THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. VII. Copyright, 1880, HOUGHTON, OSGOOD & Co. No. 226.

APRIL 24, 1880.

Entered at the Post Office at Boston as second-class matter.

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SPRINGFIELD, Mass., has just completed the second season of its experiment in steam-heating by the Holly system, and the result of so thorough a trial seems to be on the whole satisfactory. The company has now seventy customers, a number large enough to afford a fair test of the advantages or disadvantages of the system. The cost to consumers, which to most persons interested is the important point, is found to be, for the simple heating of rooms by direct radiation, which is all that is yet attempted, somewhat more than that of stove-heat, economically managed, and somewhat less than warming by hot-air furnaces. The tariff which the company proposes to adopt will serve as a means of comparison which every one can apply for himself. It is usually estimated that in heating by direct steam at a pressure of four or five pounds, which is the average tension in the Springfield radiators, one foot of radiating surface will warm eighty to a hundred cubic feet of space. The company intend to fix their minimum charge at fifty cents per square foot of radiating surface for the season, which seems a very equitable arrangement, much more so than the regulation of prices by the number of cubic feet to be warmed, which was at first suggested. On the whole, we do not anticipate a speedy revolution in house-warming from the introduction of this system, unless, at least, it can be economically applied to the heating of the fresh-air supply by means of indirect radiation. While there will always be many who will be glad to be saved the care of domestic fires, a large portion of mankind will be sorry to give up the ventilation and cheerfulness of open fires and good stoves even for the efficiency of a well-conducted steam supply.

MR. CARROLL D. WRIGHT, for some years chief of the Massachusetts Bureau of Labor Statistics, has published some of the conclusions regarding strikes of operatives which have been deduced from the records kept in his office. There is no better authority than Mr. Wright; the figures are there to prove what he asserts, and his statements merit the earnest reflection of those who are interested in the subject. According to him, there have been in the State one hundred and fifty-nine strikes, or struggles between employers and employed, since 1830. Of these, one hundred and ten were unsuccessful, eighteen were successful, six partially so, and sixteen were compromised; the result of the remaining nine is unknown. Thus barely one strike in seven secures a temporary gain for the operatives, rarely sufficient to counterbalance the loss itself causes, while the other six result in total failure. In all cases, the operatives ultimately suffer the whole loss, and these losses are becoming enormous. The Fall River strike of 1879 was simply for money, the operatives — or rather a few spinners — demanding an increase of fifteen per cent in their wages, and compelling the rest to join them. The enforced idleness lasted for fifteen weeks, during which the work-people deprived themselves of fourteen hundred thousand dollars in wages. If they had gained the advance demanded, it would have taken two years for the extra fifteen per cent of wages to make up the losses which their voluntary idleness caused them. That the strike was unsuccessful, only made the matter a little worse for them. Mr. Wright condemns the system in the strongest terms, as demoralizing in its effects upon the individual workmen, and tending directly to lessen the demand for and the price of labor by compelling the manufacturers to substitute machinery for human assistance wherever possible, in order to be free from the senseless dictation of those inflated demagogues who go about "organizing labor," to its own ruin and their private gain. It is well known that emissaries of the English trades-unions, not content with having ruined forever the great industries of their own country, played a prominent part in inciting the poor Fall River people to keep up their worse than hopeless struggle, and Mr. Wright brings against these, or others like them, the terrible charge (but idle, we trust) of having been hired with money by English manufacturers to delude the American operatives into the same destruction which their crafty arts had brought upon their own associates.

ONE hundred and seventy-two companies have made returns to the Insurance Commissioner of the State of New York of their business during the year 1879, and there is now an opportunity of comparing their condition and prospects with those which existed at the end of 1878. The returns for 1878 were sufficiently discouraging, but 1879 shows a state of affairs considerably worse. Taking together all the companies incorporated under the New York laws, and all outside companies having agencies and doing business within the State, it appears that the receipts from premiums increased during the last year, being about 3,300,000 dollars in excess of 1878, this being due both to higher rates and increased valuations. But the losses were greater than in 1878 by six million dollars, or about twenty per cent, so that the net condition of the companies is considerably worse. The cost of maintaining the companies seems also not to have diminished, so that, taking the New York corporations alone, their losses were fifty-seven per cent of their receipts, and their other expenses fifty-four per cent, making a total of one hundred and eleven dollars expenses to every hundred of receipts, the balance of eleven dollars representing a fresh inroad on their capital. The companies from other States doing business in New York make a still worse showing, their average expenditure being one hundred and fifteen dollars for every hundred received. The foreign companies alone were able to transact their affairs at so small a cost for office expenses that their net outlay was four per cent less than their premium receipts, although their losses were heavier than the others, amounting to sixty-three per cent of their receipts. How long the stockholders will be amiable enough to contribute so heavily of their means to help out the policy-holders, it is impossible to say; but if the present ratio of income and expenses is maintained, it is safe to predict that few companies will survive many years. It would be a severe lesson in regard to the really economical construction of buildings, if a general bankruptcy of insurance companies should suddenly throw upon the shoulders of the public not only all the fire losses, but an additional loss of the premiums paid, which amounted last year, in New York alone, to fifty million dollars, and the bulk of the insurance capital besides.

A NEW industry, new at least in that country, has attained considerable proportions in England. Many architects are familiar with the Dutch "cement-tegels," consisting of small tiles made of fine concrete of various colors, some plain, of square, hexagonal, and triangular shapes, like the common plain floor tiles, but smaller, and some impressed with figures which are afterward filled in with a different color, after the manner of encaustic tiles. These are, in Holland, very common and cheap, and it is natural that the extending concrete industry of Great Britain should have taken up the manufacture of similar products. It would seem that some enterprising American companies might profitably imitate the example of their Transatlantic rivals. Our resources, both for cements and coloring substances, are fully equal to those of Holland or England, and the plant required for the enterprise would be comparatively small, smaller than that needed for the cement pipe and artificial stone manufactures. The English can sell their goods at four shillings per square yard and upwards, and the cost of the Dutch tiles is about the same. The cement tiles are very perfect in shape, and are agreeable in texture and color, besides ing very easy to lay securely in ordinary cement mortar. If they could be produced here for a price as low or lower than abroad, it seems likely that the demand would be large.

THE San Francisco *Bulletin* has the honor of having done a thing not itself new, but in this case remarkably well carried out;—the publication of a plan and specification for a cheap dwelling-house. The house is a very cheap one, costing but five hundred dollars; but the ground plan is singularly well-considered, convenient, economical, and free from those strange make-shifts which mark the designs of feeble planners, while the specification is a model of thoroughness. Neither in it nor the plan is anything forgotten or left out, and the specification particularly demands, with the minuteness characteristic of a writer who thoroughly understands his subject, a construction as good as need be desired in a house of far greater pretension. The design was made for the proprietors of the *Bulletin* by a well-known architect, and the sensible view of the matter which led them to seek the advice of a professional man in good standing has been met on his part by an unusual degree of care and success in the solution of a problem which is for most architects neither easy, attractive, nor remunerative. Mr. Pelton has been engaged to furnish other designs for buildings of different character suitable for city and country, and of the same or greater cost, and the series is to appear in the *Bulletin*, one every month. We wish the publishers and their architect the success they deserve, and can assure the profession as well as the public that if the succeeding plans are as good as the first, there will be much in the series which they can study with pleasure as well as profit.

THE competition for the Glasgow Municipal Buildings excites much interest in Great Britain. The Glasgow Institute, objecting to the final clause of the circular of invitation, which reserves to the authorities the right to employ either the author of one of the "premiated" designs, or any other person, as the architect of the building, have held a meeting, at which they adopted resolutions requesting the amendment of the terms, so that it should be understood that one or more of the successful competitors would be employed to execute the work; saying, what is undoubtedly true, that although the prizes offered were very liberal, considering the amount of work required (elevation only, for a plan already adopted), the better class of architects would not consent to enter any competition where the reputation and emolument attached to the actual carrying out of his design was not to be the reward of the successful individual. It was supposed that in any case the successful architect would be associated in carrying out his elevations with Mr. Carrick, the city architect, and author of the plans, and to that the Glasgow Institute saw no objection. Some criticisms were made at the meeting upon Mr. Carrick's plans, but it was thought best to make no mention of them in the communication to the city authorities.

THIS method, very commonly adopted in municipal competitions, of having plans prepared beforehand by an official architect, under the supervision of the city officers and others who will have to use the proposed building, and may therefore be supposed both to have the most interest in the planning of the new structure, and to know best about what the business of their several departments requires in the way of space, arrangement and light, has some objections in an artistic point of view. Even with the most skilful planning, the distributing of rooms without any special care for the elevations would be a proceeding little calculated to insure a pleasing exterior, especially in a "dignified classic" style, while the actual process of endeavoring to meet the wishes of a number of officials would be likely to degenerate into the mere aggregation of rooms, a process as far removed from planning, properly so called, as the result in elevation would be from any pretense of classic elegance. Even where the competing architects are not required to adhere to the plan prepared for their guidance, most of them are very likely, however sensible of its defects, and competent to improve upon it, to be astute enough to perceive that their interest will be best promoted by adhering to it pretty closely. In that way they will not only be sure of pleasing the municipal officials, who, seeing their own familiar arrangement adopted, will cast their suffrages for it in preference to a strange plan, which they would conceive a natural prejudice against even if they were willing to undergo the labor necessary for comprehending it, but they will secure the advocacy of the city architect, who will be gratified at seeing his own design endorsed, it may be by some very eminent professional brother, and whose opinion is sure to have great weight with the councilmen, assessors, and the other burgher authorities. A better mode is perhaps to give the number of rooms required on each floor, with the desired area of each. This gives more liberty to architects, and practically secures the advantage of holding them all to an arrangement accepted as the best by those most interested, without insuring the adoption of perhaps a very ill-considered form of that arrangement. The only precaution necessary to be observed is to see that sufficient thought is given to the list of requirements, so that the aggregate area of the second-story rooms shall not, as in one case we recollect, be almost double that of those permitted to occupy the first.

THE Balmain luminous paint, to which we lately referred, seems to be preparing for a descent upon the industrial world something like that of the telephone. The substance is a combination of lime and sulphur, not exactly a calcium sulphide, but containing a certain proportion of oxygen. The luminous properties of some compounds of this class have long been known, but the late Mr. Balmain succeeded in greatly increasing them, and facilitating their application. The paint is not in itself phosphorescent, but on being exposed to light absorbs, as it were, a certain quantity, which it radiates again when the original source of light is removed. It has been tried on railways, by painting the ceilings of the cars with it, and it is proposed to use it on the masts and spars of vessels, which would thus be protected from collision by being visible over their whole extent at night. Direction posts on roads may be painted with it, and it is said that the coating of fences and railings will give light enough to direct carriages and enable them to avoid running into other vehicles, or obstructions in their path. The action of the paint does not seem to be an oxidation, attended with fumes like those of phosphorus, but is said to be rather a fluorescent condition, through which the more refrangible rays of the spectrum, ordinarily invisible, are in some way retarded and rendered visible. This explanation does not seem quite clear, as it is not generally understood that any *solar* rays, however refrangible, strike the side of the earth which is turned away from them at night, but the main point, that there is no chemical change involved, is a matter of considerable importance.

THE railroads are undergoing a season of criticism, both in New York and Massachusetts, which seems likely to take form in legislation to regulate tariffs; not in the wild style of some previous attempts, but rather for the purpose of restricting the favoritism and discrimination, for one reason or another, to the advantage of certain firms or individuals, which, under the name of "special rates," "rebates," "secret contracts," and the like, has, justly or unjustly, done great injury to those who were not included in the advantageous terms. Perhaps, as the injured ones assert, those who control these enormous highways see no harm in using their power recklessly for their own selfish ends or for the enrichment of their personal friends; perhaps, as the railroads say, it is only the universal principle of business to give extra inducements to large customers, and that they are bound to offer such inducements if thereby their stockholders will be benefited. It would be harsh to accuse any one of actual wrong: at best, the notion that railways built by private capital had any responsibility to the public is of recent growth in this country, and it is fair to say that on the whole the roads have, of their own accord, treated the public well, so that whatever legislation is necessary should be decided upon with the utmost care and consideration. The investigations bring out some singular facts, which may be due as much to confusion in the minds of traffic agents as anything. For instance, it is in evidence that large manufacturers in Rochester, New York, find it considerably cheaper to send their goods to New York, and re-ship them thence to St. Louis and Cincinnati *viâ* Rochester, than to ship direct from home, thus paying for some three hundred useless miles of transportation; and there are scores of similar cases, while the preferences given to the Standard Oil Company by the great trunk lines, allowing that corporation rates for freight less than half those charged the other companies, are said to have injured the trade of its competitors to such an extent that there is now no refinery in New York State which the Standard Company does not own.

VENTILATION OF BUILDINGS.[1] — II.

THE influence of the vapor of water on air for respiration is a very important subject. The following table shows the capacity of air or vapor, and the tension of the vapor in inches of mercury at different temperatures.

Temp. Fah.	Tension of vapor in inches of mercury.	Weight in grains per cubic foot.			Volume of 1,000 cubic feet of dry air after its saturation.
		Vapor.	Saturated air.	Dry air.	
0°	.044		606.03	606.37	
5°	.054		599.40	599.83	
10°	.068	0.84	592.94	593.44	1002.3
15°	.086		586.55	587.18	
20°	.108	1.30	580.26	581.05	1003.6
25°	.135		574.08	575.05	
30°	.167	1.97	567.99	569.17	1005.6
35°	.204	2.48	561.99	563.42	
40°	.247	2.86	556.03	557.77	1008.3
45°	.299	3.44	550.19	552.24	
50°	.361	4.10	544.36	546.82	1012.0
55°	.433	4.87	538.60	541.50	
60°	.518	5.77	532.84	536.28	1017.3
65°	.617	6.81	527.14	531.17	
70°	.733	8.01	521.41	526.15	1024.4
75°	.868	9.39	515.60	521.22	
80°	1.023	10.98	509.97	516.39	1034.1
85°	1.203	12.78	504.19	511.65	
90°	1.410	14.85	498.43	506.99	1047.0
95°	1.646	17.18	492.56	502.41	

It will be seen, by the inspection of this table, that the quantity of vapor per cubic foot is nearly doubled with every 20° of additional temperature. So that if we take air that is saturated, at any given temperature, and heat it to a temperature 20° higher, we find it only 50% saturated.

Let us now look at the actual loss of heat by evaporation.

Air (as on the sea-coast) at 60° Fahrenheit, and 80% saturated, contains 4.62 grains of water per cubic foot. Air (as in Arizona) at 70° Fahrenheit, and 40% saturated, contains 3.2 grains per cubic foot. The latter, though 10° warmer, as indicated by the thermometer, *feels cooler;* because more than four times as much heat is lost by evaporation from the lungs, as in the former case, besides the excess of heat carried off by the skin. This is susceptible of actual proof as follows: —

The specific heat of air being 0.237 (nearly), and the air weighing about 536 grains in the first case, and 526 in the second case, as per above table; there being 7,000 grains in a pound, and 966 heat units being absorbed by evaporating a pound of water, the exhaled air at 90°, and saturated, then:

In breathing air at a temperature of 60°, with a humidity of 80%, the heat absorbed from the lungs is as follows, for one cubic foot:

Absorbed by heating the air: —

$$30° \times \frac{536}{7{,}000} \times 0.237 = 0.544 \text{ heat units};$$

Absorbed by evaporation: —

Air at 60°, and 80%, saturated, contains of vapor	4.616 grains.
Air at 90°, and 100% " " "	14.850 grains.
Supplied and taken up from the lungs . .	10.234 grains.

$$\text{Now} \quad \frac{10.234}{7{,}000} \times 966. = 1.412 \text{ heat units}.$$

Total, $1.412 + 0.544 = 1.956$ heat units.

