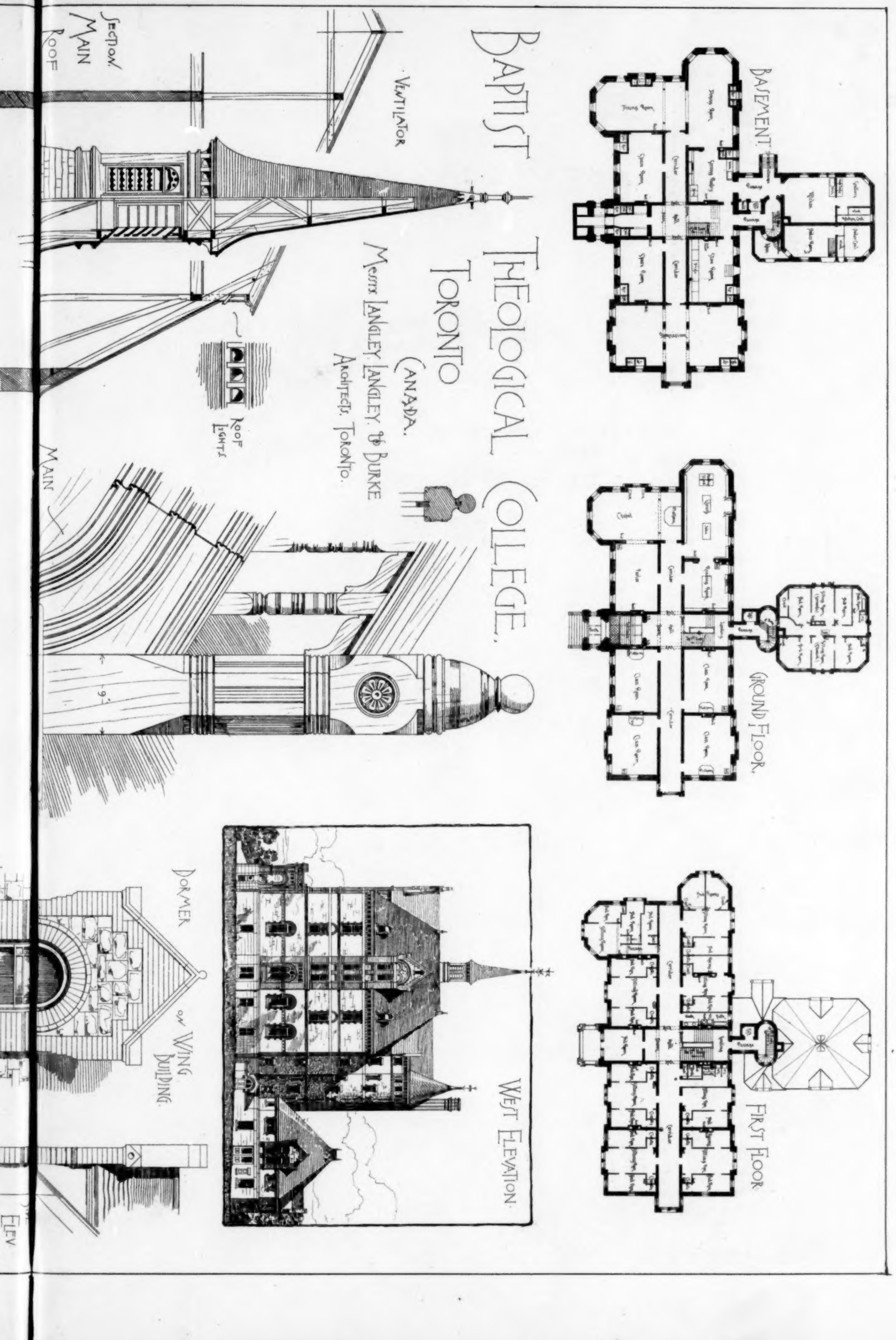
NOTES.

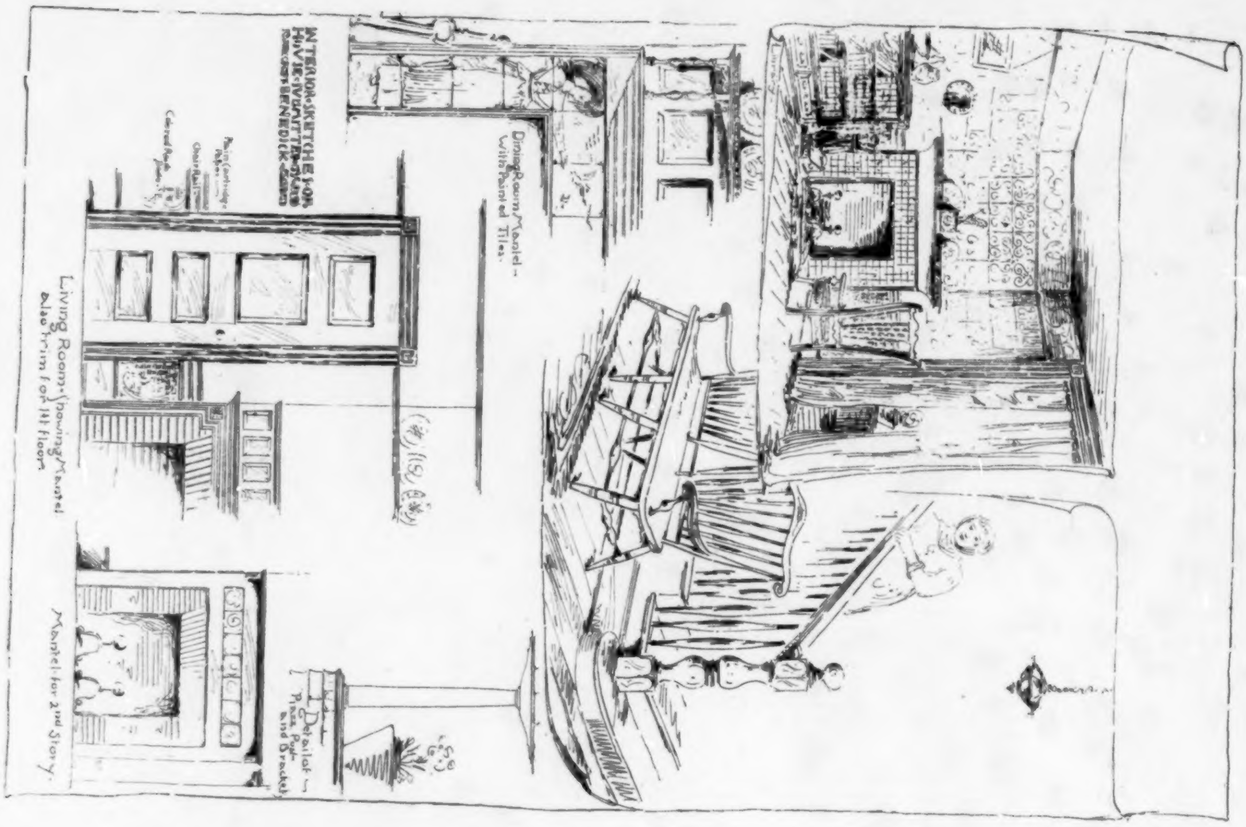
THE new Armory building at Brooklyn will be plastered with American Soapstone Finish, which has been specified by the architect. The Armory contains one large hall, 130′ x 160′, and twenty rooms, each 19′ x 42′.

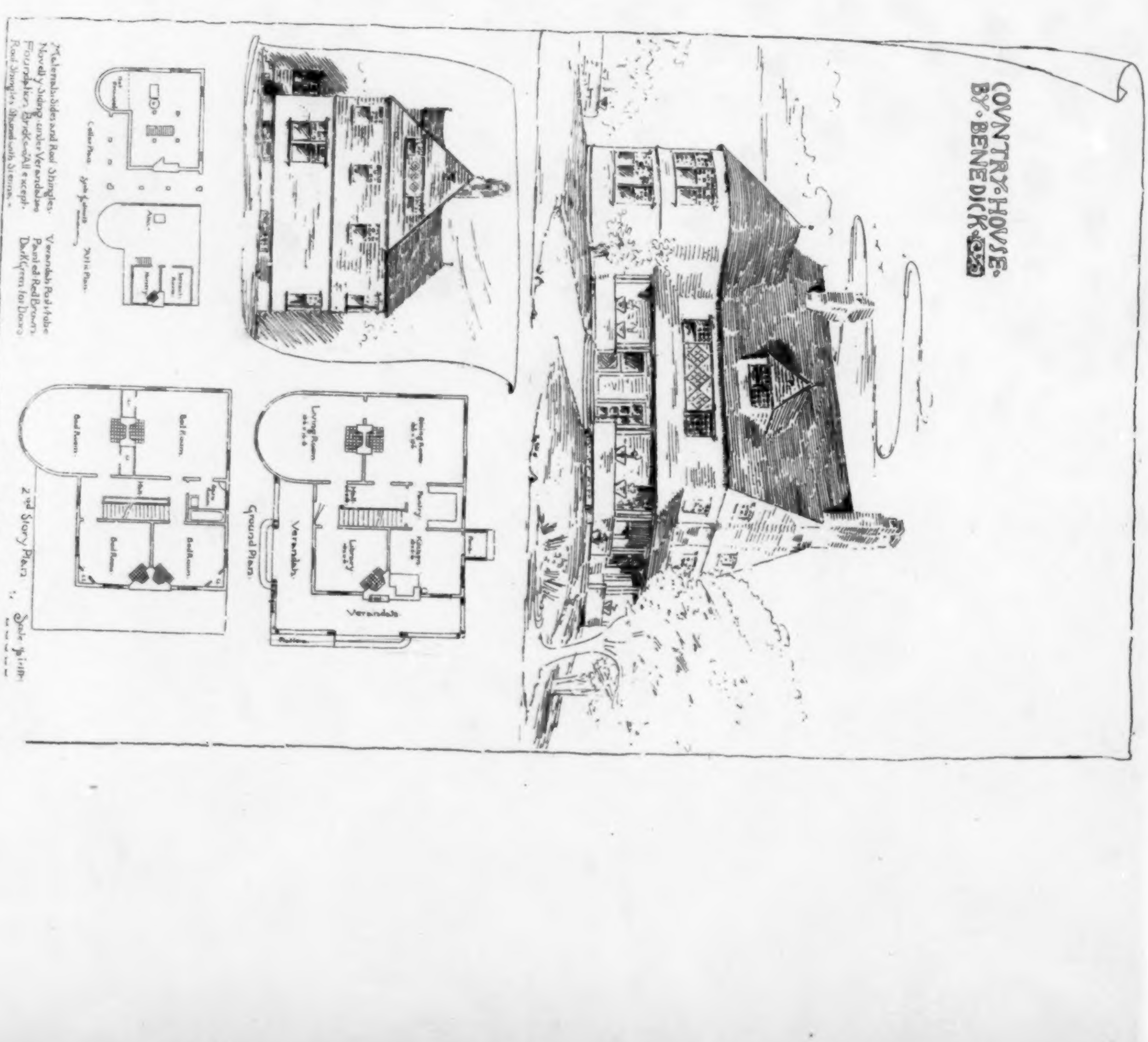
BY the casualties occurring in the towns and cities of the United States in a single day, thousands of persons have cause to regret that they did not insure in the United States Mutual Accident Association, 320 and 322 Broadway, New York.

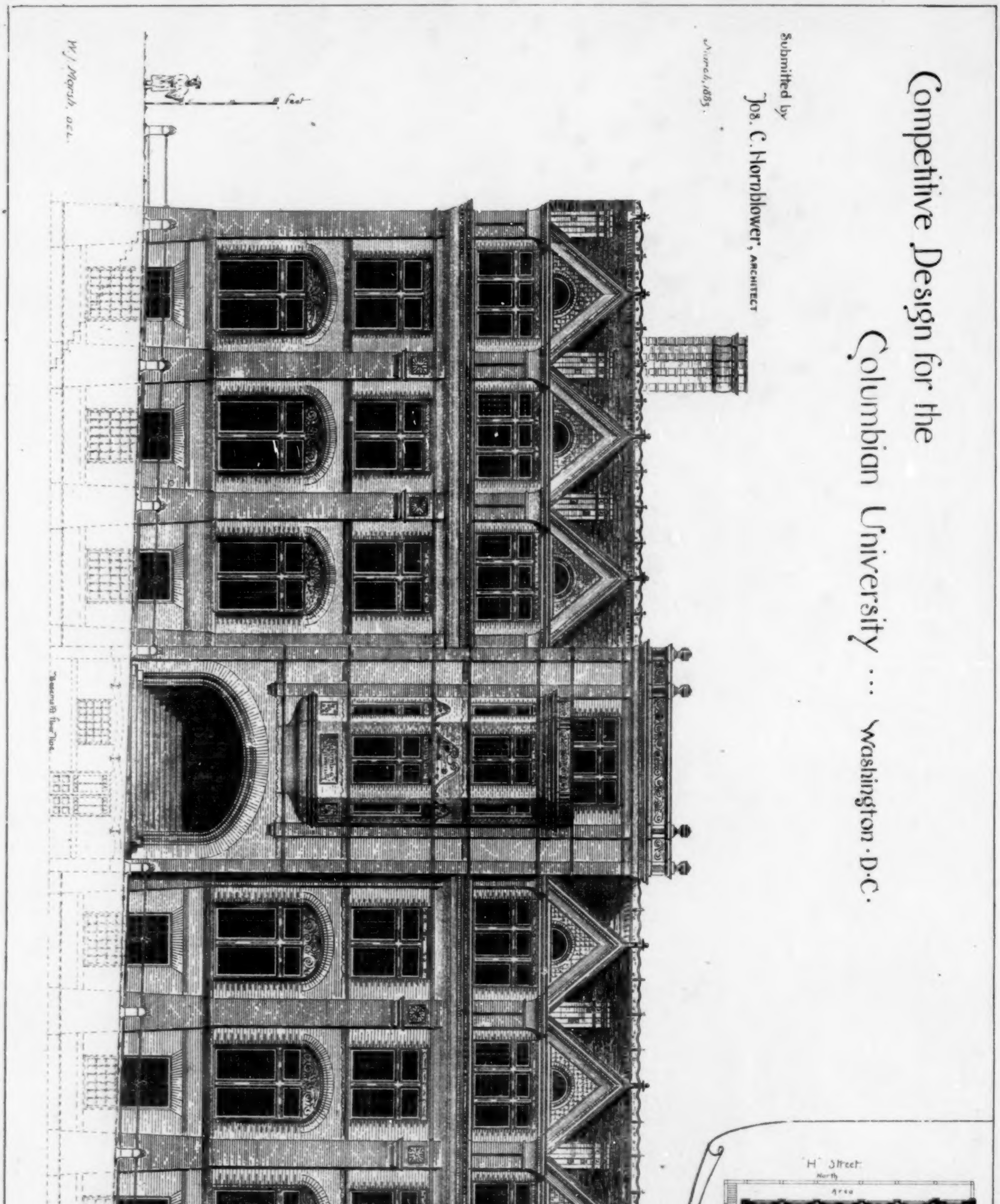
WE were sorry to note some weeks ago the report of the burning of the works of the Chicago Anderson Pressed-Brick Company, of Chicago, occasioning a loss of $125,000, and are pleased that it has been decided to rebuild the

Heliotype Printing Co. 211 Tremont St. Boston

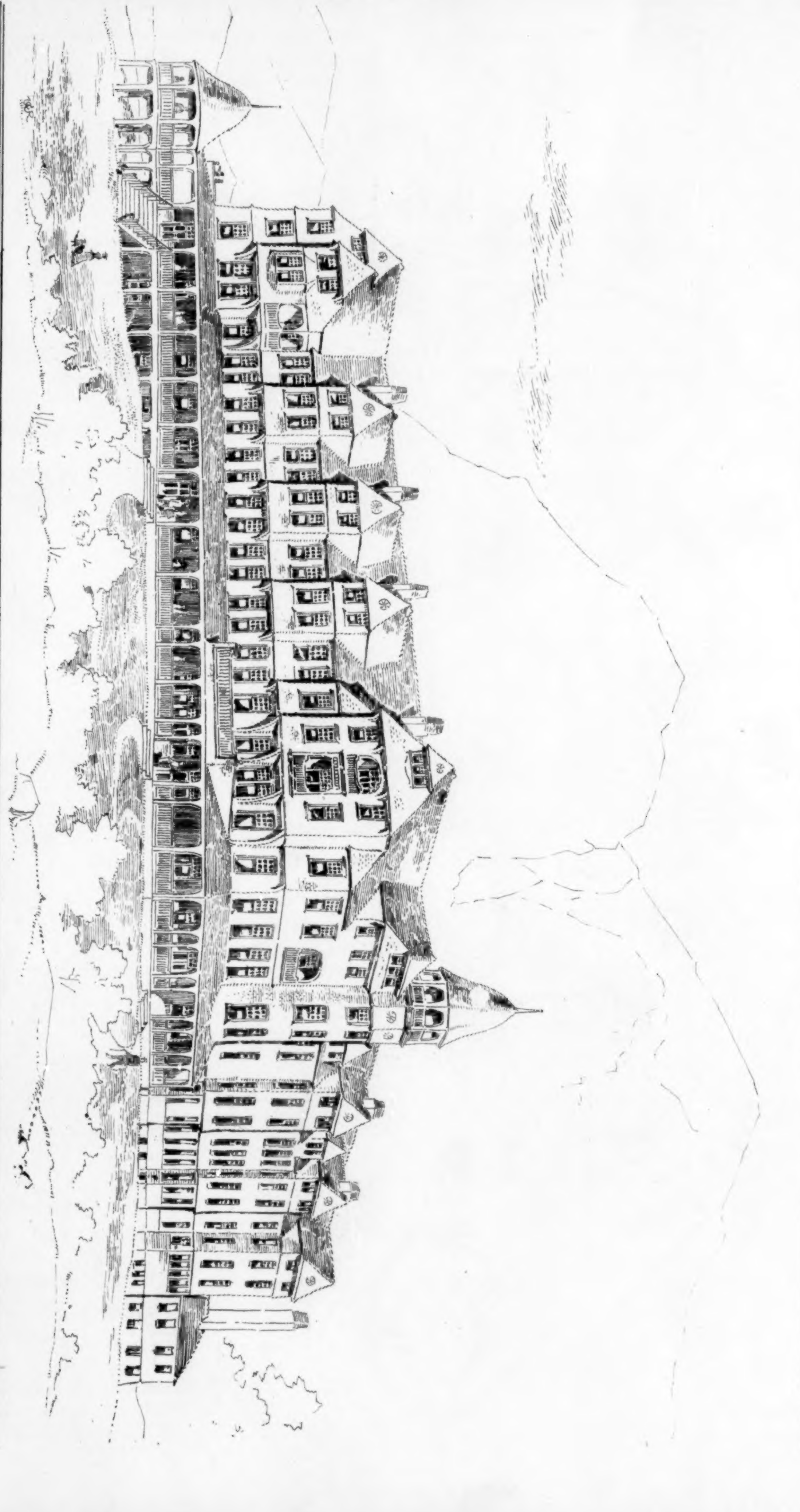

Baptist Theological College, Toronto
Canada.
Messrs Langley, Langley & Burke
Architects, Toronto.
Basement
Ground Floor
First Floor
West Elevation
Ventilator
Section Main Roof
Roof Lights
Main
Dormer on Wing Building
Elev


