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CARPENTRY AND BUILDING

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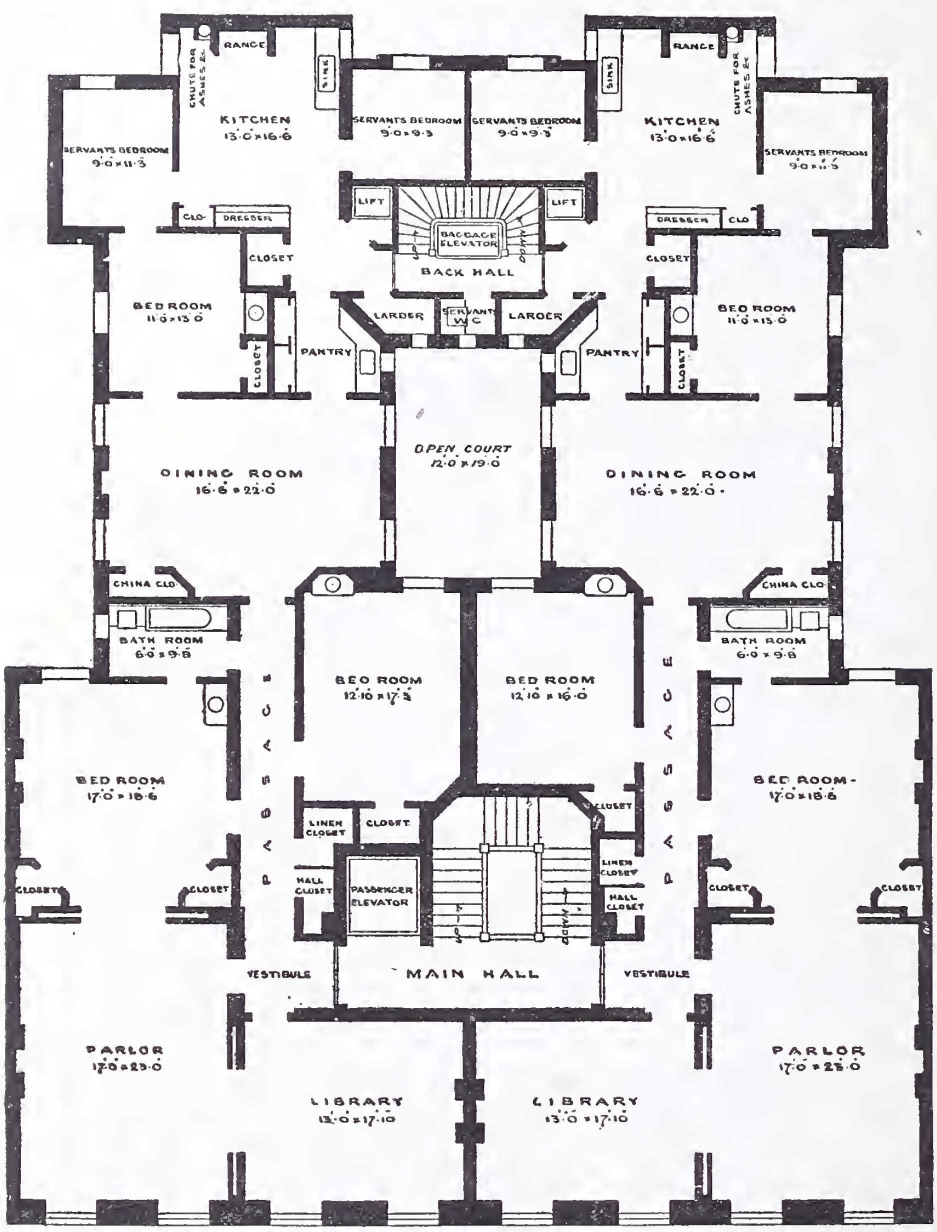
Apartment Houses.—Fig. 1.—The "Osborne," Fifth Avenue, New York City.

French Flats and Apartment Houses in New York.

Probably there is no other class of buildings which has been attracting as much attention of late as the apartment houses and French flats of this city, unless possibly we except the tenement houses. They have been a matter of interest to each of several classes in the community. First, there are the capitalists, who have been examining into them as a means of investment. Next, the architects have been studying them in the matter of design, plan and general appointments. Builders have been concerned in erecting them; while last, though not least, readers have experienced a curiosity upon this subject, and will be glad to read a brief description of flat and apartment houses, which of late are becoming so common in New York.

The apartment house of New York city is the direct outgrowth of the tenement house, having come into existence only after the tenement houses had become quite numerous. It will not do, however, to associate apartment houses and tenement houses together as being one and the same. As the terms are used in common conversation there is an important distinction maintained. But a "flat house," or "French-flat house," are terms which are used almost synonymously with "apartment house." An apartment house the halls are carpeted and are kept warm in winter, and are under the immediate care of a janitor employed by the owner of the building. We are thus particular in distinguishing between tenement houses and apartment houses because the difference is such that, without a statement of this kind, confusion would be caused in the mind of the reader.