If air is at 70°, and 40% humidity: —

Absorbed by heating the air,

$$20° \times \frac{526}{7{,}000} \times .237 = 0.356 \text{ heat units}.$$

Absorbed by evaporation: —

Air at 70°, and 40%, saturated, contains of vapor	3.20 grains.
Air at 90°, and 100% " " "	14.85 grains.
So the quantity taken up from the lungs is .	11.65 grains.

Now

$$\frac{11.65}{7{,}000} \times 966 = 1.608 \text{ units};$$

Total, $1.608 + 0.356 = 1.964$ units; or more heat than in the first case supplied by the lungs.

Now what amount of the vapor of water is compatible with the greatest degree of comfort and health?

Very vague notions prevail on this subject. We hear on one hand a general distrust of *dampness.* Air that is nearly saturated with vapor is almost universally condemned in theory, whatever be its temperature. If it be lower than 40° or 45° Fahrenheit, it feels chilly and "raw," as we call it. It carries off the bodily heat rapidly by conduction or convection from exposed parts of the body; though, as we have just seen, the lungs may not lose so much heat as by saturating a dryer air. Moreover, there are many humid climates, like that of Ireland, which are by no means unwholesome. Any circumstances which occur in such a damp climate, that tend to increase the dampness in *dwellings,* must, however, be much more carefully guarded against than here, where the natural condition of the air is relatively dryer, and such excess is readily absorbed.

We hear, also, a good deal about the need of supplying vapor to the air that is heated for warming our dwellings by closed stoves or steam-pipes, and various devices are now in general use for that purpose.

In severe winter weather, the air-supply for a furnace may be at 0° Fahrenheit, and therefore contain but 0.55 grains of vapor per cubic foot. This air is heated up to 100° or 150° perhaps, — though 100° is hot enough, — and after mixing with the air in the room we occupy, the whole is kept at about 70°. If no vapor be supplied, the 0.55 grains first found would be a very scanty supply for air at 70°, which can only be saturated by some fifteen times as much, or eight grains per cubic foot.

But even without artificial supply this air would probably not remain in this condition. All surfaces with which it comes in contact yield more or less vapor, especially if the room be occupied. But let us suppose that by some artificial means this air at 70° has been supplied with vapor enough to bring it to a humidity of 70%. This is about the state of "summer air" in this climate, when abundantly supplied with moisture by expanses of water or recent rains on the soil. Such is commonly supposed to be the desired state of things; but even if it were possible to maintain it in our heated rooms at this season, the result would not be so comfortable as we might at first suppose.

The difficulty of keeping the moisture consists in its considerable tension above the condition of things out of doors, so the vapor would escape through various cracks into the outer air by *diffusion;* also, that wherever coming in contact with window-glass or outside walls of our buildings, the cooling influence of these surfaces would instantly chill the air below the dew-point, and the vapor would stream down the glass, as we often see it do in a crowded hall under such circumstances. The discomfort or insalubrity of such a condition arises partly from the great contrast between such air and that out of doors, to which we may be alternately exposed; but chiefly to the tendency of the organic impurities to decompose rapidly when in contact with vapor of water at high temperatures. They thus become offensive as well as injurious by their putrid state, which might be in large degree avoided in a dryer air. Suppose a man to spend an hour walking or driving about the streets in a temperature of 0°. The respiration goes on actively, for a feeling of exhilaration always follows such exposure, if in health. The consequence is, as we have seen, that the air exhaled has not only to be heated some 80° or 90°, but supplied with water by evaporation to an extent that absorbs many times as much heat from the lungs as by heating the air; yet no disagreeable effect is produced. If sufficient clothing is provided to keep the skin warm, the loss of heat *there* is not great, for no sensible perspiration occurs under such temperatures without violent exertion. The air that is inhaled and heated 80° by the lungs is thereby rendered just as absorbent of moisture as if heated by contact with a stove, till the moist membranes of the lungs supply the water to it. The climate of high table-lands, such as exists in Siberia, and Arizona, is considered and in fact actually *found* to be very conducive to health; yet but very little vapor is found in the air in those places. The air is so dry that fresh meat dries up instead of putrefying in the open air, and certain tribes of Indians living in those elevated regions do not bury their dead, but dry their bodies on platforms, as we are told by Catlin.

I find the following quoted by Mr. Robert Briggs, from the report of Dr. J. S. Billings, on the Hygiene of the United States Army in 1875.

Descriptions of military posts, Fort Yuma, California. "During the months of April, May and June, no rains falls. Then, with the thermometer at 105°, the perspiration is scarcely seen on the skin, and it becomes dry and hard, and the hair crispy, and the furniture falls to pieces; ink dries so rapidly upon the pen that it requires washing off every few minutes; a No. 2 Faber's pencil leaves no more trace on paper than a piece of anthracite, and it is necessary to keep one immersed in water while using another that has been standing in water some time. Newspapers require to be handled with care; if rudely handled, they break. 12-lb. boxes of soap, when reweighed, gave but 10 lbs. Hams lost 12%, and rice 2%, of their original weight. Eggs that had been on hand for a few weeks lose their watery contents by evaporation; the remainder is tough and hard: this has probably led to the story that our hens lay hard-boiled eggs.

"This post, though not the most southerly, is the hottest military post in the United States. A temperature of 100° at Fort Yuma may exist for weeks in succession, and there will be no additional cases of sickness in consequence. We have none of the malarial diseases. The average rain-fall during four years was a little over two inches each year."

The influence of a dry climate as a preventive or cure for lung diseases is fully set forth in the report of the Massachusetts Board of Health, by Dr. H. I. Bowditch, who seems to have established it beyond dispute. Actual observation confirms the impression that no bad result follows the breathing air in hospital wards as dry as that of Arizona. Dr. Cowles, of the Boston City Hospital, says there is no discomfort arising from a humidity limited to 15% to 21% in his wards.

[1] A lecture by Mr. Edward S. Philbrick, C. E., delivered before the students of the Massachusetts Institute of Technology.

The small amount of humidity in our climate as compared with that of England is given by Mr. Robert Briggs, as a reason why a higher temperature within doors is needed here for comfort than in damper climates. The Englishman expresses surprise at the heat of our houses. A temperature of 70° to 75° appears excessive to a man who is accustomed to live in one of 55° to 60°. But the difference in humidity is a sufficient cause. If our air contained the same quota of moisture that the air of England does, we should not need the high temperature. It is the dryness of our air that absorbs heat by forcing evaporation, as has been explained, so that the system loses as much heat in our dry rooms heated to 75°, as in an Englishman's parlor at 65° with its moderate evaporation. If the damp air of England were heated to the high temperature to which we are accustomed, it would be extremely uncomfortable, if not unendurable. Dr. De Chaumont has stated (Proceedings of Royal Society, V. N., 1877, p. 495), that the amount of CO_2 in air when vitiated to certain degrees perceptible to the senses was found to be as follows: First, fresh air, 1.1943%; second, rather close, .4132%; third, close, .6708%; fourth, extremely close, .9054%. He therefore adopted 2 in 10,000 as the limit of respiratory impurity in an air-space well ventilated, being the same standard as adopted by Parkes. Dr. De Chaumont also estimated that an increase of 1% of humidity has as much influence on the condition of an air-space, as judged of by the sense of smell, as a rise of temperature of 4.18° Fahrenheit. For this reason extreme heat in England, when it occurs, is much more oppressive than in dryer climates. The surrounding ocean nearly saturates the air with moisture at all seasons. When the temperature is above 70° or 80°, comfort requires that the heat of the body be reduced, to which end a dry air that evaporates the perspiration conduces most rapidly. Hence the most uncomfortable weather we have in our own summers occurs when extreme heat is accompanied by the south-west trade-wind, that comes laden with vapor from the tropical seas, and incapable of absorbing more. We call it "dog-day weather," and it is associated with a feeling of suffocation, arising from the plethora of vapor, and the inability of such air to cool the accumulated animal heat by evaporation of perspiration on the skin. The least exertion covers us with moisture, though the temperature may be several degrees lower than on other days when a dry north-wester carries off the moisture as fast as it comes through the skin, with the corresponding cooling effect. In short, the damp air when above 60°, always feels hotter than the thermometer shows it to be, while the dry air often feels cooler than it is.

When below 50°, an air nearly saturated with watery vapor becomes disagreeably chilly, not by promoting evaporation, but by the capacity for heat existing in the water; the specific heat of watery vapor being over twice that of air, and the loss occurring by convection through contact with the skin. This effect is therefore partly checked by warm clothing, till the clothing itself becomes dampened, when its effect is rather worse than that of the damp air.

Every one knows the danger of wearing wet clothing. Mrs. Brassey says (Voyage in the Yacht Sunbeam), the rains are so frequent in Polynesia that the natives are said to be much more troubled by pulmonary diseases since their civilized habits have taught them to wear clothes, because they have not learned the importance of keeping them dry. When naked, the skin dried quickly after a shower, while now they wear wet clothing till it becomes dry, a much longer process, demanding a large supply of heat from within to carry on the evaporation.

Although it is not desirable to provide for the saturation of the air in our houses in winter to a standard near to that of summer air, and although a comparatively dry air is not found unwholesome, the addition of a small quantity of water, such as is now generally done in most of our house furnaces, is for some reason or other apparently necessary, both for comfort and the preservation of ordinary wood-furniture, which tumbles in pieces in a very troublesome way if kept in an air with less than 10% or 15% of humidity. In a paper read before the American Institute of Architects by Mr. Robert Briggs, he discusses this question very clearly and fully. He speaks of the discomfort arising from rooms heated without any artificial supply of water, and attributes it to the lack of humidity simply. But Dr. John S. Billings attributes the discomfort to a lack of fresh air, or a temperature in the air that is supplied that is too high for comfort, if enough be admitted to keep the quality good. The exposure of water and its consequent rapid evaporation absorbs this surplus heat, and allows the proper amount of fresh air to be admitted without the sense of over-heating. If it be argued that the dry air, even at the higher temperature, would call for an amount of evaporation in the lungs to cancel the surplus heat, the answer would be that the presence of any considerable number of inmates would tend itself to over-heat the room. Thus, when we come to consider large halls for the accommodation of hundreds of people, artificial evaporation is unnecessary, for the lungs of the inmates supply more vapor of water than is actually needed, and it becomes an evil. The heating of theatres and large halls, court-rooms, etc., together with a proper amount of ventilation, is a very difficult problem. We have two very different conditions to provide for; first, the heating of the vacant hall to a degree consistent with comfort, say 60°, which is simple enough; second, the maintenance of this or any other comfortable temperature after the hall is filled with people, which is far more difficult. We have then to supply fresh air for breathing, and diffuse it over the space without disagreeable draughts, at the rate of some 30 or 40 cubic feet per minute for every person in the hall, and carry off the same quantity of vitiated air. We have also to take into account the heating capacity of the inmates, rather an indefinite quantity, concerning which no reliable data can be had, and which we must estimate as best we may. The amount of heat imparted by the human body to the surrounding medium must vary largely with the state of activity, vigor of the circulation, and the difference of temperature between the body (standard, 98°) and that of the surrounding medium. Comfort requires a constant escape of heat, so we may suppose the surrounding medium to be cooler than the body, *i. e.*, that the conditions are such as we wish in order to produce comfort. It has been variously estimated under such condition, that an adult gives out from 150 to 470 heat units per hour: the greater amount is about the same as that produced by the burning of a sperm candle. But if we take a moderate estimate, say 200 heat units per hour, for people at rest in a comfortable room, we shall have for the number of cubic feet of air thus heated 1° per minute for each adult, $\frac{200}{60 \times .238 \times .0766} = 1{,}818$ cubic feet of air heated from 60° to 61° in one minute by an adult.

The capacity for emitting watery vapor from the lungs is, as above stated, sufficient to relieve us from any need of an artificial supply of vapor. The excess is rapidly diffused and carried upward with the vitiated air. This vapor has the convenient quality of seizing upon and carrying with it many noxious organic vapors and dusts which we can thus get rid of. The failure to get rid of this, in fact, is the most frequent cause of trouble. Another complication is met with here. These organic vapors arising from the exhalations of an assembled audience are mostly in a putrescent condition to begin with. The loading of the air with vapor of water tends to hasten this decomposition, so that after being heated, steamed, and sent upward by their buoyancy, mingled perhaps, in the upper gallery of a theatre, with the products of several hundred gas-burners, each emitting as much heat, watery vapor, and CO_2 and consuming as much oxygen, as half a dozen men at least, we have a state of things sufficiently repulsive to make the strongest man succumb.

The power of dry air to delay the putrefaction of solids has been before alluded to, in connection with the drying of meats in Arizona; but here we have the reverse of all those conditions: plenty of heat, plenty of vapor, and the organic impurities, already corrupt when given off, and in that gaseous or finely divided condition which is most conducive to rapid decomposition. The only wonder seems to be that we ever are able to spend half an hour in such an atmosphere without seriously impairing our health. That we do not, is only a proof of the native vigor which resists such influences.

It is a case of almost daily, or at least nightly, occurrence, to find such halls provided with the same influx of heated air, hour after hour, with the seats all filled, that was provided *before* the people came there. The degree of *heat* found necessary to bring the vacant hall up to 60°, and keep it so, is largely in excess when a thousand people are breathing in it, while the *quantity* of air coming in is rarely enough. In short, we want not only a much less supply of heat to produce a given temperature in a filled hall, than in an empty one; but we want to keep the actual temperature lower when filled than at first, owing to the increase of humidity. To accomplish this with success, and at the same time furnish the required *supply of air*, is the thing which is rarely done. Of course it requires a degree of intelligent supervision to regulate the heat of the fresh air, while keeping up the supply in volume. Regard must also be had to the condition of the air outside. A change of 10° or 15° in the outside temperature during two hours, affects the case not only by loss of heat through the walls, windows, doors, etc., but by requiring so much more heat applied to the fresh air that is introduced, in order to produce the same effect, *i. e.*, bring it to the desired temperature when admitted to the room.

I have thus far tried to describe the *amount of work* to be done in changing the air inside of buildings. I shall, in the next lecture, try to show *how* this work can best be done.

PORTLAND CEMENT. — III.

IN the discussion which followed the reading of Mr. Faija's paper,[1] Professor Alex. B. W. Kennedy, M. Inst. C. E., said: The subject of this paper is of quite as much interest to engineers as to architects, and of quite as much importance. The author's method of treating it has, however, kept him from mentioning many points of considerable importance which ought to be looked at, for some of them are too often neglected. I should like, in the first place, to say a word or two about some of the points which he has mentioned. On page 113, he gives experiments as to the non-cementing of material which passes through very small meshes, which I must say took me by surprise, as I dare say they would many who have not tried them. I had the curiosity to test the question for myself, and with a result which exactly tallied with his. I took a couple of pounds of a fairly quick-setting cement of which 17 per cent passed through a No. 50 mesh (2,500 to the square inch), while 71 per cent passed through a No. 70 mesh (4,900 to the square inch), and the remaining 12 per cent I made into a cake. At the expiration of 44 hours it had not set in the least. I find that Bauschinger has experimented upon this also. He took cement which, as delivered, had a tenacity of 398 lbs.