Dining Room Mantel with Painted Tiles.
Living Room, showing Mantel also Trim for 1st floor
Mantel for 2nd Story.
Detail of Piazza Post and Brackets


COUNTRY HOUSE BY BENEDICK
Ground Plan.
2nd Story Plan
Verandah

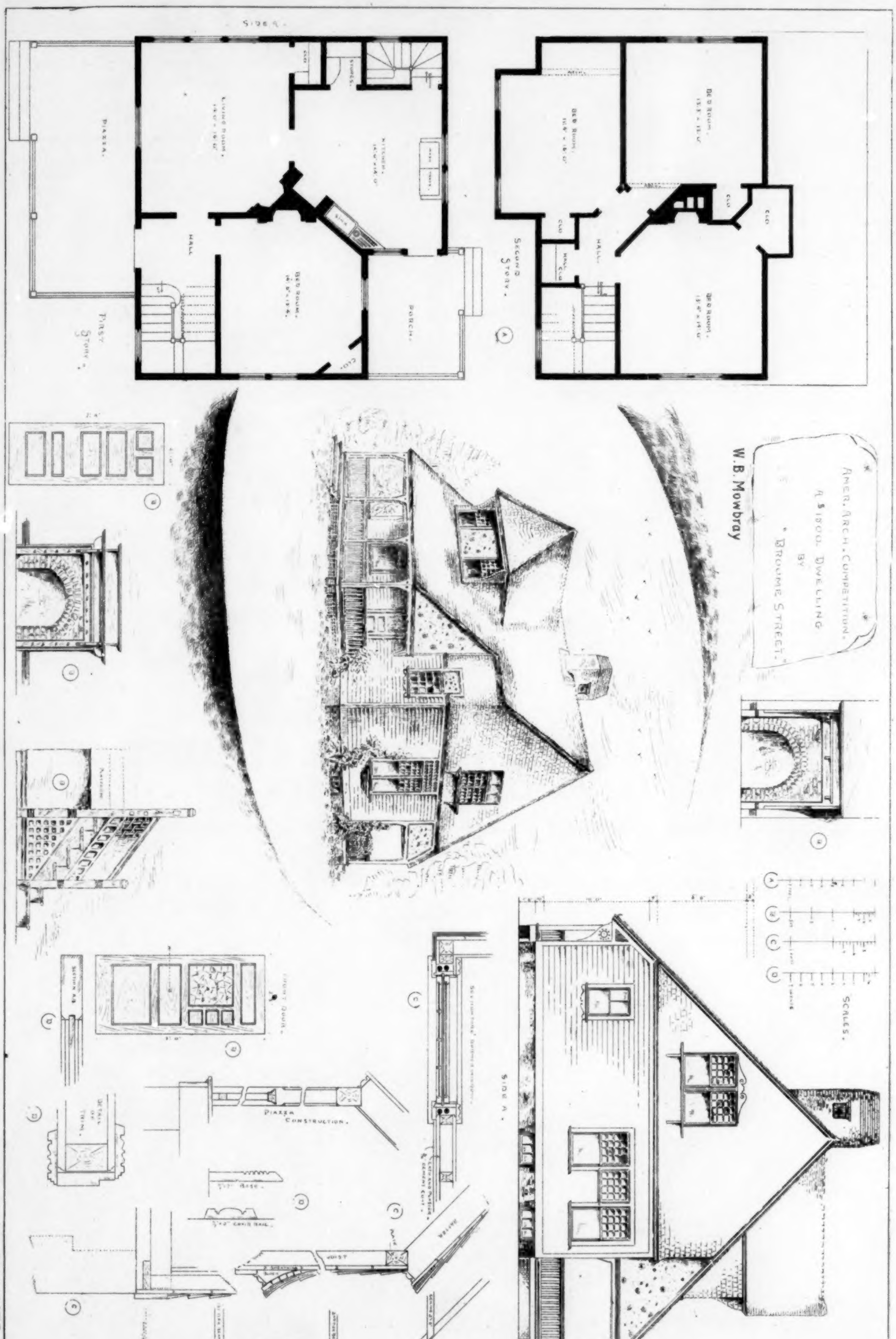


Heliotype Printing Co. Boston



Design for Hotel at Mt Kineo Maine

Hartwell and Richardson Architects Boston Mass



Amer. Arch. Competition.
A $1500. Dwelling
by
"Broome Street."
W. B. Mowbray
First Story.
Second Story.
Piazza.
Living Room.
Kitchen.
Hall.
Bed Room.
Porch.
Side A.
Scales.
Front Door.
Piazza Construction.
Construction.

works at once and continue operations. Such conduct speaks well for the credit and the enterprise of the Company.

THE various patents controlled by Messrs. Clem & Morse, the Philadelphia elevator builders, have so increased the popularity and demand for their elevators that they have been compelled to increase their facilities by taking the four-story brick building, No. 411 Cherry Street, which has been altered to communicate with No. 413, the building heretofore occupied by them.

THE Builders' and Manufacturers' Mutual Benefit Association of America, office 194 Broadway, New York, organized by Mr. A. J. Bicknell, the former architectural publisher and now secretary of this company, is, we understand, constantly increasing its membership among architects, builders and others of New York and elsewhere. It is not restricted to architects, builders and manufacturers alone, but is intended as a general association for all classes wishing insurance on the purely mutual plan, and at a nominal rate.

BUILDING INTELLIGENCE.

General Notes.

CHARLESTON, S. C.—Charleston is seriously talking of a $500,000 hotel; the stock for a $100,000 hotel at Augusta, Ga., has nearly all been taken, and Wilmington, N. C., is now moving to secure the erection of another hotel to cost $150,000.

CLEARFIELD, PA.—A. B. Weaver, brick and frame house, 36′ x 45′, cost, $4,500. Palliser, Palliser & Co., Bridgeport, Conn., architects.

CLEVELAND, O.—Contracts have been let for the new Merchants' National Bank Building, cor. of Superior and Bank Sts.; Gordon W. Lloyd, architect, Detroit, Mich.; cost will be about $150,000, and is to be completed by May, 1884.

COLUMBUS, O.—C. A. Wallingford, of Indianapolis, has houses for W. E. Guerin; cost, $10,000; and W. S. Garber; cost, $8,000.

CONCORD, MASS.—The Page Belting Company is to enlarge its works.

A chapel is to be built for St. Paul's School.

EAST GREENWICH, R. I.—Ground has just been broken for the foundation of the new Baptist Church, opposite the Free Library Building; Charles F. Wilcox, architect, Providence.

EL PASO, TEX.—A custom-house, to cost $125,000, is to be built here and the contracts have been let.

ERIE, PA.—Dwelling for F. F. Marshall, Esq., to be brick with Forest City stone trimmings; Addison Hutton, architect, Philadelphia.

EVANSTON, ILL.—J. C. Cochran, architect, of Chicago, has planned for Mr. Jas. Pajeau, at Evanston, a two-st'y frame house, Queen Anne style, to cost $5,000.

FALL RIVER, MASS.—J. L. Boomer, Linden St., two houses; Jacob Meier, Durfee Ave., house; John Blake, building, 25′ x 40′; Michael Daly, cor. Etna and Vale Sts., house and store; Robert McFarline, Cottage St., house.

Peter Carroll, house on Linden St.; John Preston, house on North Main St.; Michael McMahon, house on Durfee Ave.; and Robert Stevenson, house on Robeson St.

HARTFORD, CONN.—The Pratt & Cady Company are building a new factory, 40′ x 140′, and two-st'y, with a brass foundry, 30′ x 60′.

HOLYOKE, MASS.—Work has just been resumed on the Second Congregational Church. It is being built of Longmeadow brownstone, will have twelve hundred sittings, and cost from $60,000 to $65,000; H. F. Kilburn, architect, New York.

The Germania woollen mill is to have an addition to the main building, 50′ by 52′, and two-st'y.

MACON, GA.—Bricks are so scarce that in two instances building has been temporarily suspended.

NEW HAVEN, CONN.—A house, of brick and terra-cotta, is to be built in the French Renaissance style, at a cost of about $25,000, from designs of Messrs. J. C. Cady & Co., of New York.

ROCHESTER, N. Y.—On Gorham St., 4 brick apartment-houses, to cost $10,000; J. Hahn, owner; Oscar Knebel, architect.

Addition to new Osborn House, on South St. Paul St., to cost $20,000; N. Osborn, owner and builder.

Frame house on Sheridan Park, to cost $5,000; B. Hugel, owner; Joseph Stephany, builder.

SOUTHINGTON, CONN.—The foundations for the new Britannia Works are nearly laid. The main building will be 43′ x 210′, the ell, 43′ x 85′; two-st'y high.

SPENCER, MASS.—The contract for the Fire Department's new building has been awarded to C. M. Tripp for $7,940.

SPRINGFIELD, MASS.—W. H. Parsons is breaking ground for a block on the lot next north of the Hooker School.

ST. AUGUSTINE, FLA.—Alteration of building to hotel; Wilson Bros. & Co., architects.

STOCKBRIDGE, MASS.—Mrs. Charles Butler, of Great Barrington, Mass., has given $60,000 for the erection of an Episcopal church-building in this town.

SYRACUSE, N. Y.—Work has recommenced on St. Mary's Church; Mr. L. J. O'Connor, of New York, architect.

THOMPSONVILLE, CONN.—Rev. J. Oldham, the Methodist pastor, says that the society will have a new church within a year.

UTICA, N. Y.—H. J. Holbrook & Co. are building a new factory.

WASHINGTON, D. C.—A brick and terra-cotta house, to cost about $20,000, is to be built for Mr. Charles Nordhoff; from designs of Messrs. J. C. Cady & Co., of New York.

WELLSVILLE, PA.—H. W. Neal, cottage, cost, $2,000; Palliser, Palliser & Co., Bridgeport, Conn.

WESTFIELD, MASS.—C. H. Gowdy will begin work on his new three-st'y brick block at once. The cost, including land, will be nearly $40,000.

WEST NEWTON, MASS.—Messrs. Allen & Kenway, of Boston, are the architects of a frame residence for Mr. Albert Metcalf, 59′ x 60′; Mr. Milo Lucas, of Newton, builder.

WILSON, N. Y.—Exley M. E. Church-building, including Sunday-School room, to be of brick, 46′ x 79′; from plans by Messrs. Hazelhurst & Huckel, architects, Philadelphia.

WILTON, N. H.—Mr. Charles Haseltine will at once build a mill.

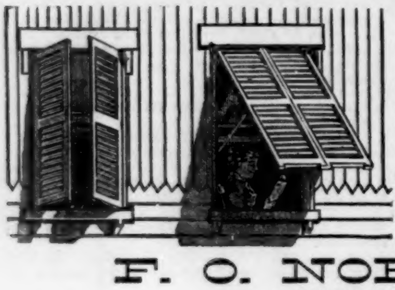
First M. E. Church, 68′ x 108′ 3″, brick, to cost $50,000; August Bemkie, architect, St. Louis, Mo.; J. C. Pellett, supervising architect of construction; McGowan Bros., contractors.

Dwelling-house for Mrs. Dr. Moyer.

Dwelling for Mr. Wick.

YOUNGSTOWN, O.—Market-house, cor. Boardman and Phelps St.

The "Automatic" Blind Awning Fixture.



Attachable to Old as well as New Blinds, on Frame or Brick Houses.

The very best blind hinge and a perfect awning fixture. No cloth to tear and wear out. No iron frames to shake and rattle. Blinds instantly converted to awnings. Awnings instantly converted to blinds. No skilled labor necessary to apply them. A child can operate them. Indispensable for summer hotels and dwellings. Rooms always cool and shady. Many thousands in successful operation. Models furnished to architects.

F. O. NORTH & CO.,

SOLE MANUFACTURERS,

276 Devonshire Street, - - - - - Boston, Mass

For Sale by all the Hardware Trade.

THIRD ANNUAL EXHIBITION

— OF —

The New England Manufacturers and Mechanics' Institute.

Will be held in Boston, Mass., from Sept. 5, to Nov. 3,

1883.

Ten Acres of Floor Space.

Half Mile of Shafting.

NO ENTRY FEE. NO CHARGE FOR SPACE.

A GRAND NATIONAL INDUSTRIAL EXPOSITION.

Showing the Rich and Varied Resources of the South, the Products of the West, and the Inventive Genius and Mechanical Ingenuity of the North.

The Exhibitions of the Institute offer unparalleled opportunities for showing the progress in mechanical arts or for introducing new inventions.

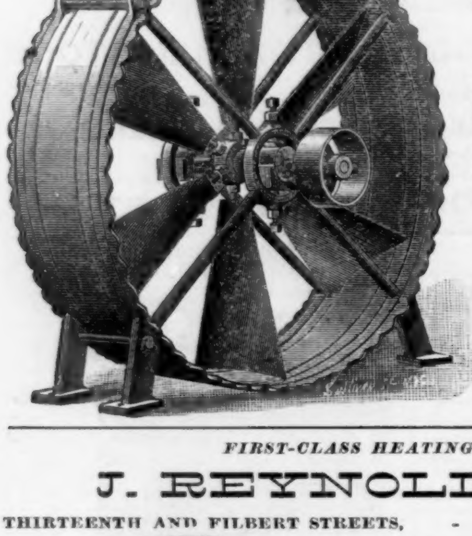
Artists, Inventors, Mechanics and Manufacturers of America cordially invited to contribute. For application blanks or particulars address

JOHN F. WOOD, Treas., 38 Hawley St., Boston, Mass.

WING'S DISC FAN

OR

EXHAUSTER.



A new light running power Fan, for ventilating churches, hotels, mines, boiler rooms, factories, etc, Also for drying paper, hides, glue, etc. For carrying off dust from rag-rooms and rag-machines. For removing steam from dye-houses, drying-cylinders, planking-rooms, etc. Requires only one-fourth the power of other fans. Blades have an expanding pitch, by which the best results are obtained.

MANUFACTURED BY

THE SIMONDS

Manufacturing Co.,

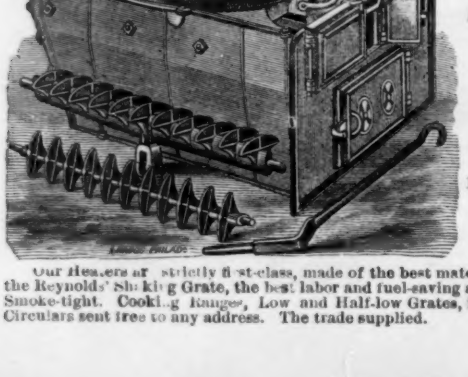
NO. 50 CLIFF STREET,

NEW YORK.

FIRST-CLASS HEATING APPARATUS.

J. REYNOLDS & SON,

THIRTEENTH AND FILBERT STREETS, - - - PHILADELPHIA, PA.



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WROUGHT-IRON

Air-tight Furnaces,

KEYSTONE

WROUGHT-IRON FURNACES,

Brick-set and Portable.

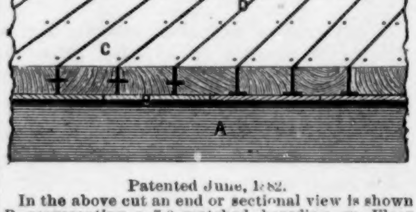
For Anthracite and Bituminous Coal or Wood.

Our Heaters are strictly first-class, made of the best material and workmanship, and are supplied with the Reynolds' Shaking Grate, the best labor and fuel-saving appliances. They are absolutely Gas, Dust, and Smoke-tight. Cooking Ranges, Low and Half-low Grates, in great variety of styles and sizes. Descriptive Circulars sent free to any address. The trade supplied.

DOLBEARE'S

Water-Tight Wood Floors.

Architects and Builders will find in Dolbeare's Water-Tight Wood Floors an improvement long sought for, combining lightness, durability, and absolute water-tight qualities. For horse-car, livery, and private stables, it is rapidly taking the place of caulking or concreting. For slaughter-houses, currier's shops, factory floors, bridges, etc., it is highly recommended. In first-class stores, hotels, and public buildings, by the use of this floor it is absolutely impossible for goods or ceilings to be damaged by water leaking through the floor in case of fire, bursting of water-pipes, etc.



Patented June, 1882.

In the above cut an end or sectional view is shown B representing a 7-8 matched boarding on Floor Timber, A, C showing a 3-inch planking with 3-8 Rabbetting or Groving (this can be laid in thickness from 1 inch, upwards), and D showing the Filling in the seams, applied hot, which, when set, is thoroughly adhesive to the wood and sufficiently elastic to allow for any ordinary shrinking, swelling or settling.

Orders respectfully solicited, and personally attended to, by addressing

W. L. DOLBEARE,

Atlantic Avenue, Fort Hill Wharf, Boston.

MIDDLESEX HORSE RAILROAD COMPANY.

BOSTON, June 14, 1882.

W. L. DOLBEARE, Esq.

Dear Sir:—It affords us pleasure to recommend your process for "Making Floors Absolutely Water-Tight." In our new Bunker-Hill Stable, where we have stalls on three floors (one directly over the other), it has given the most perfect satisfaction, and makes no extra strain upon the walls of the building, as would be the case if the old method of "Caulking" was resorted to. In very many respects I regard your floor as very much superior to any caulked floor. Very truly, CHARLES E. POWERS, Pres

SAMUEL D. KELLEY, ARCHITECT.

BOSTON, June 21, 1882.

W. L. DOLBEARE, Esq.

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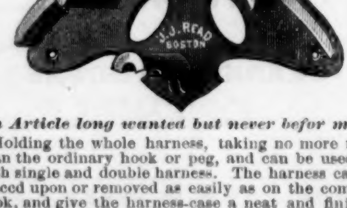

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CONTENTS.

MEMBERS of the American Institute of Architects will remember that at the last Convention, held in Cincinnati, it was voted to enliven the meeting for the present year by a competition between the members, the subject of the competition to be assigned by a committee, and the drawings to be either brought in or sent, in time to be exhibited at the meeting. The committee on the programme prepared a sensible and ingenious one, proposing that the competitive designs should be for a building situated on a corner lot, fifty by one hundred feet, in New York, intended for the use and benefit of the Institute, which would occupy a certain portion, perhaps a single floor, while the remainder would be fitted up for renting to tenants. Such a programme offers a very attractive field for ingenuity in planning, and without taxing too much the time of competitors it is capable of suggesting a beautiful and refined elevation. The committee observes that the apartments for the use of the Institute ought to comprise a lecture-hall, which would serve for meetings and exhibitions, besides a parlor, library, and reading-room; but the arrangement of the rest of the building is left to the judgment of each competitor. We may, perhaps, be allowed to add to these instructions the suggestion that the competition, undertaken merely as a pleasant exercise for the members of the Institute, may, with this programme, have a future practical application. It is well known that the Institute of Architects is already in possession of the nucleus of a building fund, and under the present laws of New York, relating to joint ownership in apartment-houses, and other buildings, a score or so of the members practising in the city might make a much worse investment of a small capital than to co-operate with the Institute in the erection of a structure which would accommodate them with office-rooms, planned expressly for their business, and at a rent which would probably be much less than that which they now pay; or, if they should at any time prefer other quarters, would constitute a very saleable property, as well as one which would constantly increase in value.

IT would be interesting, perhaps, to know why trials in the District of Columbia should be distinguished above all others by their tedious length, and the bad manners of the counsel employed to conduct them, but such an inquiry is beyond our province, and we are obliged, in our study of the investigation now going on at Washington in respect to the administration of the work upon public buildings, to sift out what we can of real interest from a mass of testimony which appears to the professional mind to be completely irrelevant. One of the most curious features of the case which we have so far been able to discover is to be observed in relation to certain contracts for tiling, which were awarded to a firm in Baltimore, and were followed by very large bills for extra work performed by the same firm. At the first view, the circumstance that a contract for tiling had been followed by an extra bill amounting to something like fifty thousand dollars would seem to cast a reflection on the prudence of the person who made the original contract; but after all the testimony in relation to the matter had been taken it appeared that this contract was awarded during the administration of the first Government Architect, who now desires to compass the disgrace of his successor, and that all, or nearly all, the orders for the extras which seem so large, were signed either by that individual or by his assistant, who is now the principal witness for the prosecution; and that the only connection of the present incumbent with the whole affair consisted in a successful effort to obtain a reduction of about ten per cent upon the extra bills which his predecessors had incurred.

THE credit of one of the most effectual measures ever adopted for restricting the practice of combustible building is due to the Chicago Board of Underwriters. This body has recently, in view of the present tendency to erect buildings of great height, the upper stories of which are beyond the reach of any fire-extinguishing apparatus operated from the outside, passed a regulation prescribing special rates of premium for property contained in buildings more than five stories in height, the rate increasing with the excess of height above that standard. As now fixed, the premium on goods contained in ordinary five-story buildings is eighty cents for every hundred dollars, that for six-story buildings not more than eighty-five feet high being one dollar. Ten feet of additional height adds twenty-five cents to the premium-rate, twenty feet adds sixty cents, and thirty feet more than doubles it, the rate for buildings between one hundred and fifteen and one hundred and twenty-five feet in height being two dollars and five cents per hundred. From one hundred and twenty-five to one hundred and thirty-five feet the rate is two dollars and sixty cents, and ten feet more makes it three dollars and a quarter; while buildings between one hundred and forty-five and one hundred and fifty-five feet in height are subjected to a rate of four dollars, which is nearly five times as great as the premium on property in ordinary structures. Considering the enormous increase in the risk from fire which excessive height involves, the new scale of rates, although it will be rather startling to the owners of lofty buildings, cannot be called unreasonable, and its general adoption would tend very greatly, by rendering such buildings unpopular among tenants, and unprofitable to their owners, to put an end to their construction unless built, as they ought to be, fire-proof; while the whole community would in the end gain much more than the underwriters by the suppression of a practice which is every day becoming more dangerous to all our cities.

THAT singular body of censors known as the Philadelphia Committee of One Hundred, has, according to the daily papers, been directing some of its steps toward dangerous ground. With that zeal in calling attention to the faults of others which marks good citizens everywhere, some virtuous individual addressed to the Committee a communication, charging that frauds were being perpetrated in the erection of the public school-houses, and the agent of the Committee was deputed to ascertain the truth. What might have been the agent's qualifications for judging of the facts which he was sent to investigate, we are not informed; but it seems that he was at least prudent enough to take with him a copy of the specifications to compare with the executed work. The specifications were, according to the account, not without peculiarities of their own, for they are reported to have provided that the mortar in the walls below ground should be made with cement and "gravel," instead of the usual sand; but the actual construction of the building was still more exceptionable, "loam from the cellar," according to the agent's report, having been used instead of the materials required. We will not pause to inquire whether it is usual in Philadelphia to dig loam out of the bottom of cellars, as it seems that the contractor, being confronted with his work, "very reluctantly admitted that he had in every sense violated the terms of his agreement with the Board." The agent, apparently charmed with this concession, pronounced the work in general to be "of the most inferior character," although we find no details of its inferiority given, except that the bond-stones in the piers were two inches thick, instead of five inches, as the specifications required. Probably we should read two and one-half, instead of two inches, as the real thickness, and it is not impossible that by the substitution of a better stone, the bond-plates one brick thick may have been as good or better than those specified, but the Committee on Property, which seems to have charge of such affairs, examined the building, and ordered the whole work to be taken down to the footings, and rebuilt. It is quite likely that in the present case the Committee is right in this summary proceeding; but we may be excused for hinting that we have known crafty contractors to invite, or at least not to oppose, the hasty action of over-zealous proprietors, misled by silly reports, and afterwards to recover a good, round price, with costs, if not damages besides, for being compelled to pull down and rebuild work, which the more sober judgment of an expert proved to have been executed in a manner within the intention of the contract.

THE Cleveland Building Law, about which we had something to say a few weeks ago, has been under discussion among the mechanics of that city, and some valuable suggestions have been made. For the first time, we believe, it has been pointed out in the discussion of a building statute, that the necessary thickness of walls of masonry does not depend upon the number of floors which rest upon them, but on the height, and, we might add, on their length; the thickness beyond a comparatively small limit, being an affair of stability, not of resistance to crushing, and an increase in the number of floors within a given height adding to, rather than diminishing from, the stability of the bearing walls. The omission in the original law to give permission for the construction of iron fronts for mercantile buildings seems to have immediately attracted the attention of the members of the Builders' Exchange, and an amended section is proposed, providing for the use of iron, subject to the approval of a Board of Examiners. Concerning the thickness of walls of chimney flues, which is always a point of difficulty in construction, the committee of the Exchange proposes that a variation should be made from the text of the law as adopted, authorizing the building of flues with four-inch walls, lined with pipes of terra-cotta or fire-clay. This modification in the ordinance would relieve conscientious builders of many annoyances in framing, and, particularly if the terra-cotta pipe is so shaped as to leave a small air-space between it and the brickwork, a perfectly safe construction can be so obtained. As we have before remarked, the perfect building law has yet to be drawn up, and all criticisms of existing ones from men of experience are valuable.

A SCULPTOR of local note has just died in Philadelphia, whose history is a somewhat romantic one. Born in Paris in 1825, he had just arrived at the most ardent and inflammable age, when the revolution of 1848 broke out, and was among the first to take part in the movement which drove the last king from France. His active interest in the revolt made, however, his native country an uncomfortable place of residence for him, and he came to Philadelphia, where, under the name of Joseph A. Bailly, he soon found employment and reputation as a cameo-cutter, and afterwards as a modeller and sculptor. Among the public works which he executed are the statue of Washington, in Philadelphia, that of Franklin, on the corner of the *Public Ledger* building, and of Dr. Witherspoon in Fairmount Park; besides some monuments in Laurel Hill Cemetery, and other places.

WE are indebted to the kindness of a correspondent for some interesting information in regard to the competition for the new State Capitol to be built at Denver, Colorado. Some of our readers will remember that in March of this year advertisements were published calling upon architects for competitive designs for a building to cost not more than a million dollars. Nothing was said about the scale of the drawings to be presented, nor about any premium for the best design; but it was stipulated that the person whose plans should be accepted should furnish plans and specifications of the entire building, with working drawings for the single wing, which it is proposed to erect immediately, receiving as compensation for his trouble the sum of one thousand dollars, besides one and one-half per cent on the contract price of this wing. It was supposed that the wing could be built for about two hundred thousand dollars, so that the dazzling prize held forth to the struggling competitors was the remote possibility of obtaining for their skill and pains the chance of being employed for two years or more in a most engrossing and anxious work for less than one-tenth the compensation which is paid to respectable architects for similar services in all other parts of the world.

STRANGE as it may seem, this invitation attracted the attention of no less than nine cheap architects, or, at least, of nine persons who had some idea of drawing, and the result of their several efforts was duly submitted to the Commissioners. The inspection of the plans laid before them seems at least to have had the good effect of opening the eyes of the Commissioners in some degree to the magnitude of the cares and responsibilities involved in the construction of a large public building, and to have led them to suspect, what five minutes' consultation with a respectable architect would have shown them in the first place, that the programme which had been drawn up for the guidance of the competitors was, to use their own words, in some respects "impossible," and in others "foolish." It was not so ludicrously silly as one which we once saw, for a much more costly building, in which the area of the second story, as found by adding together the number of square feet allotted to the various rooms in it, was about twice as great as that of the story beneath it; but it contained stipulations as to the cost and the time of completion of the preliminary wing which could not under any circumstances be complied with, and provisions in regard to the arrangement and construction which would seriously compromise the usefulness, if not the stability of the whole structure. One would think that the Commissioners, having discovered so late the grave errors in the statute which a little preliminary outlay for expert advice might have prevented, would have called in at once the assistance of some one trained in the understanding of such matters; but being men, apparently, who prefer the costly mode of learning by experience to that of consultation with professional advisers, they proceeded instead to set off by themselves for a tour among the State Capitols of the surrounding country, travelling as far eastward as Indianapolis, and securing, as we learn, "a vast amount of valuable information." The principal result of their experience was a conviction that the statute (drawn up by a judge) under which their Capitol was to be erected, needed radical and immediate revision; and as no authority could revise the law except the one which enacted it, the Board prepared and presented to the Governor a formal request that he would call an extra session of the Legislature to undo what it had done a few months before. The answer to the application had not been received at the time of our correspondent's latest advices, but it was expected to be favorable; the Commissioners arguing, very forcibly, that an extra session would only cost the State about seventy-five hundred dollars, while the saving involved in the changes which they proposed in the plans would amount to more than a hundred thousand. We might add, that to the outside world the fact appears pretty evident, that the seventy-five hundred dollars, with the cost of the peregrinations of the Board, might also have been saved by taking expert advice where others take it, — at the beginning; and moreover, that before the State gets through with building its million-dollar Capitol from the plans of an architect who works for one-tenth the usual price it is likely to find out again, and on a larger scale, that amateur or cheap professional service is the most costly of all luxuries.

OWING apparently to some changes in the organization of the corporation which owns it, work on the Hudson River Tunnel has been for some time nearly suspended, and the pioneer tunnel on the New York side of the river has hardly yet reached the silt, in which, after all the difficulties encountered on the way, it was expected that it would make rapid progress toward completion. During the delay, however, the engineers of the tunnel have taken care to maintain a sufficient air-pressure in the excavation to prevent earth from entering the headings, and a slight leakage of air which took place under one of the steamship docks, was promptly discovered and stopped, so that everything is in readiness for the prompt resumption of active operations, which may, it is hoped, occur in a few days. The first work to be undertaken in that case will be the commencement of the second tunnel on the New York side, which will, like the first, be carried out to the silt, then all the four headings, two on the New York side and two on the New Jersey side, will be carried forward simultaneously, until they meet in the middle of the river.

BUILDING SUPERINTENDENCE. — XXXI.

CONCLUSION.

IT will be seen that this plan of ventilation is totally different from that which would be adopted in a school-room, or other apartment with a low, flat ceiling. In such a room the best method would generally be to employ indirect radiation entirely, warming the fresh air in the basement, and bringing it up through long vertical pipes opening into the room by registers in the side walls, seven or eight feet above the floor, withdrawing the cold and foul air below, by exhaust registers in or near the floor. By this arrangement the fresh, warm air would pass first to the ceiling, filling the room like an inverted lake, and constantly pressing out the foul strata below, without danger of annoying the occupants of the rooms by draughts.

School-room Ventilation.

In the present case, however, we are precluded from employing any method of this kind by the great height of the ceiling, and the extent of cooling surface presented by the roof. The warm air introduced at any considerable height above the floor would rise immediately to the ridge, cooling there with great rapidity, to be precipitated again in cold draughts upon the heads of the people below, who would remain immersed in a chilly atmosphere even though that above them might be warmed to a temperature of 100° or more. It would be impracticable to fill so great a space, losing heat, moreover, so rapidly as would be inevitable under the circumstances, with anything approaching the inverted atmospheric lake of a low room, and our only resource here is therefore to keep the fresh-air supply near the floor, avoiding unpleasant draughts as much as possible, but directing all the warm currents so that they may reach those who are to breathe them before they can escape from the slight attraction exerted upon them by the floor and the objects near it, and rise into the empty space above, to be lost beyond recovery.

The course of circulation of the air being once determined, many circumstances can be made use of to promote it, and all obstacles should be removed. Radiators ought not to be placed in such a position that the inevitable ascending current from them will interfere with the general movement, and even the aspect of the different portions of the room will need to be considered, the northern and western sides being generally coldest in winter, and chilling the air next to them so as to cause it to descend, while that on the opposite side rises, in a movement of gentle rotation, which can be checked, if it should interfere with the desired system of circulation, by increasing the radiating surface near the cold walls.

Summer Ventilation.

Such ventilation as this is of course dependent upon the difference in temperature between the exterior and interior air, and the movements due to the buoyancy of warm-currents in a cold atmosphere will cease entirely as soon as the temperature outside and inside become the same. For summer ventilation, therefore, we shall need to devise a modified system, which can at pleasure be substituted for the other, but will not interfere with it at other times. Fortunately, summer is also the time of open windows, and the warm-weather ventilation is, in such a case as this, a much simpler affair than that needed for winter. The occupants of the offices in the basement and first story will keep their windows generally as wide open as possible in the hot months, and if we remember to provide fan-lights over the doors, and to place the doors opening on the corridor nearly opposite each other, we can secure for them an almost constant draught across the width of the building, which will keep the rooms as fresh as could be desired. The corridor itself, if much frequented, may need, even in summer, to be exhausted by means of its special flue, which must in that case be kept heated by a large gas-burner, in order to preserve that difference in temperature between the air inside the flue and the outside atmosphere on which the movement of the former entirely depends.

For the great hall in the second story we shall need something more than open windows, not for the sake of a fresh-air supply, since these large openings, placed opposite each other in so long a building, isolated from all others, would give a breeze across the room in the hottest night, but to remove the air which would, unless allowed to escape, collect under the roof, filling the space down to the heads of the windows with a stagnant mass, often very much heated by contact with the underside of the slated roof, upon which the sun shines all day, and always containing most of the organic impurities thrown off by the lungs and skins of the people below, which rise with their warm breath even in the atmosphere of summer. This reservoir of foul and heated vapor, although confined to the space above the sweep of the fresh breeze from the windows, is apt to make its presence disagreeably felt by diffusion through the purer atmosphere far below it, and it is important to provide for tapping it, so to speak, and allowing its contents to flow, in accordance with their natural buoyancy, upward from the highest point of the roof into the outer air. It would be useless to try to draw the foul, warm air downward as far as the openings into the tower ventilating-shaft, since its buoyant force, after a day of summer sunshine, is far too great to be counteracted by any exhaust which could be obtained in the ventilating-shaft without the aid of a fan; and it is very desirable to take full advantage of the acquired tendency of the stratum of air which we wish to remove, to assist its discharge. For this purpose an open turret on the ridge answers perhaps better than anything else. The length of the warm current ascending through it assists its velocity, and helps to draw up that which would tend to linger behind; and its position at the summit of the roof ensures the removal of the last traces of the warm and foul stratum. So long as any persons remain in the hall, or gas-lights continue to burn there, new volumes of deteriorated air will ascend to take the place of that discharged from the ridge, but if not allowed to stagnate, or accumulate heat from the roof, they will not affect the atmosphere below.

Details of Heating Apparatus.

Having now evolved a satisfactory general scheme of heating and ventilation, the details only will need attention, and these will not, for our present purpose, detain us long. After the contract for the heating apparatus has been made, and the contractor has made his appearance, with his materials, upon the ground, we shall need to examine, and if necessary to criticise, the construction of the boiler, the dimensions of the pipes, and the arrangements of them and of the radiators.

Many good heating engineers employ boilers and radiators of their own construction, to which the arrangement of the pipes must be suited; but there are some general principles applicable to all systems. The essential features of a good steam-heating apparatus are: safety from all risk of explosion, sufficient and well-placed radiating surfaces, freedom from noise in operation, and thorough drainage of all parts, so that the pipes and radiators may not be subject to injury from water left standing in them, and freezing. The first of these requisites is satisfied in various ways.

Sectional Boilers.

Many engineers, instead of boilers with a single shell, use for heating the so-called "sectional boilers," consisting of coils or groups of pipes, sometimes of wrought-iron, but generally cast, joined together in sets of five or six or even more, over a single fire-box. The water and steam circulate freely among the sections, but in case of over-heating, or insufficient water-supply, not more than one section is likely to give way at once, and the explosion of a single section, even in the basement of a dwelling-house, is rarely a serious matter. Cast-iron boilers of this kind are rather liable to such accidents, but the escape of water from the broken part extinguishes the fire, and a new section is quickly put in place of the one destroyed, making the boiler as good as ever.

Magazine Boilers.

For convenience in use, it is becoming common to adopt what are known as "magazine boilers," in which the fire-box is fed in the same way as a base-burning stove, by coal descending gradually from a cylindrical or conical magazine above. Unlike a hot-air furnace, which distributes some warmth through the registers until the last spark of fire has gone out, and the ashes have grown cold, a steam-heating apparatus, as soon as the water in it ceases to boil, and the steam-pressure falls, loses all its power of transmitting warmth to a distance, and the rooms dependent upon it rapidly cool. With ordinary house boilers, while it is easy enough to bank up the fire and keep it over night, ready to shake out and brighten up the next morning, it is difficult to maintain it without attention for six or seven hours in a state of sufficiently active combustion to keep steam in the radiators, and houses fitted in this way are apt to be cold during the night, but the self-feeding boilers, in which coal enough can be put at once into the magazine to supply a brisk fire without attention for ten or twelve hours, meet this difficulty with perfect success.

Tubular Boilers.

For large buildings, in which economy must be studied in the consumption of coal, and where skilled firemen or engineers are always near at hand to attend to it, the ordinary return-flue tubular boiler usually gives the best results, although there are various modifications of this, made with vertical tubes, which offer advantages in point of quick response to the urging of the fire, and comparative freedom from liability to choke up if neglected. That all such boilers are more or less liable to explosion cannot be denied, but the danger may be reduced to a minimum by insisting rigidly upon a hydrostatic test, and if possible a steam test, of at least 150 pounds to the square inch, even for a low-pressure boiler, before it is allowed to be put into the building. After this, care, clear water, which will not deposit sediment, and frequent cleaning, will insure comparative safety.

Pipe System.