[1] A paper by Mr. Henry Faija, Associate M. Inst. C. E., read before the Royal Institute of British Architects, February 3, 1880.

per square inch after four weeks. The part of this cement which went through a 5,800 mesh had a tenacity somewhat less at the same time. That, however, which was left behind had at best a tenacity only about one-fifth of its original strength, and in some cases would not set at all. There is a matter on page 115, which I am sorry to say I am not able to see in the same light as Mr. Faija. He says that as we express loads in pounds per square inch, it would seem natural that the briquettes should have one square inch of area. If this were any valid reason whatever, then on the Continent briquettes should have an area of a square centimetre, which of course no one would think of proposing. The question of reducing one area to another is merely an arithmetical one, and the proper area must be decided on quite other grounds than that suggested by the author. I confess my own leaning is rather to larger briquettes, for the reason that, so far as I know from my own experience and from the experiments of other people, the smaller a briquette is, the more does its resistance depend on the skill of the man who gauges it, and the less does the result obtained from it have any direct bearing on the practical value of the cement tested. The large briquette will of course give in general a much smaller result than the small one, but a result which is much more independent of specially skilled manipulation, and of much greater practical value. I, myself, am using a briquette of standard area (2¼ square inches) of a form designed by my friend Mr. R. H. Willis, with the special object of getting the line of pull exactly in the axis of the briquette. It has conical ends with flattened sides, and gives very good results. Bauschinger, who probably has made more experimental determinations on this subject than any other man, uses simply a rectangular block of 2⅝ inches by 4¾ (72 square centimetres), and grips it between wedges; his cross-section is thus 11 square inches. Indeed, I am disappointed that Mr. Faija has not said anything about the experiments which were completed about twelve months ago by Professor Bauschinger (of Munich), which contain somewhere about 15,000 separate determinations (summarized by the author), including all the points on which Mr. Faija has given results, and a great many more. He has tested neat cement after one, four, eight, twelve, sixteen and 120 weeks, cement mixed with sand in various ratios, cement old and fresh, large and small briquettes, and briquettes moulded in different ways, shearing strength, crushing strength and bending resistance, as well as tensile strength, specific gravity, chemical constitution, absorption of water, increase in volume in drying, and many other matters. I know of no more complete monograph on any subject, and it would have been of much interest if the author had given us some summary of the results. It is customary, for some reason or other, to test cement only in tension. I do not know why, for we certainly take care not to utilize its resistance to tension at all; we subject it either to crushing or to shearing. There is no difficulty about testing cement in compression, for cubes will break by crushing as fairly as any briquettes, and their breaking point is quite as determinate. It is often assumed that the compressive resistance bears some constant ratio (often 10 times) to the tensile strength. This, however, is a mistake. The ratio varies from 7 to 13, and the mere tenacity of a cement is no guide to its compressive resistance. I may give you three sets of experiments that I have made myself recently on 1½-inch cubes cut from ordinary briquettes. With a slow-setting cement, having a tenacity of 490 lbs., the crushing resistance was 5,200 lbs., or nearly 11 to 1. With a quick-setting cement of 522 lbs. tenacity, the crushing resistance was 4,510 lbs. per square inch, or 8.64 to 1; while a third cement of medium quality gave the figures 326 and 2,620 lbs. per square inch respectively, or 8 to 1. The resistance to crushing increases with time more quickly than the tenacity, that is to say, a ratio 8 : 1 after one week, becomes in sixteen weeks 10 : 1 in the average of a great many of Bauschinger's experiments. The crushing resistance of flat plates is of course much greater than that of cubes, but the exact point of destruction is not so easily determined. With the shearing resistance I have not myself made any experiments, but I find that the average of a very large number of Bauschinger's which I have examined is that the shearing resistance of cement varies little from being 25 per cent greater than its tenacity. It is singularly uniform, and it increases with time as the tenacity increases. My colleague, Professor Lewis, has asked me if I could say anything as to the elasticity of cement; but I had not experimented on this point, and have only had time just to look at it. I planed down an unbroken briquette into a prism 6¼ inches long and 1½ inches square; I put that in my testing-machine and *bent* it. To measure the deflections, Mr. Willis schemed a simple telescopic apparatus, and the deflections I got were: with a load of 50 lbs. (applied at two points four inches apart), 0.0025 of an inch; with 100 lbs., .0066; with 150 lbs., .01 inch; and at 175 lbs. the piece broke. I merely mention this experiment as a matter of curiosity, and to show that cement *will* bend, although the deflection is so very small. The maximum tensile stress which cement will stand in the form of a beam before it breaks, calculated in the usual fashion, Bauschinger appears to make somewhere about three times the direct tenacity. That I have been unable to verify myself, but I have no reason to doubt his correctness. The question of the way in which a cement shall be allowed to set before testing is of some importance. On the Continent they seem to be more fond of drying in the air than we are. No doubt, as a rule, cement which has been in water for a long time has a tenacity higher than that which has been in air only, but I do not find that the crushing resistance is affected in the same way. When, however, the cement is not neat, but mixed with sand, it does not appear to make any difference whether it is dried in air or under water. Another point which has been several times mentioned in connection with the testing of cement is the question of moulding under pressure. One uses the cement under pressure, of course, so this appears a point of some practical interest. I moulded some briquettes last week specially to try this point. I put 300 lbs. on each briquette, which corresponded to a pressure of about 20 lbs. per square inch, and their average tenacity was 505 lbs. per square inch (the minimum being 454 lbs. and the maximum 555 lbs.), while the mean of 13 ordinary briquettes of the same sample was only 273 lbs. per square inch (the minimum 240 lbs., the maximum 340 lbs.). The tenacity was increased 1.85 times, although the new briquettes had only been under water 4½ days and the other 7 days. The question whether cement is injured by being kept in bulk has often been discussed. Bauschinger has examined this point also, and having tested some 1,500 to 1,700 briquettes made from cement which he had stored from 3 to 3½ months in a dry place before moulding, the results were somewhat less regular than with briquettes made from fresh cement, but the average strength was nearly the same. And now, lastly, as to the general question raised by Mr. Faija's specification. I fear that, unless you are much fonder than we engineers are of very elaborate specifications, such intricate clauses can never be of any use, and that even if they were inserted they could never be adhered to. I would, however, make a suggestion. It being unquestionably of importance that cement should be properly tested, and equally true that if it be not tested in a uniform fashion the results will have comparatively little value, it might be possible for the Council of the Royal Institute of British Architects, in conjunction possibly with the Council of the Institution of Civil Engineers, to agree upon some standard method of testing cement. Then it would be an easy thing to put in a specification that the cement was to be tested according to an acknowledged standard, and would save all such long and minutely particular clauses as those suggested by the author, which, moreover, might and would be altered by different people in one and another detail until the whole affair became hopelessly confused. If this were done I would make two further suggestions: first, that the size of the briquette should be rather increased than diminished, and, secondly, that the compressive resistance ought to be made a part of the test, if, indeed, it should not altogether replace the test for tensile strength.

Professor Kerr, *Fellow.*—I have listened with very great pleasure to what has been said by Professor Kennedy, and I must say with a little more interest than that which I found in the paper itself, for it struck me that the learned lecturer has imparted very little information that would practically apply to the use of Portland cement by ordinary builders. As for introducing in our practice such a test as he speaks of — that is perfectly out of the question; and if, under the new Act of Parliament, the district surveyors, of whom I see a distinguished leader present, are to apply such a test as that to every sack of cement brought on a building, I do not know where it is to end. What Professor Kennedy suggests as a simple test strikes me as being exceedingly serviceable. I thought, while the paper was being read, that the tensile strain was one which it seemed difficult to proceed upon, and that the compressive test would serve our purpose a great deal better. It seemed to me that the test might be reduced to some such form as this: that a certain weight of cement, no matter what cement, might be mixed with a regulated quantity of water, and placed after a time (without any of this ceremonial about being so many days under water), when thoroughly set and dry, under some simple crushing process. Then it seems to me that it would be the easiest thing in the world to determine whether it was fit for our use or not. We do not care whether it is coarse or fine, all we care about is the effective strength; and it seems to me that the compressive test would determine that, and also that it might be determined with the least possible trouble. All this information about the German researches is very interesting, no doubt, to those who may have years to spend upon it; but as we architects use cement, something very much simpler must be put before us. I was glad to find the author at the end of his discourse mentioning that with cement, as with everything else of the kind, the less the quantity of water, the better the result. The reason is plain: the water has to be evaporated out in course of time, and that which is so evaporated must necessarily leave a vacuum behind (filled with air, of course); therefore, in plain language, the more water there is put in, the more water there is to evaporate out, and the more porous is the cement. We thus come back to the process of M. Coignet, which must have made an impression upon the minds of many persons present: that, with perfect manipulation and perfect materials, the smallest quantity of water always produces the best mortar — or the best artificial stone in his case. Gentlemen are no doubt aware that the quantity of water M. Coignet uses in his bêton is so extremely small as to be almost incapable of being discovered in the powder which is ready by pressure or gentle percussion to be converted into the artificial stone. On the whole, the information conveyed to us by Mr. Faija and Professor Kennedy is extremely useful, and I hope we shall hear the opinions of others upon the subject. One will think of what another will not, and, seeing that cement is coming more and more into use, it is extremely important that we should thoroughly understand its qualities. There is one respect in which cement is being extensively introduced, which I think requires to be considered by architects, and it has not been mentioned to-night. I refer to fire-proof floors. We find iron joists placed at certain intervals, and cement slabs, whether flat slabs or so-called arched slabs; and it seems desirable that we should understand the exact behavior that is to be expected from such slabs.

Herr Gustav Grawitz. — I quite agree with the greater part of Mr. Faija's able paper, for its contents generally correspond with the results of numerous experiments made in Germany with German Portland cement. I desire, however, to make a few remarks in order to draw comparisons between English tests and German tests, and to submit suggestions which may be of some use. As Portland cements are never used neat, but always mixed with sand in mortar or concrete, the Germans have substituted the tests with briquettes made of neat cement for those with briquettes made of mixtures of cement and sand. I am surprised to hear Mr. Faija state that tests made by the Metropolitan Board of Works are still carried on with briquettes of neat cement; for a new specification, in accordance with the German system, was introduced by the Board last October. The cement is now gauged with three times its weight of dry sand, which has passed through a sieve of 400 and been retained upon one of 900 meshes to the square inch, by which process the coarser and finer particles are eliminated. All the briquettes have to bear a tensile strain of 140 lbs. per square inch after having been forty-eight hours in air and twenty-six days in water. The German rules require a tensile strength of ten kilogrammes per square centimetre, or 142.2 lbs. per square inch; and the standard sand used in Germany is clean and dry quartz sand which has passed through a sieve of sixty meshes per square centimetre (387 meshes per square inch) and been retained upon one of 120 meshes per square centimetre (774 meshes per square inch). At the Metropolitan Board of Works the briquettes are kept two days in air and twenty-six days in water, whilst in Germany they are kept one day in air and twenty-seven days in water. I quite agree with Mr. Faija, that the briquettes should be broken directly on being taken out of the water in order to secure uniform results, for it has been proved that they lose in strength if afterwards kept in air during a lengthened period. I cannot, however, agree with his statement that all Portland cements before using should be properly seasoned or cooled; for it is well known in Germany that a very good brand of slow-setting Portland cement can, at any time, be safely used direct from the mill. In fact, a slow-setting Portland cement cannot be considered a good one if it require seasoning, but it is different in the case of quick-setting cements, from which great strength and reliability cannot be expected. With regard to the degree of fineness of cement as specified by Mr. Faija, namely, "no residue on a sieve of 625 meshes per square inch," I do not object to that. German Portland cements are often so finely ground now that, if passed through a sieve having 180 meshes per square centimetre, or 1,161 meshes per square inch, they leave not over 0.2 per cent of residue. Mr. Faija proposes that not over 15 per cent of residue should remain on a sieve of 2,500 meshes per square inch; this is decidedly too much, for finely-ground German Portland cements do not leave more than two per cent of residue on such a sieve. The last specification of the Metropolitan Board of Works requires that 80 per cent of the cement shall pass through a sieve of 5,800 meshes to the square inch, about the same degree of fineness as prescribed by the German official rules, still there are German manufacturers whose produce never leaves more than half this amount of residue, or about 10 per cent, on such a sieve, and sometimes even much less. The weight per striked bushel is specified by Mr. Faija to be not over 116 lbs. and not under 108 lbs. Now, although it is quite true that the weight, unless taken in conjunction with the fineness to which cement is ground, is absolutely valueless as a guide to the quality, and that therefore the two should always be taken in combination, it appears to me that the mode proposed by Mr. Faija is too complicated for ordinary practical purposes. Finely-ground and strong German Portland cements never weigh more than from 110 lbs. to 112 lbs. per striked bushel; and as already stated some time ago by Mr. Bramwell, and corroborated by Mr. Grant's valuable experiments, the test for heavy weight is merely a premium for bad grinding calculated to mislead, for badly-ground cement means inferior cement. As already proposed by Professor Kennedy, a uniform method of valuation is a matter of great importance for both manufacturers and users of Portland cement. The German system of official rules works admirably, and it is a pity that independent public testing rooms under Government control, such for instance as the Testing Department for Building Materials at the Royal Industrial Academy in Berlin, are not yet established in England. However reliable and trustworthy a private Portland cement tester may be, sellers and buyers very frequently disagree as to employing for this purpose the same person, and thus difficulties arise. The best reputed German Portland cement manufacturers guarantee their produce to have certain degrees of tensile strength if tested according to the official German rules. This is of great importance, enabling users to rely with confidence on the quality of a cement, whilst the security which such reliance must engender adds greatly to the consumption of Portland cement. A drawback still in existence is that those manufacturers who give themselves the utmost trouble, and do not shrink from extra expense in order to produce a thoroughly good Portland cement, much stronger than is generally specified, cannot in many instances obtain a higher price than those who supply a commodity worth much less in reality, and which merely comes up to the requirements of the specification. This is no inducement for manufacturers to improve their produce. Portland cement, therefore, provided it stands the preliminary tests for fineness, weight, expansion and contraction, should be valued, like every other merchandise, according to its quality, namely, tensile strength, as for instance in the case of alcohols, where the overproof is paid for. A cement at 50*s.* per ton may be much cheaper than another cement at 40*s.* per ton; this depends entirely on the quality, namely, the quantity of sand with which each cement can be safely mixed. Architects and engineers have every interest to use only the very best materials. Many consumers of Portland cement have no idea of the enormous waste which always takes place when weak cements are used; besides, it is obvious that if 300 tons of one cement can safely do the work of 500 tons of another cement, the preference ought to be given to the former, and a deal of superfluous expense saved on cartage and freight. I venture to submit that the establishment, in England, of a public testing department for the building-materials under Government control would be in the interest both of producers and users of Portland cement, and that official rules for a uniform method of valuation of Portland cement should be agreed upon. I also think that Portland cement in future should be valued, like every other merchandise, according to its quality, namely, tensile strength.

THE ILLUSTRATIONS.

THE CHURCH OF THE MESSIAH, ST. LOUIS, MO. MESSRS. PEABODY & STEARNS, ARCHITECTS, BOSTON, MASS.

OLD HOUSE ON SALEM ST., BOSTON, MASS. SKETCHED BY MR. G. R. TOLMAN, ARCHITECT.

The following is all that it has been possible to ascertain of the history of this house: An elderly lady, a former tenant, says it is two hundred years old. Mr. William Locke, a former owner, had some facts relating to it, but has lost and forgotten them, except that the timber of which it is built was cut on the spot, in Cooper Street and vicinity. Up the court, at the first window beyond the door, on a pane of glass, cut with a diamond, is "Lydia Greenleaf at Boston 1796." It is believed that the house is as old as represented, evidently being of the same style of work as the "Old Corner Store," in Dock Square, built in 1690, said to be the oldest one in Boston. The Salem Street building consists of a block of two, with a number of rambling tenements extending up the back yard.

STUDIO FOR R. S. GIFFORD, ESQ., NONQUIT, MASS. MESSRS. ROSSITER & WRIGHT, ARCHITECTS, NEW YORK, N. Y.

HOUSE FOR A. P. GIRTY, ESQ., CLEVELAND, O. MR. L. SCOFIELD, ARCHITECT, CLEVELAND, O.

HOUSE ON COMMONWEALTH AVENUE, BOSTON, MASS. MR. J. P. PUTNAM, ARCHITECT, BOSTON, MASS.

THE STRENGTH OF BEAMS.

BY F. E. KIDDER, B. C. E.

A large proportion of our architects and constructors guess at the required dimensions of the beams and girders they may need to use in construction, because they have no simple method of calculating the proper size. It is the object of this article to present the subject of the strength of beams, and particularly iron beams, in such a simple and practical form that any architect or builder who can substitute figures for letters in a simple formula may be able to calculate with accuracy the exact dimensions of a beam desired to carry a certain load.

The following is the notation employed in the formulæ: —

Let a, and a', denote constants derived from experiments on the different materials; b, the breadth of the beam in inches; d, the depth of the beam, also in inches; I, the moment of inertia, the axis being at right angles to the longitudinal axis of the beam; L, the length of the beam between bearings, in feet; l, the length of the beam between bearings, in inches; M, the bending moment; W, a uniformly distributed load; W', a concentrated load applied at the centre; W'', a concentrated load applied at some point other than the centre; and R, the modulus of rupture.

The fundamental formula from which all others must be derived is obtained by placing the *bending moment* of the beam equal to the *moment of resistance*, and is expressed by the formula: —

$$My = RI, \text{ or } M = \frac{RI}{y}, \qquad (1.)$$

y, in beams of regular cross-section, being equal to one-half of the depth.

The method of obtaining the values for the different quantities used in the above formula can be found in any large treatise on the strength of materials but we shall here present only the final formulæ, after we have simplified them as much as we can.

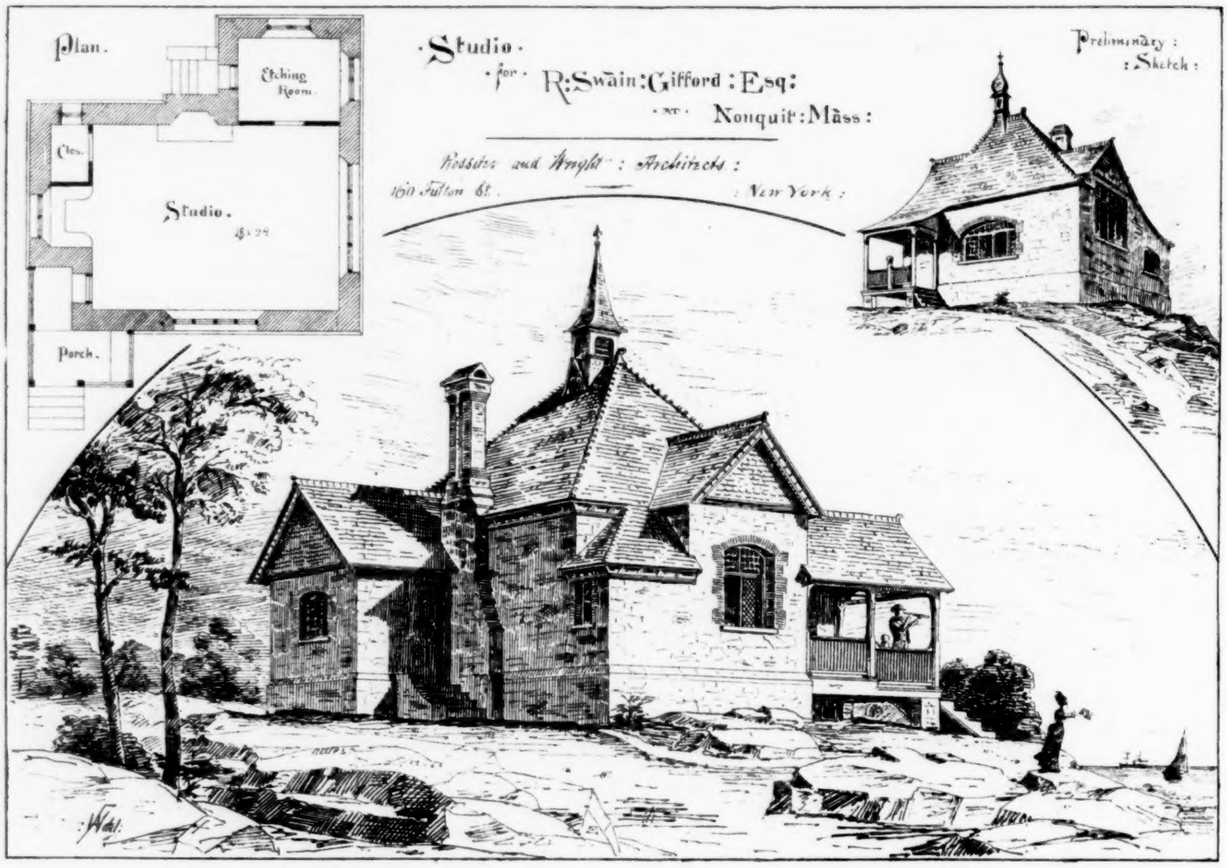
The following formulæ will serve for the calculation of *rectangular wooden beams*, under the different cases occurring in building construction.

BEAMS FIXED AT ONE END.

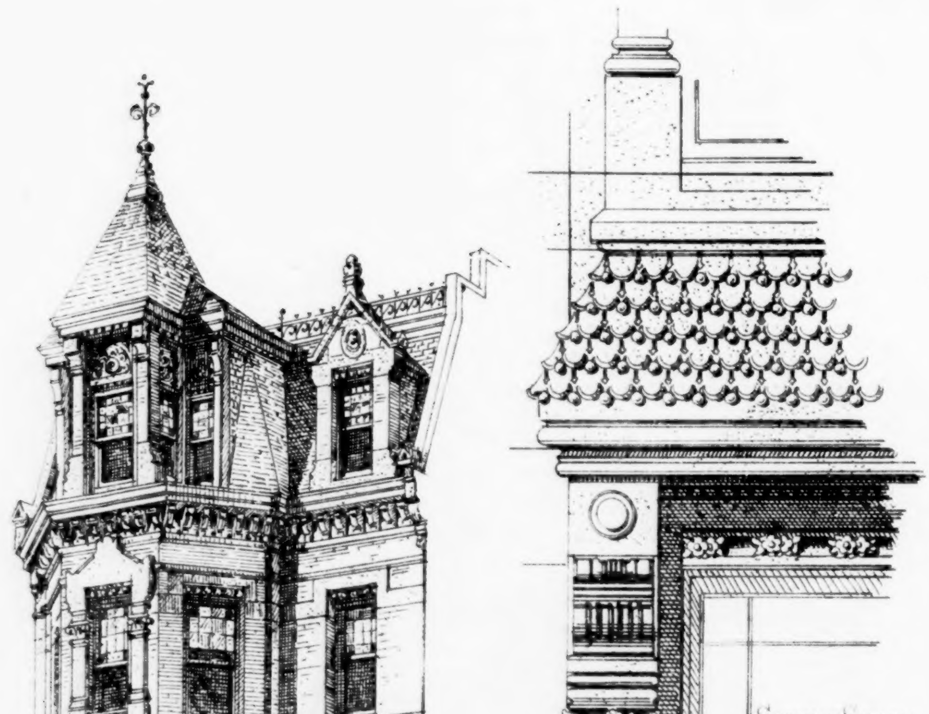
Loaded at the extreme end: —

$$W'' = \frac{b \times d^2 \times a'}{5 \times L}, \text{ or } b = \frac{5 \times W'' \times L}{d^2 \times a'}. \qquad (2.)$$

For the sake of simplifying computations, a' is substituted for $\frac{1}{72}$ of the modulus of rupture, or $a' = \frac{R}{72}$.

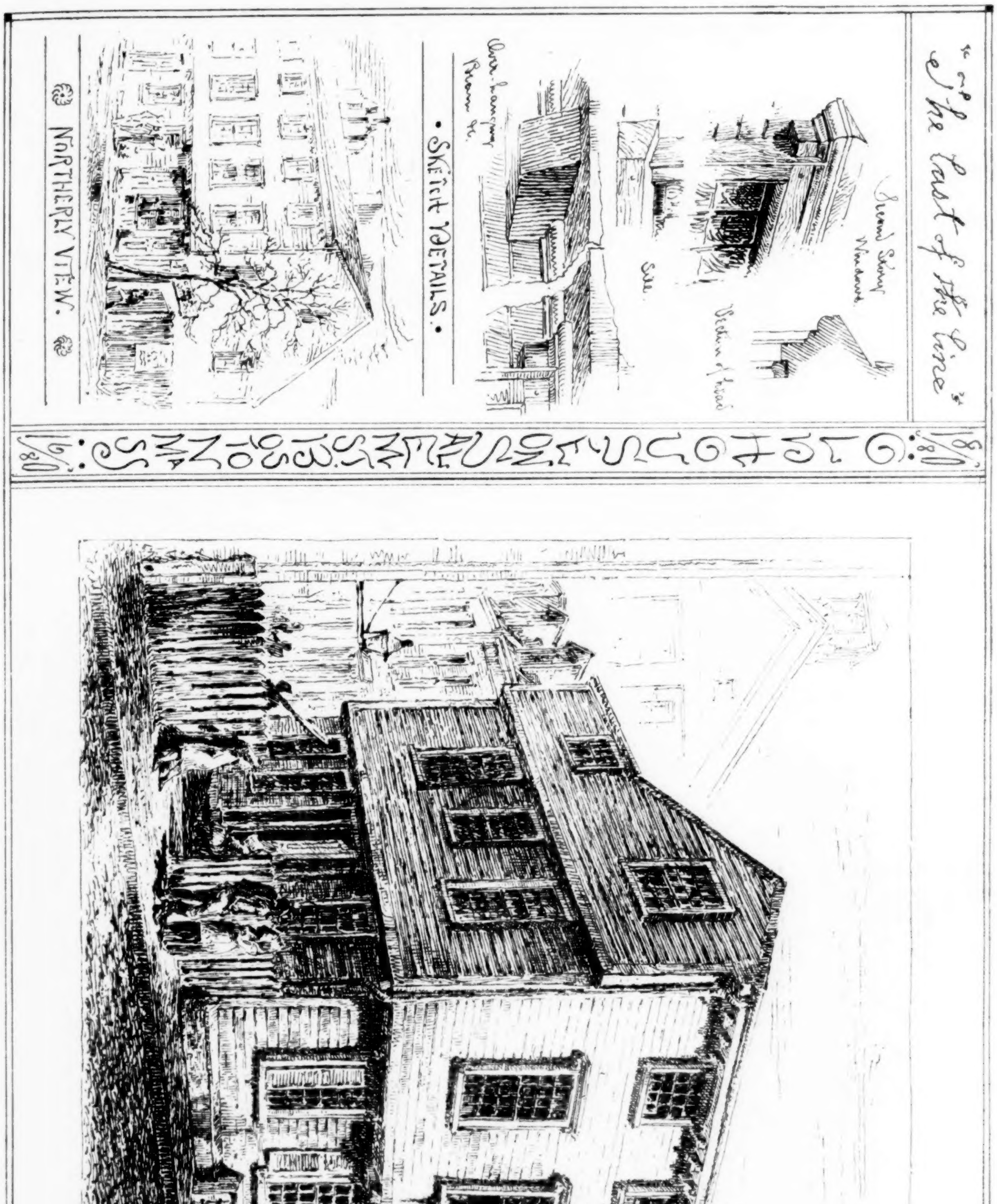


THE HELIOTYPE PRINTING CO. 126 PEARL ST. BOSTON



HOUSE ON COMMONWEALTH AVENUE J. P. PUTNAM ARCHT.

THE HELIOTYPE PRINTING CO. 126 PEARL ST. BOSTON


"The Last of the Line"
SKETCH DETAILS.
NORTHERLY VIEW.

View of Church as now building.

THE CHURCH OF THE MESSIAH ST. LOUIS MO. AD 1880

PEABODY & STEARNS ARCHTS. BOSTON MASS.

First Sketch.

THE HELIOTYPE PRINTING CO. 126 PEARL ST. BOSTON

Loaded with a uniformly distributed load: —

$$W = \frac{2\,(b \times d^2 \times a')}{5 \times L}, \text{ or } b = \frac{5 \times L \times W}{2 \times d^2 \times a'}. \qquad (3.)$$

BEAMS SUPPORTED AT BOTH ENDS.

Loaded with a uniformly distributed load: —

$$W = \frac{2 \times b \times d^2 \times a}{5 \times L}, \text{ or } b = \frac{5 \times L \times W}{2 \times d^2 \times a}, \text{ in which } a = \frac{R}{18}. \qquad (4.)$$

Load applied at the centre: —

$$W' = \frac{b \times d^2 \times a}{5 \times L}, \text{ or } b = \frac{5 \times L \times W'}{d^2 \times a}. \qquad (5.)$$

Load applied at a point other than the centre, m and n being the segments into which the beam is divided.

$$W'' = \frac{b \times d^2 \times L \times a}{5 \times 4 \times m \times n}, \text{ or } b = \frac{5 \times W'' \times 4 \times m \times n}{d^2 \times L \times a}. \qquad (6.)$$

In the above formulæ the figure **5** is what is known as the factor of safety, and is the one recommended by the best engineers for wooden beams subjected to a dead load. For a live, or moving load, **10** should be used, as a live load is twice as severe in its effects on a beam as a dead load. If the ultimate, or breaking load, is desired, the factor of safety, **5**, should be omitted.

	a	a'		a	a'
American ash	590	148	Hemlock	380	95
" red beech	580	145	American red oak	562	140
" yellow birch	534	134	" white oak	581	145
" white cedar	255	64	" white pine	461	115
" elm	338	84	" yellow pine	725	181
New England fir	367	92	" spruce	548	137

In want of other values for white and yellow pine, I have used values determined from very careful experiments on these woods made by myself, of which a full report is given in the February number of Van Nostrand's *Engineering Magazine*.

In order that the application of these formulæ may be thoroughly understood, I will give examples of the cases most commonly met with.

EXAMPLE 1. — What is the greatest load that a yellow pine beam 8×10 inches, supported on two piers 15 feet apart, will carry with safety, if the load is uniformly distributed? Formula (4) is the one which covers this case, and substituting the values for the letters, we have: —

$$W = \frac{2 \times b \times d^2 \times a}{5 \times L} = \frac{2 \times 8 \times 100 \times 725}{5 \times 15} = 15{,}466 \text{ lbs.}$$

EXAMPLE 2. — What shall be the dimensions of a spruce beam that shall be able to carry with safety a concentrated load of 9,000 pounds, applied at the centre, the distance between the supports to be 12 feet? In this case we are to determine the breadth and depth of the beam, but in order to do so, it is necessary to assume a value for either b, or d, and as the strength of the beam varies as the square of the depth, and only directly as the breadth, it is better to assume a value for d, and solve for b. Assuming, in this case, d to be 10 inches, and substituting in formula (5), we have: —

$$b = \frac{5 \times L \times W'}{d^2 \times a} = \frac{5 \times 12 \times 9{,}000}{100 \times 548} = 10 \text{ inches.}$$

If we had taken $d = 11$ inches, we should have got $b = 8$ inches, which would be the more economical beam, and have the same strength.

From an inspection of formulæ (2), (3), (4) and (5), we see that the relative strength of the rectangular beam, in the different cases, is as follows: —

Beam supported at both ends, and loaded with a uniformly distributed load 1
Beam supported at both ends, and loaded at the centre . . . . $\frac{1}{2}$
Beam fixed at one end, and loaded with a uniformly distributed load. . . . . $\frac{1}{4}$
Beam fixed at one end, and loaded at the other . . . . . . $\frac{1}{8}$

I-BEAMS. — Where it is necessary to carry very heavy loads, iron beams, of the form of the letter I, are generally used.

If we consider the web to merely connect the flanges, we should have for the safe distributed load: —

$$W = \frac{14{,}000\left(b \times d^2 - \frac{b' \times d'^3}{d}\right)}{3\,L}. \qquad (7.)$$

where b equals the breadth of the flange; d the total depth of the beam; b', the sum of the breadths of the lateral hollows; and d' equals depth of the web. But it is more convenient, and practically nearly as accurate, to consider the web to run the whole depth of the beam, and the flanges to be merely fastened to the web.

On this supposition we have the formula for the distributed load: —

$$W = \frac{112{,}000 \times d}{12\,L}\left(\frac{A_1}{6} + \frac{A \times d_1^2}{d^2}\right) \qquad (8.)$$

in which d denotes the depth of the beam; d_1 the effective depth of the web; A_1 area of web; A, area of one flange; and L, the length between bearings.