As affecting the general efficiency of the heating-apparatus, the character of the boiler is of even less importance than that of the system of pipes and radiators by which the steam from it is distributed, condensed, so as to give up its latent heat in sensible form, and returned in the shape of water to the boiler from which it started. In order to be quiet and effective, the circulation must be continuous, the steam always flowing in one direction from the top of the boiler, and the water returning into the bottom, without any of that meeting of the two currents which is indicated by the cracking and snapping of badly-planned apparatus. The necessary elements of every pipe system including radiators are the steam-distributing pipes, which carry the steam to the radiators, and the return-pipes, which bring back the condensed water to the boiler. These two duties cannot be fulfilled by a single pipe, except in apparatus on the smallest scale, without loss of heating power, and annoyance from the constant noisy collisions of the steam and water in the pipes, shaking them through their whole length by the violence with which the water is driven hither and thither in them. Such a method of heating, therefore, although cheap in first cost, is never employed in good work for buildings of any considerable size. For these, separate returns are, or should be, always used, and the effectiveness with which these do their work is nearly proportional to their extent, and consequent cost. In the simplest circulating arrangement, two pipes run side by side upward through the building near each line of radiators, one of which is connected with the steam dome of the boiler, and the other with the water at the bottom. From the former pipe branches are taken off to the steam-valve of each radiator, and branches from the corresponding return-valves connect with the other.

Noise in Pipes.

If the process of condensation took place only in the radiators, this arrangement would not need to be further complicated, but where the steam-distributing pipes are long, some condensation, with low-pressure apparatus, takes place in them, partially filling the horizontal portions with water, causing irregular action and noise. To prevent this, all horizontal distributing-pipes are in good work laid with an inclination downward, in a direction away from the boiler, so that the force of gravitation and the pressure of the current of steam will co-operate in carrying any condensed water which may form or collect in them to the lowest point, from which it runs out through a vertical "relief-pipe," which is carried down to the main return-pipe below, entering beneath the water-line. If this is done, as it should be for all horizontal pipes of any considerable length, or so placed as to receive the condensed water from a long vertical distributing-pipe above, there will be little danger of noise in the supply-pipes. The return-pipes may, however, still give trouble, as the steam may blow rapidly through some radiators into the returns, at the same time that streams of water are descending from radiators situated on the same line in colder rooms above, causing collisions and noise. To meet this danger, the proper way is to furnish each radiator with its own return-pipe, carried down separately and entered into the main return in the basement, below the water-line. Then, since the foot of the pipe is thus trapped, no steam can enter any return-pipe except through its own radiator, and the flow, both of steam and water through it, will thus be always in the same direction, and collisions will be impossible. Such separate returns for each radiator consume, however, much pipe and money, and the usual mode of palliating the inconveniences arising from the connection of several radiators with a single vertical return is simply to enlarge the pipe so as to give as much room as possible for the steam and water to pass by each other. Which of these methods should be adopted must depend upon circumstances, a favorable arrangement of radiators making it possible to use in one instance a system of piping which would give much trouble in another. In general, the radiators should be so distributed that no vertical pipe, either for steam or return, shall serve more than two radiators on each floor, and even then it is best to make the connections with the two radiators at different levels, to prevent one radiator from drawing air or water, as well as steam, from the other.

Relief-Pipes.

Separate Return-Risers.

Trapping Returns.

The rule for the size of main steam-distributing-pipes is that they should have three-fourths of a square inch of sectional area for each one hundred square feet of radiating surface which they supply; the size being slightly diminished toward the end of the pipe. Return-pipes are usually made one size smaller than the steam supply-pipes, and it must be carefully borne in mind that all the pipes, both for steam and return, will expand and contract regularly about two inches in every hundred feet, and that this expansion must be taken up in some way, or it will keep the joints strained and leaking, if it does not tear them asunder.

Size of Pipes.

The general principle of providing for expansion is to form angles at intervals in the pipe, making each leg of the angle long enough to serve as a spring, which can move to and fro in accordance with the expansion and contraction of the other leg, without undue strain upon the joints of either. As an illustration of this principle, the vertical steam and return risers, which are usually the longest straight pipes in any building, are fixed only at the bottom, leaving the whole of the pipe above free to rise and fall as its temperature changes. The only branches from the risers are, or should be, the steam and water connections with the radiators, and to accommodate these to the movement of the risers, the radiators are always set back several feet from the main vertical pipes, communicating with them by horizontal branches, which, although fixed at one end to the radiator, are long enough to spring freely, and allow the end connected with the risers to move up and down without causing the joints to leak. If the risers are fixed at the bottom, the change in length due to expansion accumulates toward the upper end, and the radiators in the topmost stories of the building may need inconveniently long horizontal connections to take up the movement without danger of leakage. In this case it is possible, with care in arranging the lower connections with the mains, to divide the expansion by fixing the risers only at the middle instead of one end. Then the upper and lower radiators will need equally long connections, and the shortest will be those for the radiators in the middle stories. Similar arrangements for throwing the expansion where it can be best taken up may be used in setting other pipes, but such details ought to be made the subject of special study.

Expansion.

FLITCH-PLATE, RIVETED AND TRUSSED GIRDERS. — II.

RIVETED IRON PLATE GIRDERS.

WHENEVER the load upon a girder, or the span, is too great to admit of using an iron beam, and the use of a trussed wooden girder is impracticable, we must employ a riveted iron plate girder. Girders of this kind are quite commonly used at the present day, as they can easily be made of any strength and adapted to any span. They are not generally used for a greater span than 60 feet in buildings. These girders are generally made either like Figure 6 or Figure 7, with vertical stiffeners riveted to the web-plates. The vertical plates called web-plates, are made of a single plate of wrought-iron rarely less than $\frac{1}{4}''$ or more than $\frac{1}{2}''$ thick, — generally $\frac{3}{8}''$ thick. Under a distributed load, the web if $\frac{3}{8}''$ thick is generally sufficiently strong to resist the shearing stress in the girder without buckling, provided that two vertical pieces of angle-iron are riveted to the web, near each end of the girder. These vertical pieces of angle-iron, or *T*-iron, whichever is used, are called stiffeners, and when the girder is loaded at the centre, and sometimes when under a distributed load it is necessary to use the stiffeners for the whole length of the girder, placing them apart a distance equal to the height of the girder. The web is only assumed to resist the shearing stress of the girder.

Fig. 6.

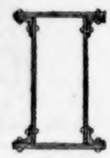


Fig. 7.

The top and bottom plates of the girder, which have to be proportioned to the loads, span, and height, are fastened to the web, by means of angle-irons. It has been found that in nearly all cases the best proportion for the angle-irons is $3'' \times 3'' \times \frac{1}{2}''$, which gives the sectional area of two angles $5\frac{1}{2}$ square inches. The two angles and the plate taken together form the flange, the upper ones being called the upper flange, and the lower ones the lower flange.

Rivets. — The rivets with which the plates and angle-irons are joined together should be $\frac{3}{4}''$ in diameter, unless the girder is light, when $\frac{5}{8}''$ may be sufficient. The spacing ought not to exceed 6″ and should be closer for heavy flanges, and in all cases it should be not more than 3″ at the ends for a distance of 18 inches or 2 feet from the end. Rivets should also not be spaced closer than $2\frac{1}{2}$ times their diameter.

Rules for the Strength of Riveted Girders.

In calculating the strength of a riveted girder, it is customary to consider that the flanges resist the transverse strain in the girder, and that the web resists the shearing strain. To calculate the strength of a riveted girder very accurately, we should allow for the rivet-holes in the flanges and angle-irons, but we can compute the strength of the girder with sufficient accuracy by taking the strength of the iron at only 10000 pounds per square inch, instead of 12000, which is used for rolled beams, and disregarding the rivet-holes. Proceeding on this consideration we have the following rule for the strength of the girder.

$$\text{Safe load in tons.} = \frac{10 \times \text{Area of one Flange} \times \text{Height}}{3 \times \text{Span in feet}}. \qquad (26.)$$

$$\left.\begin{array}{c}\text{Area of one flange in}\\ \text{square inches}\end{array}\right\} = \frac{3 \times \text{Load} \times \text{Span in feet}}{10 \times \text{Height of web in inches}} \qquad (27.)$$

The height of the girder is measured in inches, and is the height of the web-plate, or the distance *between* the flange-plates. *The web* we may make either $\frac{1}{2}''$ or $\frac{3}{8}''$ thick, and if the girder is loaded with a concentrated load at the centre or any other point, we should use vertical stiffeners, the whole length of the girder, spaced the height of the girder apart. If the load is distributed, divide one-fourth of the whole load on the girder in tons by the vertical sectional area of the web-plate, and if the quotient thus obtained exceeds the figure given in the following table, under the number nearest that which would be obtained by the following expression: $\frac{1.4 \times \text{Height of girder}}{\text{Thickness of web}}$, then stiffening pieces will be required up to within one-eighth of the span from the middle of the girder.

$\frac{d \times 1.4}{t}$	30	35	40	45	50	55	60	65	70	75	80	85	90	95
	3.08	2.84	2.61	2.39	2.18	1.99	1.82	1.66	1.52	1.40	1.28	1.17	1.08	1.00

Example. — A brick wall 20 feet in length and weighing 40 tons is to be supported by a riveted plate girder with one web. The girder will be 24″ high. What should be the area of each flange, and the thickness of the web?

Ans. Area of one flange $= \frac{3 \times 40 \times 20}{10 \times 24} = 10$ square inches.

Subtracting 5 square inches for the area of two $3'' \times 3''$ angle-irons, we have 5 square inches as the area of the plate. If we make the plate 8 inches wide, then it should be $5 \div 8$ or five-eighths of an inch thick. The web we will make $\frac{3}{8}''$ thick, and put two stiffeners at each end of the girder. To find if it will be necessary to use more stiffeners we divide $\frac{1}{4}$ of 40 tons, equal to 10 tons, by the area of the vertical section of the web, which $= \frac{3}{8}'' \times 24'' = 9$ square inches, and we obtain 1.11.

The expression, $\frac{1.4 \times \text{Height of girder}}{\text{Thickness of web}}$, in this case, $= 89.6$ and the number nearest this in the table is 90, and the figure under it is 1.08 which is a little less than 1.11, showing that we must use vertical stiffeners up to within 3 feet of the centre of the girder, or else use a one-half-inch web-plate. The vertical stiffeners we will make of $2\frac{1}{2}'' \times 2\frac{1}{2}''$ angle-irons.

From the formula for the area of flanges the following table has been computed, which greatly facilitates the process of finding the necessary area of flanges for any given girder.

TABLE.

Coefficient of Flanges for Riveted Girders.

Coefficient for determining the area required in flanges allowing 10000 pounds per square inch of gross-section fibre strain. Multiply the load in tons of 2000 pounds uniformly distributed, by the coefficient, and divide by 1000; the quotient will be the gross area, in square inches, required for each flange.

Distance between supports in feet.	Depth of girder, out to out of web, in inches.												
	12	14	16	18	20	22	24	26	28	30	32	34	36
10	250	214	188	167	150	136	125	115	107	100	94	88	83
11	275	236	206	183	165	150	138	127	118	110	103	97	92
12	300	257	225	200	180	164	150	138	129	120	113	106	100
13	325	279	244	217	195	177	163	150	139	130	122	115	108
14	350	300	263	233	210	191	175	162	150	140	131	124	117
15	375	321	281	250	225	205	188	173	161	150	141	132	125
16	400	343	300	267	240	218	200	185	171	160	150	141	133
17	425	364	319	283	255	232	213	196	182	170	159	150	142
18	450	386	338	300	270	245	225	208	193	180	169	159	150
19	475	407	356	317	285	259	238	219	204	190	178	168	158
20	500	429	375	333	300	273	250	231	214	200	188	176	167
21	525	450	394	350	315	286	263	242	225	210	197	185	175
22	550	471	413	367	330	300	275	254	236	220	206	194	183
23	575	493	431	383	345	314	288	265	246	230	216	203	192
24	600	514	450	400	360	327	300	277	257	240	225	212	200
25	625	536	469	417	375	341	313	288	268	250	234	221	208
26	650	557	488	433	390	355	325	300	279	260	244	229	217
27	675	579	506	450	405	368	338	312	289	270	253	238	225
28	700	600	525	467	420	382	350	323	300	280	263	247	233
29	725	621	544	483	435	395	363	335	311	290	272	256	242
30	750	643	563	500	450	409	375	346	321	300	281	265	250
31	775	664	581	517	465	423	388	358	332	310	291	274	258
32	800	686	600	533	480	436	400	369	343	320	300	282	267
33	825	707	619	550	495	450	413	381	354	330	309	291	275
34	850	729	638	567	510	464	425	392	364	340	319	300	283
35	875	750	656	583	525	477	438	404	375	350	328	309	292
36	900	771	675	600	540	491	450	415	386	360	338	318	300
37	925	793	694	617	555	505	463	427	396	370	347	326	308
38	950	814	713	633	570	518	475	438	407	380	356	335	317
39	975	836	731	650	585	532	488	455	418	390	366	344	325

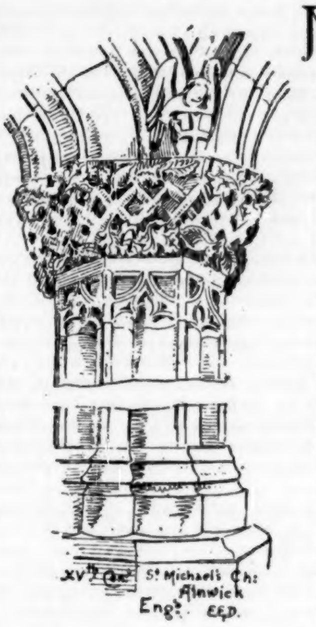
Example. — Let us take the same girder that we have just computed. Here the span was 20 feet and the depth of girder 24 inches. From the table we find the coefficient to be 250, and multiplying this by the load, 40 tons, and dividing by 1000 we have 10 square inches as the area of one flange, being the same result as that obtained before. Girders intended to carry plastering, should be limited in depth, out to out, to one-twenty-fourth of the span length, or $\frac{1}{2}''$ per foot of span, otherwise the deflection is liable to cause the plastering to crack. In heavy girders, a saving of iron may often be made by reducing the thickness of the flanges towards the ends of the girder, where the strain is less. The bending moment at a number of points in the length of the girder may be determined; and the area of the flange at the different points made proportional to the bending moments at those points. The thickness of the flanges is easily varied as required by forming them of a sufficient number of plates to give the greatest thickness, and allowing them to extend on each side of the centre only to such distances as may be necessary to give the required thickness at each point. The deflection of girders so formed will be greater than those of uniform cross-section throughout.

F. E. KIDDER.

FELT HOUSES. — An officer in the German cavalry has invented a form of transportable dwelling, which he considers will do much to obviate the inconveniences of bivouacs and the dangers to health often resulting from them. These houses are made of felt, impregnated with substances which render them impervious to water. The idea is intended to apply specially to hospital tents and the larger kinds of such dwellings. In addition to being water-tight, these tents are cool in hot weather, and, to some extent, are able to moderate a severely cold temperature. They can be packed into a few comparatively small boxes, and ventilation is duly provided for. They resist hurricanes better than linen tents. Their erection and removal is very simple, and their cost is said to be small in comparison with that of linen tents. They have been permanently introduced into the Danish army. The *Vossische Zeitung* says that leading medical authorities have approved of them.

BUILDERS' SCAFFOLDING. — XII.

THE MECHANICS OF SCAFFOLDING. — I.



MECHANICS is the science of rest, motion and force, the laws of which are the same for all bodies, celestial, terrestrial, natural and artificial, but the methods of applying the principles of mechanics to particular classes of cases vary according to circumstances peculiar to each, and hence arise branches in the general science of mechanics. It is the intention to introduce the principles of mechanics included in the branch called statics, as they are practically applicable to the solution of problems involving the forces and strains usual in scaffolding structures; and also, as far as the same conditions of the application of the fundamental principles are common to structural design, and as this paper is intended to reach working *mechanics*, who are usually the persons entrusted with the erection of scaffolding, or the superintendence of scaffold building, we will endeavor to so adapt it that they will not be deterred from reading the lessons which we shall herein consider.

2. As certain scientific terms are usually employed with restricted meanings, it will prevent confusion if at the outset we define their precise signification, because, if distinctly apprehended, it will fix the mind in a certain mode of thought which will the better prepare it for a clear conception of the line of reasoning, and a ready understanding of the principles in which they are to be employed in what we shall have occasion to enunciate.

3. It is recommended that the student shall be able to use decimal arithmetic, and understand the meaning and use of the mathematical signs, the powers of numbers, and of numerical quantities. He ought also to familiarize himself with the consideration of quantities[1] in their technical signification as represented by weights and measures of any denominations which it will be necessary to employ to represent force, stress, strain, and other statical conditions to which materials are subject in structures, either geometrically or by letters of the alphabet, or customary symbols. It would be well, too, if he learned the use of drawing-instruments, to lay off angles and simple geometrical figures, and quantities drawn to the regular draughting scales; and, above all, let the working mechanic understand that, although he is not already familiar with any of these requirements, a very little attention, if persisted in every evening, will soon enable him to understand them sufficiently for the purposes here contemplated. He must not be deterred by the appearance of a mathematical formula, which is merely a concise expression of written rules. There is no necessity, except for the mental training, and accomplishment, and the extensive body of mathematical facts which it furnishes, for a prolonged dry academic course of algebra, trigonometry, geometry, etc., as we hope to collect the elementary matter with the needful explanations so as to render it unnecessary to resort generally to special or expensive text-books on mechanics.

4. Too many writers write for mechanics in the academic text-book style, more suited to the oral recitation purposes of a regular student aided by skilled supervision, but it is wholly unsuited to those who are without these advantages, depending on their own effort, besides being hampered with an amount of stock in trade, as it were, *i. e.*, settled practical experience, gained through their own individual observation, circumscribed by the intuition afforded by their stereotyped routine of daily occupation, some of it no doubt being, in many instances, of doubtful utility, and mixed with false or irrelevant data, delusive methods of thought and conclusions, indistinct or confused formulation of ideas, with hardly the capability, and, perhaps, none of the adaptability of receiving instruction in the methods common to young men of academic habits. They seem to overlook the fact that it is difficult to override certain settled habits of mind, which they regard as not having the same obstinacy as those of the body, and to take it for granted that the practical mechanic is as familiar with mathematics as they themselves are: they overlook the important difference that whereas professional writers are in the daily habit of employing such educated methods of reasoning, demonstration and lines of thought as an exercise, with a mind already efficiently

[1] Quantities in mathematics are presented to the mind by symbols and are operated on by signs. Quantity is defined as anything capable of being increased, or diminished, or *measured*, and is distinguished as: (1) Abstract quality or quantity in the conception of which the idea of matter is not involved; and (2) Concrete quantity, which embraces everything that is material. The term *measured* has only a relative meaning and implies the existence of a known, well-defined quantity of the same kind, with which the unknown quantity is to be compared with regard to its extent, or other magnitude, or content; such known quantity is a standard of unity, or unit of measure.

drilled in the aptitude of the discipline of mathematical processes, and constantly living and developing in a mathematical and scientific atmosphere, these, unhappily, never have had the advantage of academic education, nor have their minds been exercised in what goes to make up the peculiar routine of *their* daily occupations by reasoning in academic fashion upon these subjects, which requires more familiarity with mathematical literature than can be expected of them; and hence their minds, not being suitably disciplined in those studies, and processes, and trains of thought, are ill adapted to follow academic methods of tuition and study, and would necessarily have an awkwardness akin to that of the initial performances of raw recruits, who are not expected at the outset to successfully perform graceful evolutions with the skill of an accomplished drill-sergeant, and it seems inconsiderate to expect scholarly aptitude under the untoward conditions alluded to.

5. Working mechanics have necessarily some general common-sense ideas — some from observation, some second-hand, and some of a traditionary character — about certain relations of the external [1] to the internal [2] forces and their resultant stresses, which have special applications to the particular class, uses and resistances of the structures, and the kind, form and arrangement of materials to which they are accustomed; but they have not always correct conceptions of the tendency of the strains produced by these relations, nor have they acquired adequate knowledge of the intensities which different sets of complex or changeable statical conditions impose on the parts of a structure, from their inability to resolve them into their component strains.

6. The writer once called attention, in the pages of a trade contemporary, to the negligent habit of plumbers and gas-fitters in carelessly notching and otherwise cutting away floor-joists, frequently sawing with indifference the cross-cuts one-half inch to one inch deeper than was really required to let in the pipe, allowing for its proper incline in the *middle* of the span, with no thought of the degree to which they thereby weakened their transverse strength and stiffness, which in the particular instance which immediately excited the above cautionary observations was done to a dangerous degree; when the result was explained to the mechanics, they expressed their surprise and innocence of any intentional indifference. This is but one of numberless illustrations within the writer's own experience, of the absence of true mechanical perception in many of the working mechanics whom we aim to reach with these remarks, but we would blame the prevailing system which entrusts men with duties beyond their known skill, rather than the individual. The writer has also found carpenters, plumbers, etc., cutting away the supports of girders, joists, posts, etc., without having the slightest consciousness of the dangers they were incurring.

7. And though we primarily address the working mechanic, we desire to present these principles to the consideration of the *student-draughtsman* who may not be familiar with the fundamental principles of static science, which so vitally underlie the pursuit of his art; hence the illustrations will be selected with regard to their application to frame structures, as well as to staging and scaffolding, while the conventional diagrams illustrating moments, and the nature of the action, and the properties of forces and strains developed in typical structures are of general application. We refer with pleasure to the admirable remarks on "Scaffolding" in the *Illustrated Carpenter and Builder*, London, of June 1, 1883, page 362, as serving to show that attention is being called, in trades similar to those we aim to reach with these papers, to the extending indications of how considerable is the growing importance attaching to the design, construction, and erection of scaffolding in England, because most of the observations are suited to this country and to the class of structures which we have been more immediately considering.

8. We ought to accustom ourselves to attach accurately-defined meanings to the terms employed in discussing physical phenomena, and to reason about them with mathematical strictness, thus obtaining clearly defined and intelligent conceptions of the facts and conclusions, and of the reasonings by which they are established.

DEFINITIONS.

9. MATTER is the term applied to any substances in nature of which bodies are composed, and becomes known to us by their properties, as these affect our senses, as materials of any kind with which the science of mechanics is conversant, that may be acted upon by force, or can exert force.

10. DENSITY is the comparative quantity of matter contained in a certain volume.

11. BODY is any definite quantity of matter bounded in every direction, having three dimensions, length, breadth, and depth or thickness.

12. MOLECULE is the smallest conceivable division of the substance of any body possessing all the properties of the mass; it is the physical unit of matter, and would be infinitely less than the smallest possible mechanical subdivision.

[1] External forces are those which are applied externally to a structure tending to strain or distort it as a whole, as loads, weights (including weight of structure), or any physical force exerted against the structure laterally, vertically, obliquely, etc.

[2] Internal forces are those resulting from the external forces to the different pieces or members comprising the structure, which in *skeleton structures* produce only tensile or compressive strains, tending to stretch or contract the pieces. *Skeleton structures* may be defined as those formed of members arranged in triangles, the pieces being connected together by pin joints, in contradistinction to framed or stiff joints.

13. MASS is the quantity of matter or volume contained within the cubic dimensions of a body.

14. Matter possesses certain properties: —

(1.) PRIMARY: (*a*) *Extension; i. e.*, bodies must occupy a certain limited space. (*b*) *Impenetrability; i. e.*, the impossibility of two bodies occupying the same space at the same time.

(2.) SECONDARY properties. The most important of these, considered in relation to mechanical science, are the following: (*a*) *Compressibility* and *expansibility*, by which bodies may be made to occupy a smaller or larger space. This susceptibility to compression indicates that all bodies must contain pores or interspaces between the more solid particles of which they are composed, and that there is no substance in nature which is absolutely solid, however near to it those materials approach which we are accustomed to consider solid. Various materials differ in their density for this reason; when bodies have the same size, their densities are measured by their weights or specific gravities. (*b*) *Cohesion* is the attractive force which unites the atoms composing a body into a mass, bodies being solid, liquid or aeriform according as cohesion is modified by heat, which acts in opposition to it. In gases and vapors heat is most repellant. In liquids cohesion and repulsion are equal. In solids cohesion preponderates over repulsive force. (*c*) *Elasticity* is the power of a body to regain its normal form when altered by the action of external force, as soon as the external force is withdrawn. (*d*) *Brittleness* and *toughness* are opposite properties, the first of unyielding, the second of yielding to rapid changes of form, the latter without fracture. (*e*) *Inertia* denotes the quantity of matter by which it does not oppose active resistance to the operation of force, which can only be resisted by an opposing force, and hence motion of matter is merely the manner in which the force or unopposed part of force indicates its presence in the matter, or animates or endows it with the power of motion or of resisting, retarding or preventing motion. Inertia is therefore not an active resisting force, but is merely its passive state of yielding without opposition to the action of forces. A moving body is of itself as incapable of stopping as it is of commencing of itself to move from a state of rest. A definite time is required in which to produce, by the operation of some external force, a change from rest to motion, or from motion to rest. (*f*) *Mobility* is the susceptibility of bodies to motion, admitting of a change of place.

15. MOTION is change of place, or of position in space, and refers in mechanics to that only which is produced by the action of an extraneous force upon a body. The laws regulating the motion of bodies, called the "laws of motion," are usually stated as follows: 1. If a body be at rest it will remain at rest, or if in motion it will move continually in a straight line and with a uniform velocity, if in either state it is not acted on by external force. 2. If any number of forces act at the same instant upon a body in motion, each force produces the same velocity in the direction of its action, just as if each had acted alone upon the body at rest. By virtue of this law is established the *composition of velocities; i. e.*, velocities can be compounded by the same laws as statical forces or pressures. Thus, in Figure 32, a body moving in the direction of *o a*, with a velocity which would bring it to point *a*, a distance of one foot or one furlong in a second of time, and at the same time moving in the direction *o b*, with a velocity which would bring it to point *b*, a distance of two feet or two furlongs in a *second*, the effect of both velocities acting conjointly is to bring the body at the end of one *second* to the extremity of the diagonal *o z*, found by completing the parallelogram. This identity of laws of composition of velocities and of forces or pressures is but natural, as velocity and pressure are only different kinds of effects reproduced by force; hence all the results of *statics* may be transferred to *dynamics* [3] by substituting velocities for pressures. 3. Law of motion: action and reaction are equal and contrary, the angle of reflection being equal to the angle of incidence, either perpendicular or oblique. There is a motion of *translation*, of *rotation*, of *vibration*, and each of them may be a *uniform* or *varied*, *accelerated* or *retarded* motion.

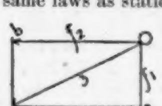


Fig. 32.

16. VELOCITY is the rate of speed of the motion with which a body passes over a unit of distance in a unit of time, and does not take into account the weight or other property of the moving body. (1) Velocities are directly proportional to the forces acting. (2) The acquired velocities are inversely proportional to the masses of the bodies. (3) The moving forces are proportional to the masses. (4) The velocity of gravitation is dependent upon vertical height of space passed through, and is not influenced by the *form* of path traversed in any oblique direction in free space. (5) With equal masses the velocities are proportional to their forces. (6) With equal *forces* the velocities are inversely as the masses. (7) With equal velocities the forces are proportional to the masses.

17. GRAVITY.—*Terrestrial Gravitation.*—There is no force which is so ever-present with destructive tendency, and against which there is need to so watchfully contend as gravity, and hence we should have a clear perception of its nature and action. Bodies terrestrial as soon as set free fall in directions perpendicular to the earth's surface, and therefore in opposite directions, or towards the earth's centre, at places which are diametrically opposite. The earth exerts this attraction, which is termed gravitation, on all bodies within the influence of its force towards the centre of what is technically termed its mass,

[3] Dynamics is that branch of mechanics which treats of moving powers, or the action of force on solid bodies, when the result of that action is motion.

the intensity being in direct proportion to the mass, and inversely as the square of the distance. This force produces a gradually increasing velocity in a body falling *in vacuo* from a state of rest, and in order to formulate it for the purposes of calculations, the space fallen through in one second of time is assumed as the basis of the measure of the force. This, however, varies for different latitudes, though it is constant for each, but for ordinary purposes is taken at 16.1 foot (which corresponds to latitude 54° 30′). As this distance is passed over by a body which commenced to move from a state of rest it is evident that in order to obtain the element of velocity acquired at the end of one *second* double this space will represent it, and hence 32.2 feet is the unit velocity, called the *acceleration of gravity*[1], and denoted by g, which, strictly, is the excess of gravitation over centrifugal force of the earth's rotation. The space described in the second *second* will be double that for the first *second*, and treble for the third *second*, and so on. The law of falling bodies is only strictly true *in vacuo*, the atmospheric resistance increasing with the volume of the body; but for ordinary substances the difference is inappreciable by reason of any difference in the density.

Herschel estimated the comparative attraction of gravity at London (51° 30′) to that at equator (0°) as 100.315 to 100.000. The downward tendency is less at the equator, because of the greater opposing centrifugal force[2] there than at London by twenty-two grains to the pound. The weight of gravity of a body is therefore the product of two factors, the vertical gravitative force × the mass; and hence the difference in weight, when tested by a spring-balance, at the top of a high mountain where it is less than at its foot.

Figure 33 is intended to represent graphically (having regard to the relation of the horizontal scale of five hundred pounds to an inch to the vertical scale of 4,000 miles, *i. e.*, the earth's semi-diameter, to an inch) the proportionate diminution of the force of gravity at successive points receding from the earth, it being zero at its centre. This diminution is in the inverse ratio of the square of the distance from the earth's centre in terms of its semi-diameter, *i. e.*, more exactly 3,993 miles, thus at 8,000 miles (= 2 semi-diameters) $2^2 = 4$, the inverse value of which is one-fourth of the forces at the surface, which for convenient illustration is assumed at 1,000 pounds. The graduation outside of the circular figure representing the mass of the earth, may be taken to indicate the force of one *ray* of attraction, radiating vertically from the earth's centre as indicated by the arrow-head. The attraction acts in all radial directions. The graduation within the figure of the mass of the earth, *i. e.*, shown on the semi-diameter, represents the force of attraction diminishing uniformly in opposite directions, towards the centre, where it is neutral. Gravitation also manifests itself by the *pressure* which it causes a body to produce upon any obstacle that sustains the body at rest, and when the obstacle is removed the body is free; gravitation draws it through a certain space in a certain time.

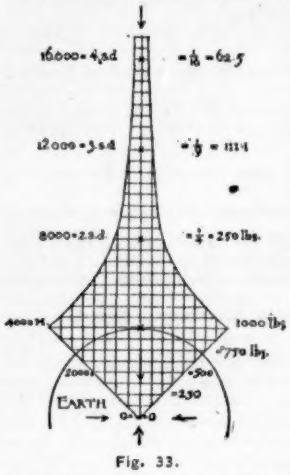


Fig. 33.

18. In all investigations regarding the effect of gravity the weight of a body is assumed to be concentrated at its centre of gravity, the mechanical effect being essentially the same for practical purposes.

THE ILLUSTRATIONS.

McMASTER HALL, BAPTIST THEOLOGICAL COLLEGE, TORONTO, CANADA. LANGLEY, LANGLEY & BURKE, ARCHITECTS.

THIS college has been erected and equipped at the sole expense of Senator McMaster. The basement is faced with gray, and the walls above in brown Credit Valley stone; the former in rock-faced ashlar, the latter random coursed. Trimmings of red brick and Ohio-stone, with black joints. Internal corridors are faced with cream-colored bricks, with red and black dado, and red frieze; ground-floor finished in butternut; upper floors and basement, clear pine. Heating by steam, direct and indirect methods. Floor and ceiling ventilation to every apartment; cost of building complete, $60,000.

This college forms one of a number of denominational colleges, in affiliation with the Provincial University, and is situated in the Queen's Park. The other colleges are St. Michael's, Roman Catholic; Knox, Presbyterian; Wycliffe, Episcopalian; and Trinity, Episcopalian. The University is considered to be one of the finest specimens of Norman Gothic in America, and cost over half a million dollars.

DESIGN FOR HOTEL, MT. KINEO, ME. MESSRS. HARTWELL & RICHARDSON, ARCHITECTS, BOSTON, MASS.

COMPETITIVE DESIGN FOR COLUMBIAN UNIVERSITY, WASHINGTON, D. C., SUBMITTED BY JOS. C. HORNBLOWER, ARCHITECT, WASHINGTON, D. C.

DESIGNS were prepared in limited competition by Messrs. Wilson Bros., of Baltimore, by Mr. Wm. M. Poindexter, and Mr. Jos. C. Hornblower, of Washington. The building was awarded to Mr. Poindexter, with instructions to prepare further designs.

PRIZE DESIGN FOR A MECHANIC'S HOUSE, SUBMITTED BY "*Broome Street*." [MR. W. B. MOWBRAY, NEW YORK, N. Y.]

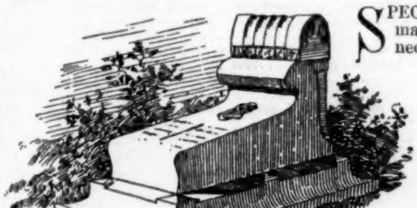
"'*Broome Street*' (third prize). This plan is larger than the two just named, and is less well arranged, as the first story extends beyond the second in the rear, the second beyond the first in front, and the partitions are somewhat scattered. The rooms are, however, well arranged around the chimney, and the house is attractive inside and outside, and has a better exterior grouping than either '*Minimum*' or '*Sweete Simplicite*.' The specifications are full, and the recommendations for future expenditure, as the owner grows more wealthy, seem as if they might be needed. The drawing is good, but lacks the dash of the two preceding sketches."—*Extract from Jury's Report.*

COMPETITIVE DESIGN FOR A $3,000-HOUSE, SUBMITTED BY "*Benedick*."

"'*Benedick*' has boldly sacrificed his hall and reduced it to the merest passage, giving every inch possible to the living rooms. The dining and living rooms form a handsome suite and are well placed; not so, however, the library, whose entrance from the narrow hall is so close to the front door that it suggests a painful economy of space. There is a medium between the large halls belonging properly to spacious summer houses and the niggardly passageway with its straight flight of stairs seen so often in our narrow city houses. '*Benedick's*' error in the latter direction is the more striking since he has treated his exterior in a rustic way which has no hint of a narrow lot of land. The rounded end of the living-room is effective and gives distinction, but such treatment, it must be remembered, is the reverse of economical in construction. Fireplaces in every room are luxuries which our limit of cost will not countenance; but in general this house is simply and economically planned. The interior details are agreeable and well worked out and very skilfully drawn. We must assume that the settee in the hall is temporarily placed there for the benefit of the jury, as a hall which, including its stairs, measures only 6′ 6″, is hardly a resting-place. The drawings, as this proves, are 'knowingly' presented."—*Extract from Jury's Report.*

THE COMPETITION FOR A MECHANIC'S HOUSE.—II.

SPECIFICATION and estimate of materials and labor necessary for the erection and completion of a small dwelling, according to plans of "*Broome Street*," architect.


TOMB – CIMETIÈRE DE PASSY. PARIS. H. BOUSSARD. ARCH'T.

The rooms, piazza and porch are nearly all under one roof, and a parlor is dispensed with, thus effecting a saving. A saving is effected by grouping the rooms around a central chimney-stack.

MASON-WORK.

A slight rise of ground with a sandy or gravelly soil will be most desirable as a site. Excavate three feet below grade and use earth to grade up to brickwork as shown. Stone to be good quality; brick to be good hard-burned "North Rivers," and stone and brickwork to be laid in a mortar composed of one part of Rosendale cement to four parts of good lime mortar. Outside of cellar stone-work to receive a one-half-inch coat of pure cement to keep out moisture.

Materials for plastering to be well mixed in the proportion of five barrels of sand to one of unslaked lime, with plenty of goat's hair. One heavy coat, well gauged with plaster, well rodded and made true and plumb; then lay on a skim-coat of white mortar, no hard-finish.

CARPENTER-WORK.

Quantities and sizes are to be as indicated in detailed estimate and on plans.

Yellow-pine is to be used for piazza and porch work and for interior finish; this is the cheapest and most durable wood to be had for the purpose. All the exterior and interior wood finish may be worked at the mill or at the building, and but little expensive carved or circular work is shown. The yellow-pine mantels and stairs may be easily made by a good carpenter. The interior yellow-pine doors are to be made from material free from pitch, and as they are to be of special pattern, may be made cheaper at the house. Few mouldings are to be used; the mould is worked on the base, trim, chair-rail, etc. A single matched yellow-pine floor to be laid in living-room, hall, kitchen, and on piazza and porch; the remainder to have single matched spruce flooring.

PAINTING.

The exterior yellow-pine finish to receive two coats of linseed oil, and the interior finish two coats of oil and one coat of varnish. The vertical shingle-

[1] The acceleration of gravitation at equator, latitude 0° 0′ is 32.091 feet. At poles, latitude 90° 0′, it is 32.255′; the difference is .164 of a foot, or nearly 2″. For New York, latitude 46° 43′ N., it is 32.1594′; Washington, latitude 38° 54′, is 32.1558′; London, latitude 51° 30′, is 32.1912′; Paris, latitude 48° 50′, is 32.1819′; Madras, Hindostan, latitude 13° 4′, is 32.0992′. *Note.*—Half of these quantities is the space in feet per *second*, described by a body falling freely in each latitude, and is denoted by one-half g. For the purposes of abstract science the mass or quantity of a body, to distinguish it from mere accidental weights, is equal to $\frac{\text{weight}}{\text{acceleration}}$.

[2] The semi-equatorial and semi-polar axes are as 494 to 495, and since the centrifugal force at the equator is one two-hundred-and-eightieth of its force of gravity, while at the poles it is zero, the two forces being in opposition, there is a consequent diminution of gravity at the equator. For intermediate latitudes it is one two-hundred-and-eightieth part of force of gravity at equator × cosine² of the latitude. *Note.*—For explanation of *cosine* see appendix to paper X, April number, p. 160, also foot-note on same page.

work to receive two coats oil and burnt sienna stain; the remaining white-pine work to receive one priming coat and two coats white lead and oil. A saving of about $80 can be effected by this method.

The owner is to do his own grading and sodding. He will set an old molasses hogshead to catch the roof-water, and lead the pump-pipe from it; but before winter he may build a cistern, cost, $25, and lay a tile-drain to carry off sink-waste, cost, $15. Next season, when he has saved some more money, he may paint the roof two coats metallic brown and oil, cost, $12; he may fit outside blinds to the windows, cost, $26: and may replace the kitchen stove by a set range (Mott's "Defiance,") cost, $22; he may purchase three portable grates and fenders for the fireplaces, cost, $8 each, and, if possible, make connections with the local water-service.