Formula (8) is the one used by the engineer of the Union Iron Mills, Pittsburgh, Pa., in calculating the strength of their beams.

EXAMPLE. — What is the largest uniformly distributed load that a heavy 10-inch I-beam, of the Union Iron Mills pattern, will bear with safety, the distance between supports being 10 feet?

From a book of sections, published by this company, we find $A = 3.15$ square inches; $A^2 = 5.1$ square inches; $d_1 = 9.19$ inches; and $d_1 = 10$ inches. Substituting these values in formula (8), we have: —

$$W = \frac{112{,}000 \times 10}{120}\left(\frac{5.1}{6} + \frac{3.15 \times 9.19^2}{100}\right), = 32{,}760 \text{ lbs.}$$

In most cases, however, it is not necessary to go to the trouble of substituting in the above equation, as the moment of inertia is generally given in the book of sections, issued by the different iron companies. When this is the case, we have only to substitute in the formula: —

$$W = \frac{224{,}000\,I}{L \times D}. \qquad (9).$$

N. B. In the last three formulæ a factor of safety (3) is assumed.

Taking the same beam used in the above example, we find from the table of sections, the value of I to be 175.5, which being substituted in formula (9), together with the values of l and d, gives $W = 32{,}760$, the same as before.

Also, some of the iron companies publish hand-books of their beams, columns, etc., which give the safe load for each beam, for spans of different lengths, so that the architect has only to look in these tables, and find the size of beam whose safe load is equal to the load it is desired that the beam should carry.

But there are probably many who have not these hand-books, or do not understand using them, and for such I have prepared the following tables, made up from tables published by the Union Iron Mills, and those published by the Trenton Iron Works, Trenton, N. J.

TABLE I.

UNION IRON MILLS ROLLED I-BEAMS.

Designation of Beam.	I. Weight per yard in lbs.	II. Safe distributed load for 1 ft. of span in lbs.	III. Moment of Inertia.	IV. Width of flanges in inches.	V. Areas in square inches.	VI.	VII.
					Flanges.	Web.	Total area.
15 inch heavy	201.	848,000	682.	5.5	10.35	9.75	20.1
15 " light	150.	658,000	528.7	5.0	8.40	6.60	15.0
12 " heavy	180.	582,000	373.7	5.15	8.64	9.36	18.0
12 " light	126.	416,000	267.	4.5	6.36	6.24	12.6
10½ " heavy	105.	308,000	173.8	4.63	5.25	5.25	10.5
10½ " light	94.5	276,000	154.9	4.53	5.16	4.30	9.46
10 " heavy	114.	328,000	175.5	4.5	6.30	5.10	11.4
10 " light	90.	278,000	149.0	4.3	5.80	3.20	9.00
9 " heavy	90.	246,000	118.7	4.34	5.85	3.15	9.00
9 " light	71.25	206,000	100.	4.06	4.79	2.34	7.13
8 " heavy	81.	198,000	84.8	4.	5.22	2.88	8.10
8 " light	66.	164,000	70.4	3.75	4.37	2.24	6.61
7 " heavy	60.	132,000	49.2	3.63	4.18	1.82	6.00
7 " light	54.	124,000	47.0	3.56	4.15	1.26	5.41
6 " heavy	48.	90,400	29.2	3.38	3.37	1.44	4.81
6 " light	40.5	76,600	24.7	3.22	2.85	1.20	4.05
5 " heavy	36.	51,400	13.8	2.88	1.85	1.75	3.6
5 " light	30.	43,800	11.8	2.75	1.85	1.15	3.0
4 " heavy	30.	32,600	7.0	2.63	1.44	1.56	3.0
4 " light	24.	28,000	6.0	2.50	1.44	.96	2.4
3 " heavy	24.	19,600	3.2	2.34	1.39	1.01	2.4
3 " light	21.	18,200	2.9	2.25	1.38	.72	2.1

TABLE II.

TRENTON ROLLED I-BEAMS.

Designation of Beam.	I. Weight per yard in lbs.	II. Safe distributed load for a span of 1 ft. in lbs.	III. Moment of Inertia.	IV. Width of flanges in inches.	V. Areas in square inches.	VI.	VII.
					Flanges.	Web.	Total area.
15 inch heavy	200	748,000	707.1	5.75	10.95	9.07	20.02
15 " light	150	551,000	523.5	5.	7.45	7.59	15.04
12¼ " heavy	170	511,000	391.2	5.5	9.38	7.39	16.77
12¼ " light	125	377,000	288.0	4.8	6.58	5.75	12.33
10½ " heavy	135	360,000	233.7	5.	8.43	4.93	13.36
10½ " light	105	286,000	185.6	4.5	6.51	3.93	10.44
9 " extra	125	268,000	150.8	4.5	7.20	5.13	12.33
9 " heavy	85	189,000	106.5	4.	4.86	3.46	8.32
9 " light	70	152,000	85.6	3.5	3.83	2.70	6.53
8 " heavy	80	168,000	83.9	4.5	5.07	2.96	8.03
8 " light	65	135,000	67.4	4.	3.97	2.40	6.37
7 " 55 lbs.	55	101,000	44.3	3.75	3.40	2.10	5.50
6 " 120 "	120	172,000	64.9	5.25	8.09	3.75	11.84
6 " 90 "	90	132,000	49.8	5.	5.70	3.00	8.70
6 " heavy	50	76,800	29.0	3.5	3.11	1.80	4.91
6 " light	40	62,600	23.5	3.	2.51	1.50	4.01
5 " heavy	40	49,100	15.4	3.	2.34	1.56	3.90
5 " light	30	38,700	12.1	2.75	1.79	1.20	2.99
4 " heavy	37	36,800	9.2	3.	2.41	1.25	3.66
4 " light	30	30,100	7.5	2.75	1.91	1.00	2.91
4 " ex.light	18	18,000	4.5	2.	1.02	.75	1.79

The values for the safe distributed load given in column II. are for *one foot* of span, and to get the load for any span it is only necessary to divide the load for a span of *one foot*, by the given span, *in feet*.

To get the safe load, if applied at the centre of the beam, divide the safe distributed load by 2.

In designing an iron beam, *the weight of the beam* itself should be subtracted from the calculated load, to give the *true working load*.

In order to illustrate more clearly the method of applying the above tables, two practical examples will be given, which may serve as types for similar cases.

EXAMPLE 1. — It is proposed to support the floor of a lecture-hall by means of rolled-iron I-beams, resting upon piers 15 feet apart; what size beam will be required?

Ans. — If the beams are 15 feet span, and 12 feet "on centres," they will each have to support a floor area of 12 × 15, or 180 square feet. The average weight of a wooden floor, including joists, etc., is about 10 lbs. per square foot, which would give 1,800 lbs. dead load on each beam.

The load that is to come upon the floor should be taken at 120 lbs. per square foot, making 21,600 lbs. live load on each beam, and this is equivalent to 43,200 lbs. dead load. Combining the two loads, we have as the total dead load on each beam, 45,000 lbs. Now in order to find from the table the size of beam necessary to carry this load, we must multiply the total load by the span, which is the same thing as dividing the values in column II. by the span. 45,000 × 15 = 675,000, and looking in column II. of tables I. and II. we find that the beam carrying a safe load, next above this, is the 15-inch heavy. Therefore, this must be the size required. The weight of this beam will be, 201 × 5, or 1,005 lbs., for the "Union" beam, and 200 × 5, or 1,000 lbs., for the "Trenton" beam.

EXAMPLE 2. — It is required to support a 16-inch brick wall, 30 feet high, and 15 feet wide, and containing six windows, three feet by six feet, by two rolled-iron I-beams. What must be their size?

Ans. — It is first necessary to find the cubic contents of the wall. If the wall were solid, with no windows, it would contain $1\frac{1}{3} \times 15 \times 20$, or 600 cubic feet of brick. But the six windows will contain $6 \times 1\frac{1}{3} \times 3 \times 6$ or 144 cubic feet of brick; so that the contents of the wall is 600 — 144, or 456 cubic feet of brick. A cubic foot of brickwork weighs, on the average, 110 lbs., hence the weight of the wall will be 456 × 110 lbs., or 50,160 lbs. The load on each beam will therefore be 25,080 lbs. dead weight. Multiplying this by the span, we have 376,200 lbs., and looking in column II. of tables I. and II., we find that we shall need a 12-inch light "Union" beam, or a $12\frac{1}{4}$-inch light "Trenton" beam, to carry this load, and it will require two of these beams to support the wall. The weight of the 12-inch beam will be 5×126, or 630 lbs., and of the $12\frac{1}{4}$ inch beam 125×5, or 625 lbs.

REGULATIONS FOR OPEN COMPETITIONS FOR ARCHITECTURAL WORK.

A SCHEDULE OF TERMS ADOPTED BY THE ST. LOUIS INSTITUTE OF ARCHITECTS, AND OTHER ARCHITECTS OF THE CITY OF ST. LOUIS.

1. — The instructions must not require more drawings than are necessary in order clearly to explain the design, and should require that the designs submitted be drawn to a uniform scale, which must be clearly defined; and that all perspectives required be drawn to the same scale as the geometrical drawings, and on a plane at the corner of the building nearest the point of sight; a deviation from which will cause their rejection. Perspectives, unless called for in the instructions, to be excluded.

2. — In case the amount to be expended is limited, the instructions must state that an excess of ten per cent on the expense of executing any design, over and above the sum mentioned, will exclude it from competition; the amount of expense to be determined by the expert in the jury.

3. — A design will be excluded from the competition if sent in after the stated period, and if it contains deviations from the instructions.

4. — The period given for preparing the design must be long enough not only for perfecting it and preparing the necessary drawings, but must make some allowance for the ordinary occupations of competitors. An explicit statement must be given as to the time when the decision on the merits of the designs is to be rendered, and that all designs shall be returned to the authors of the same. An architect's drawings are his own private property unless paid for, in which case they are for the sole use and benefit of his client; but the actual drawings still belong to the architect who made them. Always belong to architect.

5. — The designs should be submitted to a jury; one of whom should be an architect. No person should serve as a juror who submits a design, or is in any way interested in any design submitted, or who has not renounced all intention of participating in the execution of the work.

6. — In the case of open competitions, the amount of premiums in the aggregate should not be less than the amount which the architect would have received had there been no competition.

7. — It is recommended that in close competitions wherein the number of competitors is limited, a sum equal to the full value of one design be divided equally among the authors of all except the premiated design, which shall be compensated as provided for in the last preceding rule.

8. — The instructions shall state that in case the building is erected after any of the designs submitted in competition, it shall be given in charge of the author of the first premiated design, who is to be employed at the usual compensation.

9. — The premiums should be awarded under all circumstances for the designs which may have been admitted in competition.

10. — It is recommended that, in the schemes of competition, it shall be provided that the names of the competitors shall not be known to the jury.

11. — The rates of compensation referred to in the previous articles are to be the same as are acknowledged by the St. Louis Institute of Architects.

ARCHITECTURAL EDUCATION IN ENGLAND AND GERMANY.

WE find from the columns of the *Cologne Gazette* that the question of architectural education is exciting as much attention in Germany as it has done in England, with this difference, — that the people of Germany are more interested in the discussion of such matters than the English people. While we have been insisting on the need of the technical education of architects, the public and some members of the profession in Germany have been deploring the fact that they have too much of it, and that the architecture of their country has suffered in consequence, and is less vigorous and healthful than our own. The controversy, which has been waged with much spirit and warmth in Germany, owes its origin, we believe, to the remarks of Dr. August Reichensperger in the Prussian Diet, in which assembly the subject has been warmly debated. Dr. A. Reichensperger has strongly taken up and espoused the English system, and has openly charged the national system with faults and shortcomings, and called upon the Minister of Public Works to apply a remedy by official interference. As might be expected, these remarks, delivered last December, have produced a sensation among the profession in Germany, and one architect of eminence has published a reply in the *Cologne Gazette* extending over three articles of considerable length. Herr Reichensperger is not a professional architect; he speaks more from the popular side of the subject, and his remarks must be taken with some reserve. At the same time, we must admit that he represents the public sentiment, and he has found no difficulty in contrasting the freedom and individual vigor of the English school of architecture with the scientific, hard, barren, and formal style of that of his own country. Recent intercourse between the two countries must have made the visitor from Germany feel that our buildings were less cast in the same mould, bolder in conception, and less niggardly in ornament, than those of his own land. Herr Reichensperger is struck with the development in England of the Gothic and other styles of architecture, — the freedom and originality with which they are treated by English architects; and he approves in the strongest terms of the pupil-system of architectural education in this country, which he says is an adherence to and a development of the mediæval system of "master-schools," or those in which the styles of individual masters of the art were perpetuated with all their individuality of power; and he maintains that it is only possible under such conditions for the conceptions of untrammelled genius to be encouraged, or for a national style to take root. It is clear to us that Herr Reichensperger is one of those *dilettanti* of whom we have several in this country, who affect to despise all native effort, and to cast an eye abroad for everything that is excellent, — an idea in which we find we are supported by the remarks of the writer in the *Cologne Gazette*, who says that Reichensperger judges of English architecture from what he has seen, not from its intrinsic value. This disaffected amateur might learn more if he read the architectural treatises and correspondence in this country; he would then be better able to compare the essential differences and qualities of the architecture of the respective countries. No one knows better than an English architect the good and bad qualities of English art; and before sensational contrasts are drawn between the buildings of Germany and England, the critic should possess more than a superficial acquaintance or a mere first impression of the works of this country. It is in this rough-and-ready sort of way that Herr Reichensperger contrasts the great national buildings of England with the plain and prosaic structures erected in modern times in Germany, which, he says, may be useful and scientific, but excite no admiration, without considering the actual conditions that have made them so uninteresting as works of art. There is a German term, "*Bauinspectoren Gothik*," which signifies "official building inspectors' Gothic," and has become proverbial, which may help this hypercritic to understand the real causes for the stagnation of thought he complains of, though he himself employs it to deprecate German architecture.

The writer of the articles in the *Cologne Gazette* ably challenges many of the conclusions of this would-be reformer, but we must here content ourselves with giving the gist of his reply. The author is a professional architect, and evidently knows only too well the difficulties the architect in his own country has to encounter. In the first instance he shows that Germany is not rich enough to compete with England; he says that the want of magnificent buildings in Germany is due chiefly, not to deficiency of taste, or the absence of high artistic aspirations, but to want of money. In Germany the buildings are cheap, and are, therefore, meagre and poor. They are under the control of government officials, a system which must be acknowledged to restrain inventive ability, but the very circumstance of the nation being poor renders it necessary for the State to patronize and take under its care the architectural and technical education of the profession. We are very justly told that if architecture were left to private patronage in Germany, as it can well afford to be left in England, its prospects would not be encouraging. It would fare worse than it does now. The architecture would not merely be poor, but if no State education for architects existed, it would become coarse or vulgar in conception and detail. By confining study to one style, the State secures at least good architecture, if it often falls into the commonplace. We cannot, however, deny that State patronage and its restrictions seriously limit and curb the individual freedom of the architect; and the writer in the *Gazette* allows that German architecture would gain if a little of the English spirit of originality and independence were infused into it. He maintains, nevertheless, that if Germany stands in need of this spirit, England would be to a larger extent benefited if her architects' study were less one-sided, and more subordinated to the scientific and utilitarian rules of the art. He observes with justice, and from a knowledge of the results of architectural works in this country, that architects regard too much the mere outward effect of their buildings; in illustration of which he points to the result of the competition for the new German House of Parliament, for which a few English architects competed: several beautiful English designs were rejected, with the exception of one which was awarded a second prize, because, as the author observes, all the artists had studied was outward appearance, the plans being devoid of all attempts to supply practical wants. With one voice it was acknowledged by those capable of judging, that the designs were full of defects, badly arranged in plan, full of draughts, and fell wofully short of the requirements of such a building. The award was pronounced a scandal. We commend to the reader the passage relating to this subject at the close of the writer's second article. He declares, moreover, that Herr Reichensperger has been hard upon German architecture, because the Parliament-Building design promoted by him has not found favor.