ESTIMATE OF QUANTITIES AND PRICES RULING NEAR NEW YORK.

Excavating; 2 men and a team, to plow up and scoop out 3' below natural grade, 2 days, @ $7	$14.00
Stone-work, including chimney and piazza piers, 1057 cu. ft., @ 9 c.	95.13
9,486 good quality North River brick, @ $7 per M.	66.40
9 barrels lime, @ $1.10	9.90
5 loads sand, @ $1.50	6.00
Bricklayers and laborer, @ $4 per M.	37.94
Hauling water	6.00
693 Croton brick for kitchen fireplace, facings and hearths, @ $14	9.70
Materials and laying same, @ $7 per M.	4.85
Bluestone lintel for kitchen fireplace, 5' x 1' x 4', neatly axed, @ 40 c.	2.00
Axed hearth, 5' x 2', @ 25 c.	2.50
7 barrels Rosendale cement, for 3" concrete cellar-bottom, @ $1.10	7.70
2 men, 2 days	6.00
Water	2.00
1 barrel Portland cement for exterior plaster-panels	2.50
1 plasterer 1 day	3.50
10 barrels Rosendale cement, to add to brick and stone mortar and cement up outside stone wall, @ $1.10	11.00
657 sq. yds. plastering, @ 20 c.	131.40
Hauling water	7.00
2 10-inch tiles for chimney, @ $1	2.00
Total	$427.52

TIMBER.

Sills, spruce,	4" x 8"	334	ft.
Cellar girders,	6" x 6"	54	"
Corner posts,	4" x 6"	188	"
Braces,	4" x 4"	50	"
Plates,	4" x 6"	288	"
Bridging,	2" x 4"	200	"
First tier headers and trimmers,	3" x 10"	320	"
First tier beams,	2" x 10"	782	"
Second tier headers and trimmers,	3" x 9"	135	"
Second tier beams,	2" x 9"	672	"
Kitchen ceiling,	2" x 6"	168	"
Piazza and porch timbers,	2" x 8"	293	"
Rafters,	2" x 8"	1721	"
Second-story ceiling,	2" x 6"	325	"

Total, 5532 " @ $18 per M.	$99.57
96 hemlock joist, 3" x 4" x 16', @ 20 c.	19.20
132 " " 2½" x 4" x 12', @ 16 c.	21.12
106 ft. yellow-pine girts, 1" x 7", @ $25	1.55
1934 ft. box pine sheathing, $18	34.81
500 ft. extra box pine for cellar frames, shelving, outhouse, etc., @ 18	9.00
1022 ft. yellow-pine flooring, matched, ⅞" x 3", face, @ $30	30.66
1112 ft. spruce flooring, ⅞" x 4½" face, matched and dry, @ $22	24.46
Shingles, sawed pine, 18", 1000 to 155 sq. ft., 5¾" to weather, 2534 sq. ft. = 16,350, @ $4.50	73.57
350 ft. pine for outside finish, @ $45	19.71
1124 ft. clapboards, @ 35c.	39.34
315 ft. outside finish moulding, @ 2½ c.	7.87
18 window-frames, @ $1.75 average	31.50
25 ft. 1¼" pine for outside door-frames, @ $45	1.92
400 ft. yellow-pine ceiling, piazza and porch, ½" x 2½", @ $15	6.00
Milling	2.00
400 ft. yellow-pine for piazza-posts, rail, balusters, etc., @ $28	11.20
695 ft. yellow-pine for interior finish, door-jambs, trim, base, and chair-rail, @ $28	19.46
Mill-work for same	6.00
120 ft. 2" tub-stuff for wash-trays, @ $60	7.20
Main stairs	38.00
Cellar stairs	4.00
First story, eight 1¼" yellow-pine doors, @ $3	24.00
Second story, seven 1¼" " " " @ $2	14.00
Front door, 2" pine	6.00
Colored glass for same, @ $1.50 per sq. ft.	6.00
13 pr. 1½" pine sash, $2.75, glazed	35.75
4 swing sash, 1½" pine, $1.70, glazed	6.80
Four 1¼" cellar sash, $1.10, glazed	4.40
Yellow-pine for three mantels	6.00
33 ft. rear gutter, @ 12 c.	3.96
6 ft. leader, @ 10 c., and flashings	1.00
50 days, carpenters, @ $3	150.00
Total	$756.05
Painting, oiling and varnishing.	70.00

HARDWARE.

1 pr. front-door hinges	$1.10
1 front-door lock and furniture	2.30
5 mortise-locks and furniture, @ $1.25	6.25
10 rim-locks, @ $1	10.00
2 bolts, @ 15 c.	.30
8 window-catches, @ 6 c.	.48
12 sash-fasts, @ 10 c.	1 20
2 doz. window-pulls at 8 c.	.16
4 doz. H. & C. hooks	.24
300 lbs. sash-weights, @ 1½ c.	4.50
4 kegs nails, @ $4	16.00
2 kegs shingle nails, @ $5	10.00
23 pair 3½" x 3½" japanned-iron butts, @ $2.50	5.00
Screws	2.00
Total	$59.53

PLUMBING.

1 sink	$6.00
12 ft. 1" "B" lead pipe, @ 7 c.	3.36
25 ft. 1½" "D" waste-pipe, @ 7 c.	3.50
2 traps and fitting up	4.00
Total	$ 16.86
Mason-work	427.52
Carpenter-work	756.05
Painting	70.00
Hardware	59.53
Plumbing	16.86
Total	$1,329.96
Builder's profit	125.00
Total	$1,454.96
Architect's commission, 5 % of cost	$72.75
Total	$1,527.71

104 East Eighty-fifth St., NEW YORK, April 18, 1883.

I hereby propose to build the proposed dwelling according to the plans, specification and detailed estimate made by "*Broome Street*," architect, for the sum of $1,454.96. The dwelling to be built in the vicinity of New York City.

ANTHONY MOWBRAY, Builder.

The proposal is furnished by Anthony Mowbray, a practical builder, No. 104 East Eighty-fifth St., New York.

The estimate for painting was furnished by S. A. Cueman, a practical painter, No. 805 Orange Ave., Newark, N. J.

The prices for hardware were furnished by Butler & Constant, 87 Chamber St., New York City. "*Broome Street*."

THE $3,000-HOUSE COMPETITION.—XIV.

FROM THE MUSEUM OF THE VATICAN, ROME.

SPECIFICATIONS of material and labor required for the erection and completion of frame building according to plans and details furnished by "*Benedick*."

MASON-WORK.

Foundation, 12" brick wall; brick piers; chimneys, hard brick; Philadelphia pressed-brick for stacks above roof, and for jambs of fireplaces where needed; hearths to be of 8" x 8" Spanish tiles, laid in cement; cost, eight cents each.

CARPENTER-WORK.

Heights of stories: cellar in clear, 7'; first story, 9' 6"; second story, 9'; rooms in attic, 8' 6".

Entire house shingled except under veranda, where clapboards will be used.

Floors, pine; yellow-pine for first story, hall, library and veranda.

Interior Finish, pine; bath-room, yellow-pine; newel, rail and balusters, cherry, stained; stairs, yellow-pine; library, oak.

Tank to be provided in attic.

Call-bells from kitchen and principal rooms.

Usual shelving in closets and cellar.

Plumbing:—Estimates to cover bath-room, and sinks in kitchen, and proper drains.

Painting:—Inside, three coats, except hard-wood; outside, three coats, except shingles, which will be stained with sienna; no paint on roof.

Plastering:—Instead of finishing hall for wall-paper, colored mortar, with rough finish, to be used.

ESTIMATE OF QUANTITIES AND PRICES RULING NEAR NEW YORK.

800 yds. excavation, @ 20 c. per yd.	$160.00
30 ft. digging well, @ $1 per foot	30.00
20,000 bricks (cellar foundation, chimneys and well) furnished and laid, @ $10 per M	200.00
1200 yds. of plastering, @ 20 c. per yd.	240.00
5940 ft. of timber, @ $15 per M	89.10

Plate,	85 ft.	4" x 4"
Sills,	136 "	4" x 6"
Girder,	192 "	6" x 8"
Beams,	2442 "	2" x 8"
Studding,	2100 "	2" x 4"
Rafters,	720 "	2" x 6"
Piazza rafters,	111 "	2" x 4"
Piazza sills,	144 "	6" x 6"
16 piazza posts, out of		8" x 8"

2000 ft. flooring, @ $23 per M.	$46.00
9000 ft. shingling, laid	375.00
Outside blinds (none to be used in the curved rooms)	30.00
400 ft. cornice-moulding, string-course, etc., @ 6 c.	24.00
250 lbs. felt, @ 5 c.	12.50
Nails	25.00
Other hardware	75.00
Furnace	14[illegible].00
Range and plumbing	100.00
Gutters and leaders	15.00
Window-frames	80.00
Door-frames	32.00
Sash	45.00
Glazing	60.00
Painting	150.00
Mantels	200.32
Doors	33.30
Interior finish	20[illegible].00
Carpenter-work	250.00
Incidentals of all kinds	175.00
Total	$2,785.90
Builder's profit	214.10
	$3,000.00
Architect's commission, 5 %	150.00
Total	$3,150.00

ARTISTS IN THE LEGION OF HONOR.—A French paper publishes an interesting list of the decorations bestowed upon native and foreign artists at the various exhibitions held in Paris during the past twenty years. The total number of French artists who have received the Legion of Honor is 450, divided as follows: 216 painters, of whom 171 knights, 39 officers, 5 commanders (MM. Baudry, Bonnat, Gérome, Hébert, Robert Fleury), and 1 grand officer (M. Meissonier); 82 sculptors, of whom 66 knights, 13 officers, 2 commanders (MM. Dumont and Guillaume), and one grand officer (M. de Nieuwerkerke); 142 architects, of whom 122 knights, 18 officers, and 2 commanders (MM. Bailly and Boeswillwald); 30 engravers, of whom 28 knights, 1 officer, and 1 commander (M. Henriquet). Of foreign painters 66 have been decorated, of whom 54 knights, 10 officers, and 2 commanders (MM. de Madrazo, Spain, and Stevens, Belgium); of foreign sculptors there are 11 knights and 2 officers; of architects, 8 knights and 1 officer; of engravers, 2 knights and one officer. Only one lady artist has received the coveted ribbon—Mdlle. Rosa Bonheur.—*The Architect*.

EXTERIOR STAINS.

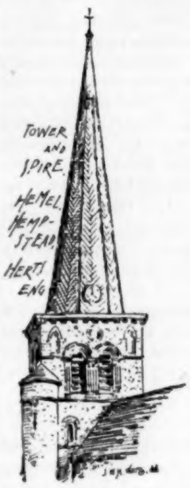
STAINS for exterior use may be divided into two classes: first, those in which the coloring material is actually dissolved in the vehicle; and second, those which are colored with a very finely divided insoluble pigment, mixed with sufficient fixative to make it adhere firmly. Stains of the latter class are therefore merely very finely divided paints. The first class where applicable, is, in the writer's opinion, superior to the latter, as the grain of the wood in the clapboards or shingles is rather more distinctly and vividly brought out. On the other hand the number of colors is very limited which admit of this application. A few of the colors of this description which have been thoroughly tried by the writer may here be enumerated.

American Asphalt	Brown	Eosin	Red
Trinidad "	"	Dragon's-Blood	"
Resin "	Reddish "	Azo Yellow	Yellow
Aloes Gum	Greenish Yellow	Amlin Yellow	"
Yellow Gum	Light "	Methyl Green	Green
Alizarine	Red	Malachite Green	"
Annotto	"	Nigrosin	Blue Black

It is useless to extend this list farther, for the writer has tried almost all the known colors that can be brought into solution in oil. Unfortunately, of this list, only the first six are upon careful trial sufficiently fast to be used for exteriors, and of these, alizarine is too expensive at present to admit of use except for some special occasion where price is not considered. The remaining ones would many of them answer for interiors, but the combination of rain and sunlight disposes of them outside too easily. We are therefore limited to a very narrow range of colors of this character, and must turn to the second class of colors, viz., those consisting of insoluble pgiments with a fixative to hold them onto the fibre of the wood. With these we can obtain almost any desired shade, and if properly ground pigments and suitable vehicles are used, effects can be obtained almost equal to the colors of the first class in respect to showing the grain of the wood. The writer has found the best pigments to be pure oxides of iron (exceedingly finely ground) for the reds, yellows and browns; pure chromate of lead for lemon yellow; mixtures of these with black and blue pigments for greens and olives. The greatest care should be used in selection of pure and very fine pigments. For a vehicle the best seems to be a purified creosote oil, which practically renders the wood imperishable and is moreover comparatively inexpensive. Linseed oil may of course be used, but it has one difficulty which every one must remember who has seen a lot of old painted shingles taken down. Just behind the butt of the shingle or clapboard is seen a deeply corroded or decayed spot upon the under side where the water has been held in between that shingle and the next by the paint which forms a *cul-de-sac* in which the moisture collects and causes the decay; this is due to the "skin" formed by the drying of the linseed oil, and is not to be found if creosote oil be used in place of linseed. In conclusion the writer would say that he thinks the best way of treating either a clapboard or shingle is to dip about two-thirds of it in the stain, which should be kept well stirred. It should then be allowed to drain back into the pan or barrel by being put into a wooden trough tipping backward, and then should be thrown out onto the grass or clean ground to dry for three or four days. Many houses are built in which the shingles are stained and the clapboards painted. The result would be much finer if both were stained, for stain has the effect of making the whole side of a house look as if it were treated in detail, so great is the beauty and variety of the grain of the wood, while paint reduces the whole to a monotony in which the color *en masse* is the only effect. Any inquiries which the writer can answer will receive the attention of Yours sincerely, CHEMIST.

CHANGES AT MONT ST. MICHEL.—The fate of Mont St. Michel in Brittany still forms the subject of a brisk interchange of notes between the Ministry of Fine Arts and the Ministry of Public Works, and the real point at issue is now beginning to appear. On the one hand it is admitted that the dike which has been constructed from the mainland by the Ministry of Public Works need not really imperil the safety of the buildings, for these could be easily protected by some additional buttresses; but, on the other hand, it is confessed that the dike is only the thin end of the wedge, and that the real object of the department is to gradually reclaim the whole of the *grève*, 35,000 acres in extent, just as the neighboring marshes of Dol have already been reclaimed. The famous mount would then raise its spires and towers above "a sea of corn, now green, now gold, alive with men and beasts of burden, and even traversed perhaps by a railway;" moreover the work would really be one of "restoration," for there was no doubt a time when the sea had not submerged the ground between the mount and the mainland. All this, however, fails to convince the "unpractical dreamers" in the Ministry of Fine Arts, who claim the custody of Mont St. Michel as a historical monument, and declare that its incorporation with the mainland would destroy its artistic merit. One may at any rate be glad that the incorporation, for which there is certainly a great deal to be said, had not been carried out before Clarkson Stanfield's drawing and Mr. Haig's etching. — *Pall Mall Gazette.*

THE ART OF VENEERING.



IT is not intended in this article to enter into an account of the merits or defects of veneered work, or to reply to the severe remarks that some writers upon furniture design have thought fit to make respecting it, but to at once proceed to describe the various operations in a concise and practical manner, commencing with the

PREPARATION OF THE GROUNDWORK.

A wood suitable for veneering requires to be thoroughly well seasoned, free from knots and shakes, and should not contain turps. The best of woods for the purpose are mahogany and American walnut, although good pine answers well for ordinary purposes. The surface, if flat, is carefully planed up with the trying-plane. It is then well toothed over with the toothing-plane — first, the lengthways of the grain of the wood, and afterwards crossways, care being taken to tooth the work *thoroughly.* If you are working pine, use a coarse toothing-iron; if mahogany or other hard wood, a finer iron is requisite. If the work presents a hollow or rounded surface, it is shaped with suitable planes, rasps and files, and finally well papered crossways with coarse glass-paper (strong 2 or 2½).

The next operation is *sizing.* To make your size, take one part of good Scotch glue, and boil it well with fifty parts of water; then brush over the groundwork while hot, allow to dry, and if there should be any defects in the groundwork, fill in with *stopping.* Make your stopping by mixing some finely-ground plaster-of-Paris with hot glue and water, enough to form a moderately-stiff paste; then lay in where necessary with a chisel, taking care to allow for shrinkage; let it dry, then level off with a rasp.

PREPARATION OF THE VENEER.

Having sized your groundwork over, you may proceed to the preparation of the veneer whilst it is drying. Look carefully at your wood before cutting it, and see that you do so in such a manner as to get the grain of it to the best advantage. Cut it rather larger than the surface you intend to veneer, to allow for levelling at the ends and sides. Most veneers, such as mahogany, oak, chestnut, maple, sycamore, birch, satinwood, and various other woods are ready for cutting as received from the merchant; but some, like burr-walnut, brown oak, Amboyna, etc., present an uneven surface called *buckly.* When this is the case, damp one side with clean water, lay it down with its *dry* side upwards, and put the *wet* side of the next veneer upon it, repeating the operation till all are done. Take particular care to keep each veneer, if you have more than three or four, in its proper order, as you damp and turn over, and do not on any account get them mixed. Let your wood stand about five or six hours, then spread out and allow to nearly dry, and they will be ready for cutting out.

The next process is *flatting.* Get two pieces of wood (dry straight pine will answer well) rather larger than your veneer, and heat them on a stove or before a bright fire; then place the veneers between them, handscrew together, and allow it to remain for about half an hour; then repeat this operation until the veneer is *perfectly dry* and thoroughly flat.

Our wood is now ready for *filling in.* If it is perfectly sound, this operation is of course unnecessary; but it frequently happens, especially with burr-walnut, that it contains holes that require filling. To do this, take a piece of the veneer (off the edges of that already cut out) and flat it precisely as the other. Select the part of it which matches best with the grain of the wood around the hole required to be filled in; place this piece underneath the hole. If you have a stump rather larger than the hole, you may now cut it square or circular, and the piece for filling it at the same time; if not, take an ordinary pocket-knife having a sharp point, and cut your hole and veneer the required shape. When you have filled in your wood, lay it on a flat board, then press your pieces in with a hammer. If they are rather large, you may use one or two fine-pointed tacks to keep them in position. Now cover all your pieces with strips of paper. Select a strong paper for the purpose, one that is not too thick; copy-book or note paper answers well for the purpose. Glue it on one side, taking care to use the glue just thick enough to hold your wood in position. Pay particular attention to this, or it will cause you a good deal of trouble. You will find it best to cut the paper in strips about one and one-quarter or one and one-half inches wide. Lay it on a board to glue, and smooth it over your veneer with a damp rag.