Discussing the vexed subject of the different systems of technical education for architects in England and Germany, the writer of the articles we are noticing boldly appeals to English professional opinion in corroboration of his own views, and it appears to us that in this final appeal he has considerably weakened the position of his opponent. He points Herr Reichensperger to the fact that for the last twenty years the English profession have been trying to insist on education; and that that critic can know nothing of the English agitation, or must have purposely ignored it, to have drawn the conclusions he has done. This fact, the writer thinks, is the best answer to the charges brought against the German system of technical education. In confirmation of this assertion, the professional critic refers to our own pages, and to those of *Nature* and other scientific journals, which have for years past abounded in appeals in favor of a reform of the English system of architectural education on the lines of that in vogue in Germany. The writer's arguments agree in the main with what we have said from time to time upon the question. He also quotes Mr. R. Phené Spiers's remarks touching the shortcomings of English architecture at the Paris Exhibition, which were reported in this journal, in which that gentleman referred to France and Germany as possessing superior theoretical teaching, from which the English architects might derive profit. The formation of architectural classes and technical schools in England, and the proposed technical college at South Kensington, to be endowed by the City Guilds, are instances cited to show that the English recognize the advantage to be derived from the very system which Herr Reichensperger assails. It is contended that it is precisely in those features of the German training that critic most disparages, that the English architects feel that they are most in need of. There is a prevailing idea, founded upon some experience, that anything like State education would nip in the bud or check individual effort, and that a system of professional education for architects would suppress, or completely destroy, the artistic instinct. It is true that the native artists of India and Japan have suffered to some extent from the spread of technical education, and the general fact has been alluded to by many writers on education, and lucidly stated by Macaulay in his well-known essay on Milton. That far-seeing exponent of architectural art, Viollet-le-Duc, has also defended the freedom of architects by boldly denouncing the system of academic monopoly which largely prevails in his own country; he has shown that where, as in the domain of letters and philosophy, painting and sculpture, there exists no intermediate authority between the artist and the public, no monopoly and interference, but where the appeal to the public is direct, the students of science, art, or literature are benefited; and he proceeds to contrast this state of encouragement of the individual with the condition of those who lock themselves up in the Villa Medici, or are bound by the arbitrary academic rules in matters of style and taste. Viollet-le-Duc was discriminate enough to see that it was not because of a school of art that architecture declined, but because its founders placed the art beyond the control of public opinion, because they became a mere *coterie*, and founded a kind of protectorate that was inimical to the interests of art. "If it would be really a school," he says, "it should derive all its influence from discussions, the exchange of ideas, and the emulation resulting from rival principles, freely manifesting themselves under the control of public opinion." He concludes that in France, architecture, above all other arts, presents conditions favorable to the prolongation of mediocrity. The French Academy has been credited with the conventional reproduction of antique forms, with a set of rules and processes which have been called the very negation of art, which is said to have given us nothing but a miserable parody of the beauties of antique taste. In Germany the heads of the pupils are, according to authorities, crammed with theories, which have acted, no doubt, prejudicially, and restricted artistic genius and invention. In many recent works on architecture, the tendency of State interference in the matter of design is clearly seen; there is a mechanical restraint, an official routine, expressed in the very lines and features of German architecture, but it is absurd to lay the charge to the influence of technical education simply. We quite agree with the remark that up to a certain point engineering and architectural studies might go together, after which they should be totally independent. We are told that the English system of instruction is not education, but merely a kind of training. It is certainly very little more; the young pupil imbibes his notions and taste from his master, or discovers them for himself. But with proper safeguards against the suppression of individual taste and enterprise, there is no need of a system of scientific education operating prejudicially. The fault is in setting up a standard of taste, an art bureaucracy; and this has been, from what we have gathered, the prevailing defect in the system, not only of France, but of Germany. The articles we have alluded to are well worthy the perusal of English architects, and we commend the controversy to the attention of the profession at large. — *The Building News.*

AMERICAN SHADE TREES.

IN the growth and spread of popular tastes in all parts of America, particularly as regards the ornamentation of our home surroundings, there is a noticeable general solicitude to learn what are the best kinds of shade trees to plant about our homesteads. The subject is one of peculiar importance. It calls for the exercise of the most thorough, mature and perfect judgment. Vegetation of every kind has individualities and characteristics, and these have to be studied and understood. The trees of our country are not more diverse in their kinds, than are the soils, the climates, the seasons, the positions of trees, their exposure, their relative demands for moisture and drainage, and all the other concomitants which make up the problem of successful arboriculture, whether for shade and ornament, or for fruits and their many enjoyments. The first needful thing in choosing American shade trees is to know which of all the diverse families of forest growths, indigenous to the different parts of our country, are best adapted to grow vigorously and rapidly, and so as to produce the largest amount of shade in the shortest lapse of time. This is the main thing to aim at, for the reason that much the greatest number of trees are of slow growth, — slow in comparison with the shortness of human life. Let us consider this subject carefully; and to do so, let us divide the United States into four ideal districts, so far as regards our country lying east of the Rocky Mountains. These large districts will therefore be properly named and described as follows: —

1. The north-western belt: this may be regarded as extending from the Upper Ohio River westward to the foot-hills of the Rocky Mountains.
2. The Atlantic front, the Alleghanies, and the trans-Alleghany region: all these extending from the St. Lawrence and the Lakes, thence southward to the south end of the mountain-chain, — the Alleghanies.
3. The central Western States, and also those parts of the several regions not embraced in area No. 1.
4. The southern and south-western regions: this area sweeps through the lower parts of South Carolina, and all Georgia, Alabama, Florida, Mississippi, Louisiana and Texas.

In the first three districts the good, thrifty and rapidly-growing trees which are most thoroughly adapted to use as shade and ornamental trees are, in the order of excellence: ash, poplar or tulip-tree, cottonwood, balm of Gilead, buckeye or horse-chestnut, catalpa, chestnut, Lombardy poplar, willow of several kinds, Lynn, mulberry, wild cherry, cucumber tree, ailanthus or "tree of heaven," silver-leaved poplar or quaking ash. To these, it is probable, can be added the famous and monstrous "eucalyptus," a tree of Australia, which actually attains the wonderful height of two hundred and fifty to three hundred and fifty feet. The "eucalyptus" of those South Pacific climes, and the redwood tree, or *sequoiæ* of California, are the loftiest and largest growths of trees yet known anywhere in the world. These sixteen kinds of trees, including the three trees introduced from abroad, viz., the "Lombardy poplar" from Lombardy in Europe, the "ailanthus" from China and the East Indies, and the "eucalyptus" from New Holland or Australia, are trees which are easy of propagation and generally or always exempt from predatory worms and insects, clean in styles of growth, handsome in form, quick of growth, and picturesque in the landscape. Some of them add a fine effect to the prospect of any country. The weeping willow, the silver-leaved poplar or quaking ash, the Lombardy poplar, the ash, the chestnut and the buckeye are especially handsome to view when they are either near or far off. These sixteen varieties of trees are especially recommended to notice and adoption as shade and ornamental trees, having more particularly in mind the requirements of the greatest quickness of growths. If, therefore, to this characteristic can be added the qualities of healthiness, cleanliness, grace of form, and beauty of effect, we shall gain a combination of advantages by choosing these special classes of trees to embellish rural estates and set off the grounds about suburban villas. All or nearly all the trees above named will thrive in either of the first three districts mentioned.

All such trees are usually to be found in the nurseries, except the *sequoiæ* and the eucalyptus. They can be obtained as seeds or scions by addressing the United States Commissioner of Agriculture, Washington, D. C., whose able and interesting reports speak of these remarkable trees. Nearly all the varieties, or more than three-fourths of them, in the above list of trees can be found in or about our American woodlands, and all of them attain a reasonable growth in a short period — say from four to six or eight years from the time of planting the young saplings. Their average rates of growth for each tree per annum range from two and one-half to five feet, according to the care of planting, and are determined by the nature of the soil and course of the seasons. The eucalyptus is known to grow at the rate of ten to twenty feet per annum. In area No. 4, — the southern and south-western regions of the American Union, — all these kinds of trees will do well, and to them may now be added some other trees which will flourish in the south and south-west parts of our Republic east of the Rocky Mountains. These are the following varieties, viz., such as the China-tree or "Pride of China," "Bois d'Arc" or Osage orange, Spanish oak (seen in the Alleghanies), walnut (both the black and the white), cypress (in some low places of the Mississippi Valley and Atlantic front), and cedar. These twenty-two kinds of trees are easily obtained. Besides, other varieties that can be named would increase the number perhaps to as many as thirty-five to forty kinds.

The growth of the different sorts of trees in the above list is probably much more rapid than the growth of any other kinds of trees known in any settled parts of America. It has been recommended by persons who are familiar with the eucalyptus, that it should be introduced into all portions of our country for the following reasons: it is a very rapid grower; it makes a beautiful and thick shade; it has a tall and picturesque form; it is unique in being unlike all American trees; it exudes a gum that has useful qualities; it emits an odor that proves to be a fever destroyer by its tendency to promptly and surely absorb all malaria; it is very sure to grow, when properly taken up and carefully planted, and it requires but little care to do this. It has been introduced into several parts of Europe within the past fifteen years, and it flourishes well there. The eucalyptus grows in favored spots and in climes well suited to it, at the rate of ten to fifteen feet per year, even fifteen to twenty-five feet in some places. The remarkable virtues which it possesses in being an absorber of all miasmatic poisons are virtues which are not recognized in any conspicuous degrees in any other trees. A permanent and great disinfectant like this, which increases its power and efficiency in the ratio of its growth, is of incalculable value to our country. W. G. Atkinson.

NOTES AND CLIPPINGS.

Ice-Machine. — It is said that an ice-machine has recently been put in operation in New York which will produce ten tons of ice in thirty-six hours. It consists of a large tank in which galvanized sheet-iron boxes are placed, each box being 42 inches long, 12 inches wide, and 6 inches deep. The boxes are filled with pure water and tightly closed. A reservoir containing water charged with chloride of magnesium, and chilled by means of coils through which a gas composed of ether and sulphurous oxide is forced, communicates with the tank, and the magnesium water circulates around the sheet-iron boxes in a continuous current. The temperature of the magnesium water grows lower every time it comes in contact with the coils, but it will not freeze, while the water in the iron boxes is congealed into solid blocks of ice.

Proposed Circular Canal at Milan. — Perhaps no city of Italy has become more greatly benefited by national independence than Milan. Among the schemes of public improvement which are attracting attention is the proposal of Francesco Ajraghi for a canal around the city. The estimated expense is 10,087,766 lire ($2,017,553.00). Among the proposed advantages are: 1, increased facilities for the distribution and storage of commercial products: 2, completion and extension of the system of irrigation; 3, a motive force of 6,281 horse-power, available for manufacturing; 4, increased revenues from local imports of various kinds, from rents and from the sale of city lands; 5, a better and more abundant supply of excellent water for household use and for ornamental fountains; 6, improved sanitary conditions, especially in the suburbs. — *Il Politecnico.*

New Thames Tunnel. — A tunnel has been authorized by Act of Parliament, between Greenwich and Millwall, two districts which have an aggregate population of two hundred and fifty-nine thousand persons. When the ferry-boats are interrupted by the frequent fogs, a detour of about twelve miles has to be made in order to cross by way of London Bridge. The new sub-way, which will be the fourth tunnel beneath the Thames, will be a third of a mile long, approached by a descent of fifteen steps at Millwall and by twenty-four steps at Greenwich. — *L'Ingen. Univ.*

An Ary Schaefer in Danger. — General Garfield, at the instance of Hon. Robert C. Winthrop, called the attention of the House of Representatives to the neglected and dangerous condition of Ary Schaefer's painting of Lafayette. We cannot feel that the painting is out of danger until it is known what the Library Committee, to whom the matter has been referred, decides to do about it.

Miners' Measurement of Water-Power. — A miner's inch of water is a quantity that will flow through an inch aperture with a free discharge, and under a constant pressure of six inches above the top of the opening. An aperture of twelve and a quarter by fifteen and three-quarter inches, under pressure of six inches above the top of the opening, will discharge two hundred inches, and is the basis of all measurements where water is retailed in small quantity in the States of California and Nevada. A miner's inch will discharge a quantity of water equal to twenty-two hundred and fifty cubic feet, or about seventeen thousand gallons, weighing one hundred and thirty-nine thousand five hundred pounds in twenty-four hours. An inch of water (miner's inch), having a grade of four inches to the rod, will carry off in twenty-four hours, a distance of ten miles, ten tons of heavy quartz, sand, and iron. At one gravel-mine in Nevada County, California, twenty-five cubic yards, or forty tons of detritus or tailings, as the waste material is called, are moved from three to fifteen miles every twenty-four hours. One hundred miner's inches of water, conducted through iron pipes and falling three hundred and fifty feet vertically, and applied by means of a nozzle against a hurdy-gurdy wheel sixteen feet in diameter, will furnish sufficient power to run an eighty-stamp mill, beside carrying off all the ore which it has furnished the power to crush. — *Mining Review.*

Japanese Rules of Art. — The Boston *Commonwealth* has discovered among the Japanese the following wise precepts as to art objects: The Japanese are fond of pictures and ornamentation in their dwellings, but they do not, as we do, have a great many things exposed to view at once. One or two pictures, a fungus, and a hanging basket or a bracket serve for a time, when these are laid away, the pictures being rolled up, and their places are supplied by other things. But if a visitor expresses a liking for such things, they will bring out quantities for his inspection. They enjoin the following good rules for looking at a picture: You must not look at it on a dark day, nor a cloudy day, nor when it is so cold that your breath will form a mist before you; nor must you look at it when you are ill, or cross, or unhappy, lest these circumstances influence your opinion. You must not unroll it so as to see the artist's name at first, but study it at leisure, so as to judge impartially of its merits, and who the artist may be.

The Electric Light Abroad. — The Jablochkoff system of electric lighting is now in operation, not only in public thoroughfares, but in a great variety of works and private establishments, as well as in those of public resort. It is also in use in the palace of King Theebaw, of Burmah, at Mandalay, where there are sixty lights, and in the palace of Shah Nasser ed Deen, of Persia, at Teheran, where there are four lights. Prince Agaklan has six in his palace at Bombay, and King Dom Luis I. of Portugal, six in his Royal Palace of Caseněo. Queen Isabella of Spain has also six in the conservatory of her residence in Paris. The Paris Municipal Council has renewed for one year the contract for lighting the Avenue de l'Opéra, and Place du Théâtre Français, and the Sous-Secrétaire d'Etat, at the Ministère des Beaux Arts, has authorized the lighting of the *Salon* at the Palais de l'Industrie in June next, on the Jablochkoff system. Altogether the application of this system is quietly extending, and the Metropolitan Board of Works deserve every credit for the part they have taken in developing the question of electric lighting in London. — *Times.*

Catacombs for Warsaw. — The *Kurier Poranny* reports a project which it understands to be under serious consideration for early execution, the object of which is to substitute a row of colossal catacombs for the cemeteries now in use in Warsaw for burying the dead. A design of the proposed vaults has already been prepared. The vaults are, as observed, to be built on a gigantic scale, and to be of sufficient size to hold no less than fifty thousand coffins. It is proposed that each coffin shall be kept in the catacombs only for the space of five years, and shall after that be destroyed by fire, together with its contents.

Artificial Stone. — Artificial stone can be produced by the following process, recently discovered by Ternikoff: A mortar consisting of equal parts of lime and sand is exposed for a few hours to a temperature of 150 degrees centigrade in the presence of water vapor. The paste having been taken out of the furnace is now placed under the cylinders of a machine like that for manufacturing bricks, and it comes out in the form of cubes which, on being exposed to the air, become dry and hard. In the course of eight or nine hours these cubes are as hard as good building stones, and are fit for use. This artificial stone is, in fact, a sort of brick of mortar baked at a low temperature, and the cost, too, is about the same as that of bricks.

Drawing on Photographs. — Mr. Robert Grimshaw, Ph. D., recommends the following procedure, where it is desired to obtain an India-ink drawing from a photograph, without resorting to tracing. Very nice results are obtained thus: Prepare a print in the usual manner. Instead of toning as usual, fix immediately in "hypo." Wash well in running water to get out all the hypo. Draw directly on the print with India-ink. This finished, bleach with a saturated solution of corrosive sublimate (bi-chloride of mercury) in equal parts of water and alcohol. Flowing is better than brushing, for applying the bleach, as it avoids smearing.

An Old Distich. — A writer in *Notes and Queries* says that there yet remains to be seen on a pane of glass at Little Moreton Hall, in England, the following distich, cut with a diamond, and dated 1621: —

"Man can noe more knowe woman's mind by teares,
Than by her shadow judge what clothes shee weares."

Packing for Steam-Pipes. — J. Kathe makes a packing, which also may be used as a non-conductor for wrapping the pipes, by grinding twenty parts of hemp-refuse, and mixing it in a Hollander, with forty parts asbestos, twenty parts wool-waste, and twenty parts wood-pulp. The mass is then saturated with soluble glass, and dried. — *Dingler's Journal.*

BUILDING INTELLIGENCE.

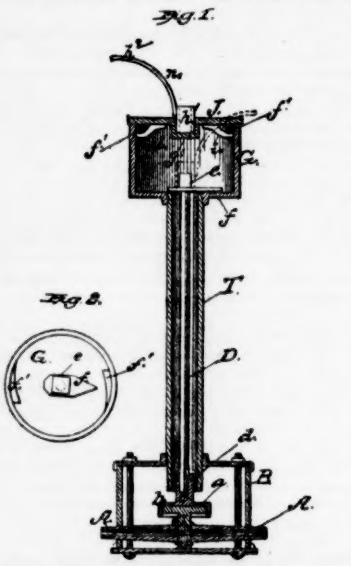
[Reported for The American Architect and Building News].

[*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.

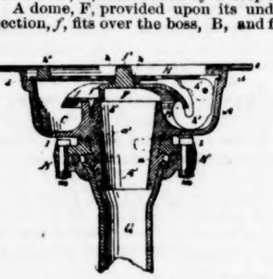
[*Printed specifications of any patents here mentioned, together with full detail illustrations, may be obtained of the Commissioner of Patents, at Washington, for twenty-five cents.*]

225,385. SERVICE-PIPE BOX. — Eli H. Hummer and Joseph S. Gemmill, York, Penn. This invention relates to cutting off or letting on gas or water to a house. A, designates the supply-pipe leading from the main. This pipe extends through a box, B, that, for for convenience of being placed around the pipe, is made of separable parts. C is a spigot, which lets on



and cuts off the supply of gas or water. Extending up from box, B, encircling the rod, D, is a metallic tube, T, the upper end of which opens into a second box, G, sunken into the ground flush with the surface. This tube, T, is usually screwed into B, and extends through the bottom of G. D extends up into G, and terminates in a wrench-seat, *e*, so that it may be turned by a wrench. Upon this rod is a finger, *f*, which indicates the position of the water-way, and whether the water or gas is turned on or off. The box, G, is cylindrical in form, and has upon its inside, near its margin, the oppositely-inclined cams, *f'*, and the lid, J, that closes this box, has lugs, *i*, that engage these cams, and when turned in the proper direction cause the lid to be tightly fastened to the box. This is accomplished very readily by means of the sunken wrench-seat, *g*, in the lid and a wrench, *n*. The upper box is snugly closed, is not liable to collect dust, ice, or snow, and the seat in the lid, being sunken below its level cannot trip up passers-by. Moreover, the operating-rod being a permanent part of the device, and extending through the surface-guard, the attendant is spared the fatigue of carrying the long-stemmed iron implement now in common use for letting on and cutting off water or gas.

225,503. SINK-TRAP. — Edgar W. Anthony, Boston, Mass. A is the bowl of the trap, so shaped as to have in its center a boss, B, surrounded by a deep annular groove, C. A dome, F, provided upon its under side with a projection, *f*, fits over the boss, B, and forms a



cover to the drain-pipe G. This dome, F, is fastened firmly upon the edge of the said drain-pipe. There is a free annular space beneath its edge from the annular groove, C, to the drain-pipe, G. The edge of the dome laps over the edge of the boss, B, and thus, when water is standing in the annular groove, C, there is a water-seal between the pipe, G, and the sink. The strainer, H, fits around the pin f^3. Upon the ledge *d*, there are, at three different points, slight elevations, *d'*, which furnish friction-bearings for the edges of the strainer, and prevent it from being raised above the central bearing by the accumulation of grease on the ledge *d*. The lower part of the trap forms the coupling-cone, A', which has two ears on opposite sides, *a*, and around this cone is an annular groove, for the packing or putty. On the lower side of H is a bracket, *h'*, to which is pivoted the hook, h^2, which hooks under the inside of the dome; and the strainer is further provided with a pin, h^3, by which it can be readily revolved; the hook, h^2 being in contact with the walls of the dome, serves as a means to scrape the inside of the dome during its revolution, and thus prevents the passage under it from being clogged with grease. The bottom and edges of this hook, h^2 also come in contact with the bottom of the annular groove, C, and keep it also clean. The drain-pipe, A', of the body of the trap is long enough to extend down into the pipe, G, so as to furnish a proper seal between the two, and is locked into place by revolving the trap under the spiral cams, l^3.

226,387. PACKING FOR STEAM AND WATER-PIPES. — James W. Cameron, New York, N. Y.

226,404. SOLDERING APPARATUS. — John J. Johnson, San Francisco, Cal.

226,406. WINDOW-CORNICE. — Barret W. Kerfoot, Dayton, O.

226,410. PIPE-VISE. — Francis I. Maule, Philadelphia, Pa.

226,440. FLOOR OR WALL-COVERING. — George Paice Chiles, Camden Town, Eng.

226,444. EARTH-AUGUR. — Decatur P. Cudd, Concrete, Texas.

326,449. FIRE-ESCAPE. — Henry Fuller, Franklin, Ohio.

226,461. MANUFACTURE OF ROOFING FABRICS. — William H. Stewart, Brooklyn, N. Y.

226,477. SHINGLE-MACHINE. — Martin A. Bidwell, Sacramento, Ky.

226,478. SAFETY-ATTACHMENT FOR ELEVATORS. — Daniel M. Bissell and Frederick H. Littlefield, Boston, Mass.

226,487. SASH-LOCK. — Eben C. Bryan, Rochester, N. Y.

226,488. SASH-HOLDER. — Eben C. Bryan, Rochester, N. Y.

226,490. WRENCH. — Joseph W. Calex, North Easton, Mass.

226,507. VENTILATOR FOR CHIMNEY-CAPS, &c. — Benjamin W. Felton, Boston, Mass.

226,519. WASH-BASIN TRAP. — Jesse L. Hutchinson, Baltimore, Md.

226,579. VENTILATING WASTE-PIPES. — Richard Wilson, Toledo, Ohio.

226,582. WRENCH. — Ephraim Miller, Spring City, Penn.

9,145. LIGHTNING-ROD COUPLING (*Reissue*). — Elmore C. Bacon, Cleveland, Ohio.

SUMMARY OF THE WEEK.

Baltimore.

BUILDING PERMITS. — The following building permits have been issued since the last report: —

Adam Pohl, three-st'y brick dwell., 49 Fairmount Ave.

Edward Renneburg, two-st'y brick building, 25' x 47'; cor. Wolf and Washington Sts.

First Colored Baptist Church, cor. McEldery and and Caroline Sts., 52' x 87.

ICE-FACTORY. — A company is forming in this city to manufacture ice. A site has already been selected for the factory, near Calverton, with ample water-power for driving the machinery, and pure water to be converted into ice.

SCHOOL-HOUSES. — Thirteen new school-houses were contracted for by the Baltimore County School Board during the past year, ending September 30, 1879. Seven of these were finished at the same date named (September 30, 1879), and now all are completed.

STOCK EXCHANGE. — The question as to whether Baltimore is to have a new stock exchange was definitely settled on the 14th inst., at the morning meeting of the Stock Board, when it was almost unanimously decided to accept the proposition made by a number of members to erect a suitable building if the Exchange would agree to rent it, and it is stated that the new structure will cost $50,000. The site of the building will probably be on German Street, near South, directly in the rear of the National Farmers' and Planters' Bank. The exact plans of the new structure have not been decided on.

Boston.

BUILDING PERMITS. — Since our last report the building permits granted are as follows: —

Brick. — 337-339 *Commonwealth Ave.*, 2 houses, 24' x 62', three stories; A. H. Caton, owner and builder; Kirby & Lewis, architects.

466 *Commercial St.*, for J. Kelly, 1 dwell., 22' x 24', four stories.

375-79 *Marlboro St.*, for G. Wheatlan, Jr., 3 dwells., 23' x 42'; Vinal & Dodge, builders.

86 *Albion St.*, 1 tenement-house, 23' x 45', four stories; J. Graham, owner and builder.

West St., Ward 4, for Middlesex R. R., 1 blacksmith shop, 48' x 123'; M. S. & G. N. Miller, builders.

Wood. — *Washington St.*, Ward 24, for E. Torrey, 1 stable, 33' x 42'; S. Beal, builder; Cabot & Chandler, architects.

Brookside Ave., Ward 23, 1 hat-factory; J. P. Shaw, owner and builder.

FACTORY. — Messrs. Kirby & Lewis, of this city, are architects of a factory on Vale St., Highlands, for the Dennison Manufacturing Company. The building measures 35 by 80 feet, is three stories high, and will cost about $10,000. Jacobs & Son, contractors.

STATE NORMAL ART-BUILDING. — The bill giving a site on the Back Bay to the Normal Art School was engrossed by the Senate, with an amendment providing that the building must be erected thereon in three years, else the land will revert to the State.

Brooklyn.

BUILDING PERMITS. — *Manhattan Ave.*, *No.* 211, 1 three-st'y frame tenement, 25' x 52'; cost, $3,500; owner, William H. Graham, cor. Oakland and Freeman Sts.; architect, F. Weber; builder, Walling & Fenwig.

Hancock St., 6 three-st'y brown-stone dwells., 20' x 43'; cost, each, $6,000; owner, etc., Joseph H. Townsend, 60 Putnam Ave.

Bedford Ave., 7 four-st'y brown-stone flats, 20' x 50'; owner, Geo. W. Brown, 728 Fulton St.; architect, C. B. Sheldon; builders, Levi Brown and C. E. Cozzens.

Clinton Ave., 5 four-st'y brown-stone flats, 20' x 65'; owner, George W. Brown, 728 Fulton St.; architect, C. B. Sheldon; builders, Levi Brown and C. E. Cozzens.

Morton St., 1 three-st'y brick factory, 51'6" x 50'3"; owner, F. H. Cowperthwaite; architect, W. H. Gaylor; builder, James Rodwell.

Ross St., 1 three-st'y brick stable, 22'6" x 46: owner, Edmund McLaughlin; architect, William H. Gaylor; builder, Thomas Gibbons.

First St., cor. South Sixth St., 1 three-st'y brick factory, 98' x 40'; owner, Frederick W. Wurster; architect, W. H. Gaylor; builders, William & Thomas Lamb, Jr.

Park Ave., 4 two-st'y frame dwells., 20' x 40'; owner, etc., Conrad Guthard, 694 Park Ave.

ALTERATIONS. — *Henry St.*, *No.* 547, raise roof, one-st'y extension, 20' x 4'; cost, $1,500; owner, L. J. Elliot, on premises; builder, —— Murphy.

Meeker Ave., No. 38, raise roof, three-sty frame extensions, 24' x 20', tin roof; cost, $1,400; owner, Anton Lang, 38 Meeker Ave.; builders, Sammis & Bedford; mason, J. Auer.

Sixth St., *No.* 253, raise one-half story, three-sty frame extensions, 20' x 7'; cost, $1,200; owner, Frederick Young, 255 Sixth St.; builders, J. Rauth and J. Friess.

PUBLISHING HOUSE. — Mr. C. C. Buck, architect, has just finished plans for a six-st'y building for A. S. Barnes, 71 by 100 feet. It will cost $30,000.

Chicago.

BUILDING PERMITS. — Thomas Mackin, 5 two-st'y dwells., cor. Indiana and Cass. Sts. Cost, $20,000.

Wolf Bros., dry-kiln, 211 North Curtis St.; cost, $2,000.

J. Chanderis, cottage, Ninteenth, near Loomis St.; cost, $2,100.

Bauerle & Stark, dry-kiln, 228 West Ohio St.; cost, $2,000.

Benjamin Allen, two-st'y stone front dwell., Indiana Ave., near Twenty-fifth St.; cost, $9,000.

Weir, Johnson & Co., engine-house, Cologne St., near Ashland Ave.; cost, $2,000.

West Seebert, two-st'y dwell., 3,167 Wentworth Ave.; cost, $2,700.

John Gebrke, 2 twe-st'y dwells., cor. of Wells and Goethe St.; cost, $8,000.

Burr Mission Church, two-st'y church, Wentworth Ave., near Twenty-third St.; cost, $6,000.

New York.

ALTERATIONS. — *Willet St.*, *No.* 22, three-st'y frame store and dwell., to be inclosed by twelve-feet brick walls, etc.; cost, $6,000; owner, Henry Ruh; architect, Julius Boekell; masons, B. Schaff & Son; carpenter, Chas. Lehmann.

West Thirty-eight St., *No.* 1, to be raised to six stories; also a five and six-st'y brick extension, 17' x 49'; cost, $10,000; owner, J. H. Burton, 275 Madison Ave.; architects, D. & J. Jardine.

Wooster St., *Nos.* 36 *and* 38, to be raised to four stories; cost, $2,000; owner, W. Wyans; builders, J. & G. Layton.

East Eighty-first St., *No.* 412, a third story to be added to extension, the building to be extended; cost, $6,000; owner, Martin Clear; architect, Julius Boekell.

Sixty-second St., *No.* 114, to be raised to four stories, and interior alterations; cost, $3,000; owner, D. P. Barker; architect, Geo. W. Walgrove.

Washington Sq., *No.* 1, two-st'y brick extension on University Pl., 42' x 27'; cost, $20,000; owner, C. R. Roberts; architects, Gambrill & Ficken.

Sixth Ave., cor. Thirteenth St., one-st'y brick extension, 25 x 12 feet; cost, $2,000; owner, John A. Oxley; architect, Jas. W. Porter.

Grand St., cor. Wooster, side wall rebuilt and interior alterations; cost, $3,000; owner, W. Wyans; builders, J. & G. Layton.

West St., cor. Albany St., new front and interior alterations; cost, $3,000; owner, Chas. Spear; architect, H. R. Searle.

Commerce Ave., cor. Depot Pl., Highbridgeville, three-st'y frame building to be repaired; cost, $2,690; owners, estate of W. B. Ogden; architect, N. D. Bush; builder, Isaac A. Hopper.

Sixth Ave., *No.* 600, one-st'y brick extension, 24'8½" x 46'; cost, $2,200; owner, Mrs. R. A. Witthaus; architects, D. & J. Jardine; builder, Alex. Brown, Jr.

Bentner's Lane, near Riverdale Station, internal alterations and repairs; cost, $7,500; owner, William Meikleham; architect, James Stroud; builder, P. B. McEntyre.

Tenth Ave., two-st'y brick extension, 15'4" x 20'; cost, $2,500; owner, V. K. Stevenson; architects, D. & J. Jardine; builder, Alex. Brown, Jr.

Broadway, *No.* 1214, exterior alterations; cost, $2,400; owner, Henry Bang; architect, Wm. José.