We now proceed to *jointing.* Place your veneer in the position it will appear in when laid. Observe that it *matches.* If you are to have one joint with two veneers, or two joints with four veneers, see that the grain of the wood forms a figure having both sides alike; if you have kept your veneers in their right or following order, this will not be difficult. If you are working a thick veneer (saw-cut), make your joints with an iron plane or ordinary trying-plane on the shooting-board; if using a thin veneer (knife-cut), make them with a chisel and straight-edge. Take *particular care* to have *the bevel edge* of the chisel against the straight-edge when cutting, or it will run, and you may come off with an ugly cut. Now put the jointed edges together on a deal board. Tack one edge down; put the tacks about three-fourths of an inch from the jointed edges, and about two and one-half inches apart. Having tacked one piece down, put the other up to it, and tack in the same manner. Now cover all the joints with paper, glue in the same manner as previously mentioned for the filling in, smooth it well down with a damp rag, and allow to dry. If the weather is hot it is best to cover your joints, to prevent them drying too quickly. A good and simple method is to lay your board with the veneer downwards on the floor. Let the joints dry, then take out the tacks and knock the tack-holes up with hammer from the underneath side. Put the veneer aside until you are ready for laying it; it is best to cover it up and keep the air from it by placing it under a board or wrapper.

There are two ways of laying veneer: by means of a caul or a veneering-hammer. I shall describe both methods, although the first is of greater importance, and should, wherever practicable, be adopted; but in certain cases which I shall mention, the second is extremely useful.

VENEERING BY CAUL.

In the first place, to make a *caul*, take a well-seasoned piece of cedar or pine, rather larger than the surface you intend to veneer (about one inch or one and one-half inches each way), and plane it up true on both sides if the work is flat; if otherwise, make it the requisite shape to fit the work, hollow, round, or whatever it may be. If you have to shape your caul you should use thicker stuff, and it is advisable to screw two or three battens on the back. When making shaped cauls, it is best at the same time to get out the pieces of wood necessary to form a flat surface when the work is put in the caul. Thus, suppose we want to veneer a door having a rounded surface on one side, and a hollow one on the other; we have made a *hollow* caul to correspond with the *rounded* surface, having its under side flat; now put the round side of the door in the caul, and shape your pieces of wood, *rounding* to fit the *hollow* side of it. They should be two inches wide, the same width or a little wider than the caul, and five or six inches apart. If one side only of the work is shaped, these woods are unnecessary. If your wood is not wide enough, make a good joint, dowel it together, and only glue the dowels into one side, so that you can take it to pieces for heating. The caul, if likely to be much in use, should be covered with zinc. Cut the metal out large enough to cover the face of it, with sufficient to turn over the edges and ends, and fasten it on with flat-headed zinc or copper nails.

GLUE.

Numerous failures in unaccustomed hands may be ascribed to the use of *bad* glue. Nothing but the *very best* glue should ever be used for veneering. Get the best Scotch glue you can obtain, break it up and boil thoroughly. It differs so much in strength that the proportion of water suitable for it can scarcely be given; but after breaking up in pieces, just cover with water and allow it to soak, then boil off with frequent stirring. It will, if good, now require about half as much water as previously added, to bring it to the right consistence for veneering; it should spread evenly under the brush and be free from lumps. Having made the caul and prepared the glue, get the handscrews and cramps ready and commence laying. Heat the caul on a stove or before a bright fire. If it is doweled together, and if it is more convenient, take it to pieces, taking care to mark your joints first. If you intend laying two similar pieces of veneer on flat surfaces, heat both sides of it, and do both of them together; if not, get one side of it well heated as hot as you can without letting it burn; while it is heating, set the handscrews and cramps open as near the distance as you will require them, and place handy to your work. Now glue your groundwork well, and if your veneer shows any inclination to be *backly*, glue it slightly on the underneath side, as this will help to soften it (remember the jointing paper on the veneer is laid on the *outside*). Having finished gluing, put the veneer on the work, and smooth it gently over with the hand. Then see that the caul is hot enough, and its surface free from any small cinders or dirt; now rub it over with a greasy rag, and lay it gently on your veneer. Draw your work and caul a little over the front or end of the bench, just enough to get the handscrew on; put it on very gently, then tighten as much as possible. You can then stand it upon the floor, and if you have not any one to hold it for you, rest the handscrew against your bench while you put on the remainder. They should be placed about six inches apart, and mind that they *bite fairly*. Do not get one screw tighter than the other, or you will only get the pressure at the outside or inside of the chaps. If you have a piece of work so wide that the screws will not well reach its centre from either the sides or the ends, get two pieces of wood, two inches or two and one-half inches thick, and about the same width as thickness, plane them up, slightly rounding on one side; put their *rounding* sides, facing each other, on the work, and handscrew them at *each end*; they will then tighten in the middle and give sufficient pressure. Let your caul remain on for an hour — in very hot weather longer will not hurt; then undo the handscrews, and if the caul sticks, insert the edge of a thin metal square, the back of a handsaw, or anything of a similar nature, between it and the veneer, and work it carefully about till you get them apart. If you have used the glue thick enough, and greased the caul well, you will not have much trouble, and they will often come apart themselves, or by giving the end of the caul a tap with a hammer or on the bench. See that the veneer is down; feel it all over with your hand. If it is up, you will be able to tell by the hollow sound on tapping it with the tip of your finger, as well as by the raised appearance, termed *blisters*, it will present when held in the light. If you heat your caul sufficiently, use your glue thick enough, and put the handscrews on properly, you will not be troubled with blisters; should there, however, be any, let the work stand about one or two hours, and then put a smaller hot caul on where required, until well down all over.

To *level* the veneer, first lay it (veneer side downwards) on a board, and scrape off with a chisel as much of the glue that has come over the edges as you can. Now put it in the bench-screw, and level towards you with a paring-chisel, if thin veneer; if thick, use a smoothing-plane. Put it aside to dry. If you have two pieces the same size, put them with their veneered sides together; if only one, place it so that the air does not get at the veneer. Allow to stand two or three days, then scrape off the paper used for filling-in pieces and jointing with a chisel, having previously damped it with hot water. The work is now ready for sizing; this operation may be dispensed with, but it is decidedly advantageous, especially if you are working wood having an open grain. The size, which should be about the same strength as that used for the groundwork, is brushed or rubbed over the veneer with the hand, then wiped off as dry as possible with a cloth.

VENEERING BY HAMMER.

As I have already mentioned, this method of veneering is useful in certain cases. We sometimes want to veneer an edge, or put a narrow strip of veneer on some small surface, where it would be very inconvenient to caul it down. If we are working a wood of a glossy or greasy description (like satinwood or rosewood), its nature will not admit of sufficient pressure by this process, nor should it ever be adopted for work where water will act injuriously. I believe the prevailing opinion is that veneer requires a good deal of water to make it lie. In the first process, you will remember that it is laid *quite dry*. In the second process water is used, and if we consider that a damp surface tends to cause the wood to cast as it dries, we can readily understand where it should be used. — *T. H. S., in the Building News.*

MONTHLY CHRONICLE.

June 6. Grain elevator of Manigold Brothers & Kershaw, Milwaukee, Wis., bursts. Seven men supposed to be buried under the grain.

June 8. Powder mills near Newburgh, N. Y., struck by lightning. One man killed.

June 9. Burning of the Gaiety Theatre, Manchester, England. The building was empty at the time.

June 13. Fall of the roof of J. L. Haven's factory, Cincinnati, O., during repairs. Four men injured.

June 14. Cyclone on Long Island, N. Y.

June 16. Burning of Gray's Opera-House, Boston, Mass., early in the afternoon. The audience escapes unhurt.

Panic of children assembled in Victoria Hall, Sunderland, England. Two hundred and two children of all ages crushed to death.

June 28. Burning of a place of amusement at Dervio, Italy. Forty-seven persons burned to death.

NOTES AND CLIPPINGS.

Rembrandt's "Advocate Tolling." — There has just been sold in London a famous print of Rembrandt's, which is either the identical impression or the one other example not in a public gallery, of which a celebrated story is told in Charles Blanc's book on Rembrandt. At the Pole-Carew sale in 1835 all the great amateurs of that day were assembled, and the almost unique "first state" of the "Advocate Tolling" (as the print was then called) came on. Mr. Pole-Carew had given £56 for it, but the biddings soon rose to £150, then to £200. At this point a foreign gentleman rose and addressed the assembly. "Gentlemen," he said, "I am an old man. I am the Chevalier de Claussin, author of a catalogue of Rembrandt's works that is in the hands of all of you. I have sought this print for twenty-five years; if I miss it now I shall never get another impression. I have only £200 in the world! A little pity, gentlemen; let it fall to me!" There was a moment of compassion: but who is really self-denying at such a time? Other competitors bid, and the print was knocked down at £220 to M. Verstolk van Soelen, Minister of State in Holland.

A Landlord's Responsibility. — A bank had several tenants in its building, one of whom occupied an upper room in which there was a water-bowl with a faucet, but the apertures for the escape of the water were not sufficiently large to carry off the water at night if the faucet was left open, the pressure being then much greater. This faucet was left open negligently by the tenant at night, and the water overflowed and ran down upon and injured the goods of another tenant who sued the landlord for damages on the ground of negligence in putting in an insufficient bowl. In this case the Supreme Judicial Court of Maine reversed the judgment below in favor of the plaintiff. Judge Symonds in the opinion said: "Legal liability of the landlord for negligence does not result from the facts in this case. If the landlord of an upper tenement should cause a faucet of proper construction and capable of safe use with due care, but without any overflow at all, to be put in only for the purpose of drawing water, there would be no conclusion of law from that fact, without other evidence, that the landlord was negligent and liable for the damages resulting from his tenant's carelessly leaving the faucet open." —*Sanitary News.*

SAFE-BLOWING EXTRAORDINARY.— The National City Bank, after employing five different experts continually day and night since last Friday morning in attempting to get its vault open, as a last resort to-day tore it out of its brick and stone encasement and conveyed it to the works of the City Forge and Iron Company, where it was blown open with dynamite. In order to remove the vault it was necessary to remove the plate-glass windows of the bank. The time-lock of the safe had become deranged, and showed how impregnable an arrangement it is by successfully resisting the efforts of all the experts.—*Cleveland (O.) Leader.*

THE SEVEN SUPREME COLORISTS. — The art of color, in which Giorgione discovered himself to be so masterful, is one of the proudest functions and faculties of the painter, if not in some respects the ultimate one. "To color perfectly" says Mr. Ruskin, "is the rarest and most precious (technical) power an artist can possess. There have been only seven supreme colorists among the true painters whose works exist, namely, Giorgione, Titian, Veronese, Tintoret, Correggio, Reynolds, and Turner; but the names of great designers, including sculptors, architects, and metal-workers, are multitudinous." It is in the same connection that Mr. Ruskin observes: "If these men" (the Venetian painters) "laid architecture a little under contribution to their own art, they made their own art a glorious gift to architecture, and the walls of Venice, which before, I believe, had received color only in arabesque patterns, were lighted with human life by Giorgione, Titian, Tintoret, and Veronese. Of the works of Tintoret and Titian nothing now, I believe, remains; two figures of Giorgione's are still traceable on the Fondaco de' Tedeschi, one of which, singularly uninjured, is seen from far above and below the Rialto, flaming like the reflection of a sunset." *— London Society.*

COMPRESSED AIR AS A MOTOR. —*The London News* of the 17th ult., states that the day before a practical trial was made of the British Mékarski Company's improved air-engine, applied to the propulsion of street tram-cars. The experiment was made with the approval of the local authorities under a board of trade license, on the line of the Metropolitan Street Tramways Company from Camden road, Holloway, to King's Cross, a distance of about two miles. The engine claims superiority over other inventions of the same kind in the passing of the compressed cold air through hot water, and so giving it reëxpansive power and force. A reservoir, not much larger than an eighteen-gallon cask, is fixed at each end of the car, on the platform occupied by the driver; and, under his control, mechanical driving gear to the weight of ten tons, fixed under the car and protected by iron skirting, propels the car. The reservoirs are charged by steam power at the depot to the extent of a pressure of four hundred and fifty pounds on the square inch, and require recharging after each return journey. The experimental test, with a car laden with directors and visitors, was perfectly successful. No attempt was made at any more than ordinary speed, nor did this comparatively novel mode of travel attract more than passing attention even from horses, whose aversion to the rival power of steam on roads is sometimes dangerously evident. Assuming the steady and continuous working of the engines and mechanism, the main drawback to permanent supersession of the clumsy and costly horse service seems to be the difficulty of clearing, or rather circumventing, obstruction through the breakdown of any ordinary vehicle on the line. In that case, while the horse-car can at some small inconvenience in the way of jolting be drawn from the line over the roadway, the engine car must either be a dead block or must carry off the obstruction by a cowcatcher. The engine has worked four years in Nantes without any serious breakdown. This trial included a length of one hundred yards or more over a canal bridge where the gradient is one in twenty-seven.

PEAT. — Peat or turf is composed of various kinds of plants which are undergoing a gradual transformation by a process of slow burning or carbonization, in which the oxygen of the plant is being liberated under special conditions of moisture and heat, leaving a spongy carbonaceous mass in which the remains of the plants are often so well preserved that the species may be easily distinguished. The formation of peat may be regarded as one of the most important geological changes now in progress. In color the combustible varies from a yellowish-brown through all graduations to a very dark brown — almost black. The former is light in structure, spongy and fibrous; the latter is more compact and pitchy in its appearance, the fibrous texture being almost entirely obliterated. In advanced stages of decomposition it is compact and dense, presenting an earthy fracture when broken. In general, the darker the peat the richer it is in carbon.

Peat formations are confined to cold and temperate climates and swampy ground. In its natural and advanced state, the material contains about three-fourths of its weight of water. In the earlier stages of decomposition the quantity of water present often amounts to as much as ninety per cent of the whole weight, and is totally unfit for any of the purposes for which the fuel is used. Owing to the abundance, cheapness and superior heating power of coal, peat has not found much favor in this country. In Ireland, Germany, Sweden and several other foreign countries, however, it is largely used not only for domestic, but also for metallurgical purposes. In a French report on the use of peat as a fuel for locomotives, after experimenting on a large scale the conclusion was reached that an economy of nearly one-half might be effected over a similar mileage and tonnage with coal, setting aside the greatly reduced injury to boilers, flues and grates. It is also claimed for peat in this report that the firing, once understood, is much more easily managed than with coal, no stoking being required, and the heat being more regular and not subject to the constant changes in intensity that occur so frequently with coal and coke. The charcoal produced by the carbonization of ordinary air-dried peat is very friable and porous, takes fire very readily, and, when once ignited, nearly always continues to burn until its carbonaceous matter is wholly consumed. It scintillates in a remarkable degree when burned in a smith's fire, and its extinction when in mass is difficult. From this arises the difficulty in its manufacture by the usual method of carbonization in piles, and it is so little coherent that it cannot be conveyed without much of it being crushed to dust. — *Metal Worker.*

IN THE CHANNEL TUNNEL.— A tall shaft, a steam-engine, an air-locomotive and a couple of wooden shanties mark the spot destined, it may be, to abut upon the English mouth of the Channel tunnel, or rather of a Channel tunnel — for there are other schemes afoot to join London and the extremest point of the Continent of Europe in a continuous railway journey and without change of carriages. Sir Edward Watkin airily calculates that the cost of the enterprise in which he is interested would amount to three millions sterling, and that the tunnel would allow the passage of 250 trains each way every day, at an average speed of forty-five miles an hour. So that the tunnel of twenty-two miles in length might be traversed in half an hour — a speed, be it said, very much higher than that kept up in the longest tunnels of the St. Gothard between Switzerland and Italy. At the bottom of the shaft, at the mouth of the boring, no more than seven feet in diameter from end to end — excepting here and there a somewhat wider square opening, technically called "a turn-out" — we found a couple of trollies, fitted with seats on either side, after the manner of the tram-cars of the military train familiar to habitués of Wimbledon camp. Running along the sides of the trolly, close to the ground, was a footboard like that attached to a railway carriage, and above the seat was a semi-circular hood, lined with red baize, sufficient to protect the head and shoulders from dripping wet or particles of falling débris, but not wide enough to save the legs and feet. By reason of the space taken up in the lower arc of the circle, so as to make a level floor, along which the rails were laid, it was necessary that we should sit with knees drawn up and heads bent during the whole time occupied in journeying to the face of the tunnel and back again. A Rembrandt or a Salvator Rosa might have done pictorial justice to such a scene. Under foot for a great portion of the way the ground is almost ankle-deep in slush; and the stalwart fellows who drag and push the trollies — trudging manfully along — have enough to do to keep their foothold. The travellers, for the greater length of time, moving through a dim twilight, cannot well make out the features even of those who sit beside them. Now and again the little electric lamps, set in rude niches of the naked gray chalk, cast a brilliant but fugitive light on the passing train. Then, for awhile, all is again but darkness visible. There are shadows above and beneath and all around. Looking backward or forward, through the deepening gloom, the traveller sees an ever receding, seemingly endless funnel-shaped perspective, lit at long intervals as with fiery eyes. Onward, and yet onward — to no sound save the splashing made by the tall workmen tramping through mud, and the drip, drip of the water upon the hood above our heads — we are dragged and pushed beneath the shingle and the sand of the shore for a time level with the beach, and then down a quarter of a mile deep, past low-water mark under the bed of the Channel. The bore has cut clean through the gray chalk in a circle as round and true as the inside of a wedding-ring. So thoroughly, indeed, is the instrument adapted to the work and to the material that in dry places it is possible to see the chisel-marks made a couple of years ago. At intervals along the route, where it is feared the water might come through, the sides and roof have been packed with lead or clay, and held up with solid iron bands apparently about eighteen inches wide. Sometimes, in the fitful flashes of light, the eye rests upon falling red rivulets, like streams of blood, pouring down the damp walls. Ever and anon there are "faults" in the clayey chalk not yet remedied. So we go on and on, moments seeming as minutes, until the electric lamps cease altogether, and the long, awful cave is enveloped in a darkness which would be impenetrable but for the glimmer of a few tallow candles stuck into the bare walls of the cutting. Even a mile and more from the mouth of the shaft it is not difficult to breathe; for the same machine which works the bore pumps drives a continuous supply of fresh air into the seven-foot pipe which at present forms no more than the nucleus of a tunnel. At a distance of 2,300 yards from the pit-mouth we come upon the simple and wonderful piece of machinery which can pierce through the bed of the sea with extraordinary celerity and at a cost cheaper than is required for the making of an ordinary tunnel under a hill. By permission of the President of the Board of Trade the engineer is allowed to make a couple of turns in order to show our party the method of its working. Presently we remount our not too comfortable carriage; and pass stooping, once more, along the fearsome narrow way; pass by spaces of horrible shadows and glimpses of welcome light. And finally we are swung up through the shaft into the outer air, where the glad sunshine catches the tall cliff's face and bathes the smiling and yet unbetrayed Channel in an atmosphere of golden glory.—*The London Daily Telegraph.*

A NEW RAPHAEL. — The London *Pall Mall Gazette* in a recent issue says: "The gallery of the Louvre has just made an acquisition which reflects great praise or great blame on our authorities at home. The number of Raphaels in the world is very few, and in a fortnight a new Raphael will be hung in the 'Salon Carré.' If the work be genuine, it is sad to think, not only that it might have been ours, but that it actually was ours. In 1850 it was sold at Christie's, and subsequently passed into the hands of Mr. Morris Moore, who has just sold it at Rome to the authorities of the Louvre for £8,000. It is understood one of the conditions of sale was that the picture was to hang in the gallery of honor, close to the other Raphaels which make the glory of the Paris collection. It is only recently that this 'Apollo and Marsyas' has been definitely attributed to Raphael. So long as we had the picture the ascriptions of authorship were very varied, and included Mantegna, and Francia, and the Florentine painter, Francia Bigio, whose well-known picture, for many years fathered on Raphael, and now in the Louvre, will probably make way for the last acquisition. It was the discovery of a cartoon in Venice a few years ago which established the authenticity of the new Raphael."