West Tenth St., *No.* 192, to be raised four feet, and a four-st'y brick extension on rear, 21'8" x 37'; cost, $12,000; owner, Mrs. Catharine Cook; architects, Cook & Babb; builders, Robinson & Wallace.

APARTMENT-HOUSE. — Mr. E. T. Littell is drawing plans for an apartment-house, 45' x 100', and four houses 16'6" x 50', to be built on Fifty-fourth St., between Sixth and Seventh Ave. The building will be of brick and stone, with some terra-cotta, and will cost $60,000.

BUILDING PERMITS. — *Lexington Ave.*, cor. Seventy-third St., for James Judge, Thorn & Wilson, architects, 6 brown-stone dwells., 17' x 52'; cost, $51,000.

Sixty-fourth St., for J. Waldron, Thorn & Wilson, architects, 3 brown-stone dwells., 18' and 16' x 60'; cost, $36,000.

Lexington Ave., cor. Seventy-fifth St., for Farley Bros., Thorn & Wilson, architects, Farley & Bros., builders, 6 brown-stone dwells., 17' x 53'; cost, $54,000.

One Hundred and Thirtieth St., for L. C. M. K. Yost, A. Yost, architect and builder, 2 brown-stone tenements, 25' x 60'; cost, $16,000.

East Seventy-second St., Nos. 241, 243, 245, for C. H. Bliss, Wm. Grant, architect; Geo. J. Carey, builder; 3 brown-stone dwells., 16'8" x 50; cost, $18,000.

East Sixteenth St., Nos. 713 *to* 715, for Jno. Koach & Son, Wm. J. Frye, Jr., architect; List & Lemon, builders; brick factory, 165' x 60'; cost, $20,000.

Stanton St., Nos. 152 *and* 154, for Thos. Rothmann, Julius Boeckel, architect, 2 brick tenements and store; cost, $16,000.

Mercer St., No. 239, for E. H. Bowman, Patrick Childs, builder; brick factory, 25' x 48'; cost, $1,000.

Madison Ave., cor. Sixty-ninth St., for Anthony Mowbray, Lamb & Wheeler, architects; Anthony Mowbray, builder; 4 dwells., 2 of brick, 2 of brown-stone; cost, $125,000.

FACTORIES. — The plans for the factory corner Duane and Hudson Sts., have been completed by Mr. S. D. Hatch. The building will be 101'3" x 78'7", of brick, with granite and Wyoming stone finish, and will cost $150,000. J. H. Masterton will do the mason-work; Jno. Sniffin is the carpenter and Leopold Schepp the owner.

The lot of ground, the site of the recent fire on the corner of Twenty-ninth St. and Sixth Ave., it has been decided, will be used for an extension of the factory of Messrs. Frederick Beck & Co., 100' x 125'; six stories high, at an estimated cost of $35,000.

HOSPITAL. — Excavations have commenced on the lot corner of Park Avenue and Forty-first Street, on which will be built the Manhattan Island Eye and Ear Hospital. The building will be 98'9" x 70', of brick and stone. The style is to be Jacobean. Cost, $100,000. Mr. Charles C. Haight is the architect.

LUNCH-ROOM. — No. 23 New St. is being altered, and a handsome lunch room and bar is being made. All the finish will be of the finest mahogany. Stained glass windows are being prepared by W. J. McPherson, of Boston. Mr. George E. Harding, architect.

"POST BUILDING." — The Post estate propose rebuilding the "Post Building" on Hanover Sq.

REAL ESTATE. — Real estate is firm, and large sales have been made this week, on Tuesday, by order of the Mutual Life Insurance Co.; 236 pieces of property were sold at prices higher than they were expected to realize, and though no "boom" has been experienced, the quiet and steady rise in prices causes a feeling that figures will be well maintained.

STEINWAY HALL. — Messrs. Steinway & Son propose enlarging their concert-hall, which has been found inadequate to hold the audiences at some of the recent concerts.

STORE. — Mr. Myers will have built at the corner of Bowery and Hester St., a store, 53' x 104', of brick, with stone finish, the first story to be of iron. Estimated cost, $40,000.

THEATRE. — It is said that the Olympia Theatre is to be rebuilt.

Philadelphia.

ALTERATION. — *Chestnut St., No.* 706, extensive alterations are being made for Passitor, Reed, & Elbridge.

BLIND ASYLUM. — The corner-stone of the new Industrial Home for Blind Women, at Powelton and Saunders Avenues, West Philadelphia, was laid April 15. It will measure 50 by 120 feet, and will be three stories in height. The first story will be built of stone, and the two remaining stories of brick. Cost, $29,000.

BOILER-HOUSE. — *Twenty-second St.*, cor. Penna Ave., 1 boiler-house, 14' x 36'; owners, Wm. Wood & Co.

FACTORIES. — *Twenty-second St.*, cor. Spring Garden St., five-st'y factory, 78' x 66'; owners, Wm. Wood & Co.

Fourth St., cor. Lehigh Ave., 1 five-st'y factory, 55' x 153'; W. H. Bilgen, contractor.

Twenty-first St., cor. Nicholas St., two-st'y factory, 36' x 62, W. J. Moore, contractor.

Kiernan St., No. 1315; two-st'y factory, 19' x 55'; owner, J. Raffus; contractor, W. R. Chapman.

Callohill St., No. 1810, 1 two-st'y factory, 16' x 36'; Lewis Beck, owner and builder.

Kensington St., cor. Elizabeth St., four-st'y factory, 40' x 155'; owners and builders, John Dallas & Son.

HOUSES. — *Queen St., No.* 2223, three-sty dwell., 20' x 74'; owner, Morris Flushner; cost, $10,000; architect, Willis G. Hale.

Sunnyside Ave., east of Thirty-fifth St., 8 three-st'y dwells., 16' x 29'; owners, Keely & Brownback.

Bonvier St., south of Oxford St., 5 three-st'y dwells., 20' x 56'; owner, Charles Blanchard.

South Broad St., No. 908, 1 three-st'y building, 14' x 30'; O. S. Tice, contractor.

Bainbridge St., No. 1933, three-st'y dwell., 18' x 53'; Ernest & Aiken, builders.

Bridge St., No. 124, 1 three-st'y dwell., 26' x 34'; owner and builder, Geo. Yerricks.

Frankford Ave., Nos. 2825 *and* 2827, 2 two-st'y dwells., 20' x 68'; J. & E. Blood, owners and builders.

Thirty-fifth St., cor. Alleghany Ave., 7 three-st'y dwells, 15' x 30'; owner and builder, Samuel Hutchinson.

INSURANCE BUILDING. — In the competition for designs, etc., for the Insurance Company of North America, this city, Messrs. Cabot & Chandler, of Boston, were the successful architects.

STORE. — *Market St., No.* 4032, two-sty store, 17' x 70'; tractor, John A. Palmer.

Providence, R. I.

ALTERATION. — Howland Hazard is to make a brick addition 21 by 32 feet, to his house on William Street, in the style of the old work, which is Colonial. Work is to done by C. F. & J. M. Hull; architects, Walker & Gould.

HOUSES. — Helen M. Kirby is building a frame dwelling at the corner of Albany and Tell Streets. John Sprague furnishes the plans and does the work. Cost, about $3,000.

Mr. James Russell furnishes the plans, and is building a dwelling on the corner of Almy and Tell Streets for Mr. John J. Breen. Cost, $2,500.

STABLE. — Mr. E. P. Chapin is having plans drawn for a frame stable and billiard-room 40 by 59 feet, at the rear of his house on High St. Work done by the day. Probable cost, $6,000. Architects, Walker & Gould.

STORE. — L. R. Billings is excavating for a block of stores and offices, corner Westminster and Union Streets. Building is to be of brick, stone, and iron, and to cost about $48,000. Masons' work, Geo. W. Lewis; carpenters' work, Richard Hayward. Plans in charge of Mr. Robert Manchester, who is assisted by Messrs. J. C. Bucklin & Son, architects.

TENEMENT HOUSE. — Mr. Ferdinand Potter is building two tenement houses, to cost $3,600 each, corner of Bridgham and Kendall Streets, from plans furnished by Mr. A. N. Parker, who does the carpenters' work also.

St. Louis.

BUILDING PERMITS. — Forty-six permits have been issued for the week ending April 16, 1880, of which seven are for frame structures of slight importance. Of the rest, those worth $2,500 and over are as follows: —

Owners.	Use.	Stories.	Rooms.	Cost.
C. Moder,	Dwelling.	2	6	$4,500
Mrs. Carrie Marshall,	Dwelling.	2	7	3,400
Mrs. C. Hitchcock,	Store.	1	1	15,000
J. A. Symonds,	Dwelling.	2	7	5,220
Cochran & Co.,	Store.	3	9	3,500
C. Parsons,	Dwelling.	2	8	5,000
Union Depot R. R. Co.	Stable.	1	1	5,000
J. B. Lucas,	Dwelling.	2	14	7,000
M. Keller, agent,	Store.	3	15	5,000

General Notes.

AKRON, O. — Proposals for building the parsonage for the first Universalist Church are received to-day by Jacob Snyder, architect.

BELMONT, MASS. — $25,420 have been contributed to the Massachusetts General Hospital, in Boston, which will be used for building a house for convalescents here.

BRIDGEHAMPTON, N. Y. — Mr. C. C. Buck, architect, of Brooklyn. is to built a house for R. Esterbrook, Jr. Cost, $15,000.

BRYAN, O. — A new school-house is to be built from plans of Mr. N. B. Bacon, architect, of Toledo, O. Cost, $3,000.

CHELSEA, MASS. — The first Congregationalist Society have raised nearly $5,000 to repair the church.

CLAREMONT, N. H. — Mr. H. R. Beckwith, architect, has just finished drawings for houses for J. Knoll, C. E. Parks and A. Tracy.

COLUMBUS, IND. — The Palace Theatre, burned a year or more ago, is being rebuilt.

CONCORD, MASS. — The town has just voted to build a school-house, at a cost of $12,000, and to make alterations in the existing school-houses.

CONEY ISLAND, N. Y. — A new depot is to be built for the New York & Brighton Beach R. R. Dieten Hotel will be utilized in its construction. Mr. George E. Harding, of New York, is the architect.

COOPERSTOWN, N. Y. — A three-story block of good buildings is to be built by Bundy Brothers.

DANVERS, MASS. — Extensive improvements are to be made to the Catholic Church.

DENVER, COL. — E. Anthony, architect, has completed plans for a three-story store, for Jerome S. Riche. Contract awarded to T. C. Kelsey for carpenter-work. Barcus & Carson, brickwork. Cost, $30,000. It is a continuation of the Kassler block, just finished by the same architect at a cost of $50,000.

DETROIT, MICH. — Chas. H. Marsh, architect, is engaged on the plans for the new buildings of the Michigan Grape Sugar Company.

Douglas Smyth, of New York, is drawing plans for a house 50 by 75 feet, to be built on Jefferson Ave., for Mr. H. D. Barnard. The building will be of red brick, with plain stone finish. A little terra-cotta work will be introduced. Cost, estimated at about $10,000.

DUBUQUE, IO. — F. D. Hyde, architect, is preparing plans for a Queen Anne cottage, frame, to be built on Willson Avenue, for C. M. Carter, Esq. Cost, about $2,500. Also plans for a two-story three-house tenement block, brick, for A. Palmer, Esq., to be built on Bluff Street. Cost, about $7,500.

EAU CLAIRE, WIS. — Wallace Hume, architect, of Chicago, has completed the plan of the opera-house for this city, 165 by 105 feet, three stories high. The seating capacity is 1,000; material of building, brick and stone; cost, $10,000.

HICKSVILLE, O. — The architect of the new store for Ainsworth & Co., which is to cost $3,500, is N. B. Bacon, of Toledo, O.

HOLYOKE, MASS. — St. Marie & Beaucheum, will begin to build a three-story block, at the corner of Park and Cabot Streets, as soon as brick can be obtained.

LOUISVILLE, KY. — Annie C. Courtnay is to alter a two-story brick store on Jefferson Street, between Second and Third St. Cost, $1,300.

MANSFIELD, O. — The new opera-house is to be built by D. W. Gibbs & Co., architects, of Toledo, O. Cost, $40,00.

NARRAGANSETT PIER, R. I. — A stone chapel is to be built, at a cost of $10,000, from designs of Mr. J. C. Cady, of New York.

NEWARK, N. J. — The corner-stone of the new House of the Good Shepherd was laid April 18.

NEWTON, MASS. — Ground will soon be broken for a house measuring 45 by 90 feet, which is to be built from the design of G. A. Freeman, Jr., architect.

NORTH LONG BRANCH, N. J. — Two cottages have just been started, The designs are by Mr. E. T. Littell, of New York.

NORWICH, MASS. — Two summer cottages are soon to be built, one for Rev. W. Bacon, the other for Mrs. Kirkland. Mr. S. C. Earle, of Boston, is the architect.

OSWEGO FALLS, N. Y. — The Oswego Falls Manufacturing Company is building fifteen new tenement-houses.

PALMER, MASS. — The New London Northern Railroad is building sheds 375 feet long.

PEORIA, ILL. — Harvey Lattimer is to build a three-story brick house on South Washington Street.

Industrial.

AUBURN, PA. — Miller & Randall will build a new wooden shoe-factory in the summer. It will be 70 feet long, 50 feet wide, and three stories high.

BRADFORD, MASS. — John P. Gilman is building a large hat-factory.

CHICAGO, ILL. — The Crane Brothers Manufacturing Company is to build on Canal Street, with 125 feet on Judd and 50 feet on Wilson Streets, a large manufacturing establishment.

DETROIT, MICH. — A match-factory will probably be built here, in which Hammond, Standish & Co., will be largely interested.

NEW BRIGHTON, PA. — Logan & Strobridge have broken ground for a new foundry and machine-shop.

NEW ENGLAND VILLAGE, MASS. — The Washington Mills Emery Manufacturing Company is about to build a new mill, 30 by 80 feet, three stories high.

J. S. Nelson & Son, are arranging plans for an addition of 60 feet to their shoe manufactory.

NEWTON, N. C. — Ryne & Mehaffy are building a three-run steam flouring-mill.

PAWTUCKET, R. I. — Messrs. Dexter & Clarke are putting up a new mill, 50 by 100 feet, to be used for the manufacture of card-board. Kenyon, Whittaker & Smith are the contractors; cost, $16,000; no architect.

POMEROY, O. — The pulp-mill will be rebuilt at once.

QUINCY, ILL. — The Quincy Paper Company is building a new mill.

ROME, GA. — J. J. Leary is building a large iron-foundry near this city.

THOMASTON, CONN. — The brass-mill extension is under way. Work is also being rapidly pushed upon the Marine Clock shop addition, whose dimensions are 100 by 40 feet.

Bids and Contracts.

BIRMINGHAM, CONN. — The Beardsley Building Company has the contract for the addition to Malley's factory. It is to be of brick and four stories high.

BLACKSTONE, MASS. — The contract for building Mr. W. J. Miller's house has been awarded to Mr. Ichabod Cook, of East Blackstone.

BROOKLYN, N. Y. — The contracts for building the new school-house at the corner of Dean Street, and New York Ave. have been awarded thus: mason-work, Ashfield & Son, $14,242; carpentering, P. F. O'Brien, $13,863; plumbing, M. J. Brien, $900.

The contracts for the new Eastern District Hospital have been awarded.

DOVER, N. H. — H. C. & J. F. Howe, contractors, of Lowell, have been awarded the contract for the four-story mill, 700 by 74 feet, which is to be built here by the Cocheo Mills.

INDIANAPOLIS, IND. — Hon. W. H. English has concluded a contract with J. B. McElfatrick & Son for the construction of his new opera-house. It will be 84 by 228 feet, with a capacity for 3,000 to 4,000 persons. At first it will be seated for 2,200.

PEORIA, ILL. — The contract for building the Ninth District school-building has been let to Valentine Jobst.