A CEMENT FOR GLASS AND METAL. — Those who use brass letters on glass windows know how often they drop off from unequal expansion, or from the too-energetic efforts of window cleaners. They will be glad to have the following recipe: Litharge, two parts; white lead, one part; boiled linseed oil, three parts; gum copal, one part. Mixed just before using this forms quick-drying and secure cement. — *Exchange.*

BUILDING INTELLIGENCE.

(Reported for The American Architect and Building News.)

[Although a large portion of the building intelligence is provided by their regular correspondents, the editors greatly desire to receive voluntary information, especially from the smaller and outlying towns.]

BUILDING PATENTS.

[Printed specifications of any patents here mentioned, together with full detail illustrations, may be obtained of the Commissioner of Patents, at Washington, for twenty-five cents.]

279,917. Screw-Driver. — Frederick J. Colville, Hamden, Conn.

279,930. Key-Fastener. — Wm. H. Flinn, Nashua, N. H.

279,932. Combined Lock and Latch. — Theodore Friedrick, Ottawa, Ontario, Can.

279,943. Wash-Basin. — Arnold C. Hawes, Noroton, Conn.

279,952. Faucet. — Joseph Kaufmann, New York, N. Y.

279,975. Hand-Saw. — David A. Neidig, Canton, O.

280,002. Burglar-Alarm. — William H. Wright, Atlanta, Tex.

280,009. Automatic Fire-Extinguisher. — Jas. W. Birkett, Brooklyn, N. Y.

280,017–018. Water-Closet. — Chauncey N. Dutton, Washington, D. C.

280,024. Chimney and Ventilating Flue. — William P. Esterbrook, New York, N. Y.

280,034. Metallic Skylight. — George Hayes, New York, N. Y.

280,035. Transom-Lifter. — George Hayes, New York, N. Y.

280,036. Skylight. — George Hayes, New York, N. Y.

280,055. Door-Check. — Thomas D. McCurdy, Lancaster, Tex.

280,065. Fire-Escape Cable. — Abraham O. Morford, Port Chester, N. Y.

280,070. Fire-Escape. — William Newland, Brooklyn, N. Y.

280,073. Calipers. — Andrew Nimmo, Bristol, R. I.

280,085. Rain-Protector for Chimneys and Roofs. — Isaac Sage, Pleasantville, N. J.

280,092. Ventilator. — Frank R. Siltz, Leon, Io.

280,099. Pipe-Wrench. — John J. Tower, Brooklyn, N. Y.

280,108. Water-Closet. — Thomas Wilson and Chauncey N. Dutton, Washington, D. C.

280,111. Eaves-Gutter. — Hosea I. Aldrich, St. Helena, Neb.

280,113. Floor-Clamp. — Frederick E. Allen, North Grafton, Mass.

280,136–137. Cock or Faucet. — Wm. S. Cooper, Philadelphia, Pa.

280,151. Elevator. — Andrew M. Dungan and Milton Lacrone, Springfield, O.

280,152. Floor-Plank Clamp. — Grafton H. Duvall, Philadelphia, Pa.

280,154. Transparent Blower for Fireplaces. — John W. Edmonds, New York, N. Y.

280,155. Mercury-Seal Trap. — Abraham Edwards, Asbury Park, N. J.

280,175. Match-Plane. — Philip Hickey, Boston, Mass.

280,180. Water-Closet. — Elias S. Hutchinson, Washington, D. C.

280,193. Sewer-Trap. — William W. Lemmon, Portersville, Ind.

280,226. Pivoted-Jaw Vise. — Andrew J. Odom, Sumner, Ga.

280,231. Fire-Escape. — Aaron Palmer, Rochester, N. Y.

280,243. Cistern for Water-Closets. — John Reid, Brooklyn, N. Y.

280,251. Elevator. — Uzziel P. Smith, Chicago, Ill.

280,261. Door-Securer. — Thomas E. Tateum, Worcester, Mass.

280,271. Brick-Drying Apparatus. — Nathaniel S. Willet, Newark, N. J.

280,275. Water-Waste Preventer for Flushing Water-Closets. — Charles Winn, Birmingham, County of Warwick, England.

280,292. Sash-Holder. — William P. Clason, U. S. Navy.

280,294. Fire-Proof Structure. — William Corliss, Providence, R. I.

280,306. Fire-Escape. — John Gowdey, Janesville, Wis.

280,316. Brick-Machine. — Lewis B. Kennedy, Keokuk, Iowa.

280,326. Mortising-Machine. — Lyman O. Orton and Lucien H. Berry, Philadelphia, Pa.

10,346 (*Reissue*). Apparatus for Ventilating Water-Closets. — Frederick Hainsworth, Chicago, Ill.

SUMMARY OF THE WEEK.

Baltimore.

Dwellings. — Thos. Dixon, architect, has prepared drawings for Mrs. Mary M. Wagner, for 2 three-st'y brick, stone and terra-cotta houses, to be erected on n s North Ave., e of Park Ave., each 24' x 64', to cost $15,000; Lewis H. Robinson, builder.

The labor market quotations for the month of July remain unchanged, same as for June.

Building Permits. — Since our last report sixteen permits have been granted, the more important of which are the following: —

Mrs. Karter, two-st'y brick stable, in rear of No. 9 East Biddle St., between McDonough and Ann Sts.

Omitta Green, two-st'y brick stable, in rear of n e cor. Park Ave. and Wilson St.

B. & O. R. R. Co., one-st'y brick roundhouse and car-shop, s w cor. Pratt and Poppleton Sts.

Robert Garrett, two-st'y brick stable and extension to greenhouse, in rear of Nos. 69 and 71 s s Mt. Vernon Pl.

A. Hamilton, 4 three-st'y brick buildings, n s Lafayette Ave., between Calhoun and Carey Sts.

Marion H. Ould, two-st'y brick bakehouse, w s Morris Alley, between Preston and Rose Sts.

Boston.

Monthly Report. — During the month of June, 17 permits for brick and 105 permits for wooden buildings were issued in Boston, at the office of Inspector of Buildings.

Building Permits. — *Brick. — Hamilton St.*, cor. Wendall St., Ward 12, for Moses Kimball, mercantile building, 28' 2" x 30' 3", four-st'y flat; James Smith, builder.

Middlesex St., No. 10, Ward 16, for J. C. Haynes, tenement, 40' x 40' 2", four-st'y flat; G. W. Pope, builder.

Stillman St., Nos. 25–29, *North Margin St., No.* 32, *Cooper St., No.* 32, *rear*, Ward 7, for John G. Williams, parochial school, 68' x 80', five-st'y hip, ell, 25' x 56' and 71'; Frank Jones & Son, builder.

Wood. — Delle Ave., near Parker St., Ward 22, for C. H. Proessdorf, 2 dwells., 16' x 21' and 24' x 31', three-st'y flat; Robert D. Ward, builder.

M St., Nos. 159-161, Ward 14, for Wm. T. Eaton, dwell., 20' x 44', dwell. and store, 20' x 44', three-st'y flat; W. T. Eaton, builder.

Tremont St., Nos. 26–34, Ward 3, for Charles Robinson, Jr., 5 dwells., 13' 3" x 30' and 20' x 34', three-st'y flat; Geo. M. Starbird, builder.

Delle Ave., near Parker St., Ward 22, for Hannah Fitz Patrick, dwell., 20' x 27' and 24' x 32', two-st'y mansard; R. D. Ward & Co., builders.

Greenwich Pl., cor. Fenton Pl., Ward 24, for Wm. A. Burrell, dwell., 23' x 36', two-st'y flat; Wm. J. Jobling, builder.

Clifton St., near Cottage St., Ward 20, for Miss Kate Maguire, dwell., 25' x 29' 6", two-st'y pitch; F. S. Crosby, builder.

Washington St., near Williams St., Ward 23, Jas. Dolan, dwell. and store, 27' x 34', two-st'y pitch.

Sullivan St., No. 50, Ward 3, for Sarah M. Jones, dwell., 22' and 24' x 36', three-st'y flat; J. W. Jones, builder.

Heath St., rear of, near Bickford Ave., for Francis Bleiler, stable, 24' x 38', one-st'y pitch; Robert D. Ward, builder.

Marion St., No. 194, Ward 1, for Henry Kenway, storage, 22' x 50', two-st'y flat, Henry Kenway, builder.

Cedar St., No. 11, Ward 3, for Wm. Murray, dwell., 21' x 51', three-st'y flat; John F. Wilson, builder.

Cottage St., rear, near Norfolk Ave., Ward 20, for Henry L. Batchelder, mechanical, 12' x 17', one-st'y pitch; John M. Stinson, builder.

Havre St., No. 70, Ward 2, for Sisters of Notre Dame, stable, 21' 6" x 40, one-st'y mansard; Holmes Bros., builders.

Errickson St., rear, opp. Fulton St., Ward 24, for Putnam Nail Co., stable, 39' x 64', two-st'y pitch, Putnam Nail Co.

Winslow St., near Zeigler St., Ward 20, for Warren Lathrop, dwell., 31' x 51', three-st'y flat; Henry G. Allen, builder.

Gardner St., near Baker St., Ward 23, for Highland Ice Co., dwell., 21' and 33' x 28' and 34', one-st'y pitch; Geo. A. Spear, builder.

Cottage St., near Railroad Bridge, for Henry L. Batchelder, office, 17' x 17' 6", one-st'y hip; John Horsfield, builder.

Buttonwood St., rear Mt. Vernon St., Ward 15, for Morris Welch, dwell., 21' x 30', one-st'y flat.

Saratoga St., No. 593, for Thomas Pounder, dwell., 19' x 27', one-st'y pitch; Wilbur Goodwin, builder.

Wadsworth St., near Milton St., Ward 1, for Ohabie Shalon, et al., chapel and dwell., 24' x 26', two-st'y pitch.

Shawmut Ave., Ward 19, *Nos.* 781-783, for J. C. and F. A. Loud, 2 dwells., 19' 6" x 60' 6", three-st'y flat.

Monadnock St., near Dudley St., Ward 20, for Edwin H. Kieth, dwell., 22' and 28' 6" x 20' and 32', two-st'y pitch; Duncanson & Marchbank, builders.

Mt. Bowdoin Summit, rear of, for Mary T. Mallon, stable, 42' 8" x 46' 8", two-st'y pitch; Geo. W. Woods, builder.

Commercial St., near South St., Ward 24, for Dexter J. Cutter, storage of coal, 50' x 100', one-st'y mansard; Malcolm McLeon, builder.

Ashmont St., cor. Unnamed St., Ward 24, for Timothy Dunn, 2 dwells., 15' x 25', two-st'y pitch; S. D. Ramsdell, builder.

M St., No. 3, Ward 14, for Wm. T. Eaton, dwell., 20' x 44', three-st'y flat; Wm. T. Eaton, builder.

West Third St., No. 65, Ward 13, for Wm. T. Eaton, dwell. and store, 20' x 36', three-st'y flat; Wm. T. Eaton, builder.

Gilbert St., near Centre St., Ward 23, for Owen Nawn, 2 dwells., 26' x 37', three-st'y flat; Stephen McNeil, builder.

Middle St., Nos. 71 *and* 73, Ward 15, for Michael Donovan, 2 dwells., 20' x 28', three-st'y flat; Clarence C. Snow, builder.

Park St., near Adams St., Ward 24, for Daniel Kelshea, dwell., 22' x 30', two-st'y flat; R. McCormick, builder.

Perkins St., rear of, Ward 23, for McDermott & Gormley, greenhouse, 30' x 75', one-st'y pitch; Reed & Ryan, builders.

Tudor St., No. 57, Ward 15, for Thomas W. Roulston, dwell., 22' x 42', three-st'y flat; Thomas W. Roulston, builder.

Brooklyn.

Building Permits. — *Elm St.*, s s, 235' w Bushwick Ave., 2 two-st'y frame dwells., tin roofs; cost, each, $2,800; owner and builder, Henry Stocks, 1437 Broadway; architect, J. Herr.

Nassau Ave., n s, 60' e Eckford St., 2 three-st'y frame tenements, gravel roofs; cost, total, $8,500; owner, Edward Preston, Leonard St.; architect, P. J. Tilson; builders, J. & J. Van Riper and S. W. Randall.

Herkimer St., n s, 248' 9" e Bedford Ave., 3 three-st'y brownstone front dwells., tin roofs; cost, each, $8,500; owner, M. E. Stafford, 835 Dean St.; architect and builder, John Stafford.

Grand St., n s, 200' w Ewen St., 3 three-st'y brick stores and dwells., tin roofs; cost, each, $7,000; owner, Coleman Estate, 171 Bedford Ave. and 206 Washington Ave.; architect, E. F. Gaylor; builders, S. J. Burrows and S. L. Hough.

Gates Ave., s s, 63' 4" w Throop Ave., 2 three-st'y brownstone front stores and tenements, gravel roofs; cost, each, $3,500; owner and builder, L. E. Brown, 126 Herkimer St.; architect, C. E. Cozzens.

Vernon Ave., n s, 160' w Tompkins Ave., 2 two-st'y brownstone front dwells., tin roofs; cost, each, $5,000; owner and builder, Jno. Cregier, 125 Vernon Ave.

Wolfe St., No. 116, s s, 320' e Franklin St., three-st'y frame tenement, gravel roof; cost, $4,000; owner, architect and builder, C. H. Reynolds, 111 Noble St.

Leonard St., e s, 330' s Nassau Ave., 3 three-st'y frame tenements, gravel roofs; cost, total, $9,000; owner, Mrs. Thos. Denman, Eckford St.; architect, F. Weber; builders, J. & J. Van Riper and S. W. Randall.

Ten Eyck St., No. 203, three-st'y frame double tenement, tin roof; cost, $4,000; owner, Catharine Scherer, 205 Ten Eyck St.; architect, J. Platte; builders, J. Schleret and F. J. Berlenbach.

Block bounded by Marcy and Harrison Aves., Lynch and Hayward Sts., three-st'y in front and one-st'y in rear, brick armory for Forty-seventh Regiment; cost, $96,000; owner, State of New York; architect, W. A. Mundell; builders, Jas. Rodwell & I. B. Jacobs.

Fourth St., n s, 150' w Sixth Ave., 3 two-st'y brownstone front dwells., tin roofs; cost, each, $5,000; owner and builder, Patrick Mullady, 576 Quincy St.; architects, Parfitt Bros.; mason, Philip Sullivan.

North Eighth St., n s, 80' e Third St., four-st'y brick tenement, tin roof, iron cornice; cost, $6,600; owner, Frederick Rau, Third St.; architect, A. Herbert; builder not selected.

Paige Ave., n w cor. Oakland St., one-st'y frame open shed; cost, $4,000; owner, Edward Smith, 131 Noble St.; architect and builder, S. F. Bartlett.

Alteration. — *South Eighth St., No.* 134, part of building raised three stories and part raised one-st'y, tin roof, etc.; cost, $8,000; owner, Jos. Heiser, Rockaway Beach; architect, J. Platte; builders, J. McQuade and Jenkins & Gillies.

Chicago.

Houses. — Cobb & Frost, architects, have plans ready for the following: —

House on the North Side, for Mr. R. W. Tansill, of greenstone, rough-hammered, slate roof.

Dwelling-houses on Bellevue Pl., for Mr. Potter Palmer, each 23' x 90', three-st'y brownstone.

House for Mrs. Turner, adjoining above, to be 30' x 90', of blue Bedford stone.

Dwell. for Mrs. Rothschild, on Michigan Ave., 25' x 65', three-st'y, pressed-brick and brownstone.

W. L. Carroll has completed plans for sixteen houses for Mr. R. T. Crane, Chicago pressed-brick, cut-stone trimmings.

Plans by same architect for three-st'y stone front house for L. T. Law, at 591 West Monroe St.

Burnham & Root, architects, have plans ready for house on Prairie Ave., for Mr. T. R. Birch, two-st'y brownstone.

Same architects will build house on North State St., two-st'y, for Mr. J. W. Brooks.

Mr. J. M. Van Osdel, architect, planned residence to be built on cor. of Adams and Leavitt Sts., for Mr. B. L. Crumb, two-st'y brownstone front; cost, $7,000.

Depot. — Burnham & Root are building a depot for the Chicago, Burlington & Quincy Railroad, at Galesburg, pressed-brick and stone, slate roof, 100' x 250'.

Church. — C. Chapman, architect, has prepared plans for a church for the Methodist Episcopal Society, cor. of Twenty-eighth St. and Portland Ave., 46' x 74', to be of Chicago pressed-brick, stone finish, two stories high.

Flats. — J. M. Van Osdel, architect, has drawings ready for flats on West Monroe St., for Mr. E. H. Gammon, three stories and basement, Bedford stone front; cost, $10,000.

Building Permits. — Stegman & Spory, two-st'y dwell., 21' x 56', 3440 Dearborn St.; cost, $3,000.

Louis Link, three-st'y basement store and flats, 25' x 75', 581 Blue Island Ave.; cost, $8,000.

J. Wittans, three-st'y basement stores and flats, 24' x 104', 607 Throop St.; cost, $11,000.

John Eger & Co., two-st'y brick factory, 35' x 85', 375–377 Illinois St.; cost, $3,000.

Theo. Dyckman, three-st'y basement store and flats, 25' x 59', Twenty-sixth St.; cost, $6,000.

D. Delaney, three-st'y flats, 22' x 64', 3603 Daspiel St.; cost, $4,000.

Thos. L. Gomier, 9 one-st'y stores, 32' x 297', Throop St., cor. Madison St.; cost, $20,000.

M. M. Rothchild, 3 two-st'y basement and attic dwells., 50' x 65', 3203 Indiana Ave.; cost, $15,000.

A. B. Johnson, four-st'y basement brick warehouse, 42' x 120', 551–555 Green St.; cost, $12,000.

M. Hagerty, two-st'y dwell., 24' x 46', 198 Polk St.; cost, $3,500.

Western Refrigerator Co., six-st'y brick refrigerator, 50' x 100', 231-233 Michigan St.; cost, $30,000.

J. Bauer, two-st'y dwell., 24' x 63', 401 Indiana St.; cost, $3,500.

Chas. Heineman, two-st'y basement dwell., 23' x 61'; cost, $5,000.

John Downey, three-st'y dwell., 24' x 108', No. 322 Harrison St.; cost, $11,000.

M. Morrison, two-st'y and basement dwell., 21' x 50', 841 Twenty-second St.; cost, $4,000; architect, G. Zucker; builder, W. Horack.

Geo. Auer, two-st'y and basement dwell., 23' x 48', 146 Johnson St.; cost, $3,500; architect, A. Bessler; builder, E. C. Chapper.