We have stated that the apartment house in New York was an outgrowth from the tenement-house system. It was the direct result of an effort made to provide houses containing a number of suites of rooms, each suite being calculated to accommodate a family, which should attract to their support a better class of people than the occupants



Apartment Houses.—Fig. 2.—Second, Third, Fourth and Fifth Floors of the "Osborne."—Scale, 1-16 Inch to the Foot.

the thousands of families who are now occupying narrow single houses in the city at exorbitant rents, or who, for reasons of economy, are living out of the city with the constant necessity of journeying to and from it, and those who in other respects are uncomfortably housed on account of the crowded condition of the city, have been anxiously investigating the subject of flats and suites of apartments, hoping to find in them a satisfactory solution to the problem of how to live comfortably and economically in the great city. Much has been written, in a general way, upon the subject of flats, yet, with the general public outside of the city, not excepting builders and architects, we believe there still exists an inadequate conception of what a flat is and how it is arranged. We presume that many of our apartment house or a flat house, then, is a building arranged in suites of apartments to accommodate a number of families. A house of this description differs from the "tenement house" principally in the character and style of the building and its appointments. In tenement houses the rooms for a family are from two to four in number, while few or no conveniences are provided, and the finish throughout is of the plainest order. In an apartment house the number of rooms in each suite ranges from four to ten, while the appointments are of the better class. A range, bath, water-closet, window cornices, gas fixtures, mirrors, &c., are provided, and go to make up the conveniences. In a tenement house the halls, which are used in common, receive little or no attention from the owner of the property. In an of the ordinary tenement houses. The difference between them, it will be seen, then, is one of degree rather than of kind; yet a distinction is rigidly maintained between the two, and no one in the city would make the mistake of calling an apartment house a tenement house.

With this definition of terms we will proceed to describe the French flat or apartment house, whichever our readers may prefer to call it. In houses of this kind, as with those of every other class, there is a wide range between the best and the poorest. Perhaps we cannot better indicate this difference than by making a comparison of the prices obtained in the way of rent. There are apartment houses in New York in which suites rent for $2000 per year and upward. There are also apartment houses in which suites rent at from $16 to $20 per month. Of course, between these two extremes there is a difference in the number of rooms. The highest priced suites would consist, probably, of 10 rooms, while the low-priced ones would contain possibly but four rooms. An average flat contains seven rooms, arranged in something like this order: First the parlor, with a bedroom back of it. Generally there is a private hall running from the entrance to the suite, which is commonly the back part, to the parlor, which is in the extreme front. In some it runs only to the front bedroom, in which case the latter occupies the entire width of the building. This hall is always very narrow, frequently it is less than the width of an ordinary breadth of carpet, and as it is quite long and often without light save from the doors opening into it, it presents anything but a cheerful appearance. Next opening off from the hall is a second bedroom, somewhat smaller than the first, although the first would be considered very small to those who are accustomed to the spacious rooms of village and country houses. Then comes the bath-room, back of which is another bedroom. Next the dining-room and then the kitchen, off from which is a small bedroom for the servant.

The size of rooms among the average flats is about as follows: The parlor, occupying the full front, say 14 x 14 feet; a back parlor or a bedroom, as we have called it above, opening from the parlor, say 10 x 10 feet. The second bedroom, say 8 x 9 feet. The dining-room 10 x 12 feet and kitchen 10 x 10 feet, with a servant's bedroom, 6 x 9 feet. Generally about four closets are distributed through these rooms, located in corners, the total capacity of them being about one-half of that of an ordinary closet built where room is abundant. Room for a very small ice chest is provided in the passageway connecting the dining-room and kitchen, which in width is what is left after taking off the servant's bedroom above named. In some cases, what is called an ice-closet, is built in the house, drip pipes being provided connecting it with the regular waste-ways of the house. The bath-room is too small to admit of anything more than the water-closet and a very short bath tub. Very generally one of special size, made for this particular purpose, is employed.

Light is provided to the bath-room and also to the back chamber, and in some cases likewise to the dining-room, from what are called "light-wells." These may be described as notches in the side of the building, or holes down the center of it, running from basement to roof, for the sole purpose of affording light and ventilation to such rooms as would otherwise be deprived of both. In many cases, however, they are too small to do effective service in either capacity.

Each apartment house is provided with a janitor, whose duty it is to keep the halls in order, as above mentioned, and also to wait upon each of the occupants in the way of sending up coal, receiving and delivering parcels to rooms, sending up marketing, removing ashes, garbage, &c. The latter, however, is very frequently provided for in the way of ash shutes in the kitchens. In some apartment houses, particularly those in stylish neighborhoods, a hall-boy in livery is kept to wait upon the door. In many cases, however, what are known as "door-openers" are employed in connection with bells and speaking tubes. Upon entering the vestibule of a house of the latter kind, one is confronted upon either hand with an array of name plates, in combination with letter boxes, speaking tubes and bell-pulls. Discovering the name of the occupant upon whom we wish to call we ring that bell, and, being questioned through the speaking tube, answer with our name, and, possibly, the nature and reason of our call. A moment later (presuming, of course, we are not unwelcome) the door opens as if by magic, and we enter. The peculiar mechanism by which the door is opened, and other interesting details in connection with the hardware used about flats, we must leave until another time.

A dumb waiter is provided, connecting with the kitchen of each suite of rooms, leading from the basement in which coal is kept. A set of bells and speaking tubes enables the servant upon any flat to communicate with the janitor and order such supplies as are required. The kitchen is ordinarily fitted with a range and boiler, stationary tubs, sink, &c. It is necessarily small in size, like other rooms of the suite, but it is very compact in its arrangement, and is quite convenient. Washing for the family is done in the kitchen by the servants, thus employing the stationary tubs above mentioned. The roof is the only place for drying clothes, for yard room there is none. In many cases, however, the washing is sent out to laundries, or else is done by the family of the janitor. In some cases, of which the house illustrated by the accompanying engraving is one, a general laundry or wash-room is provided upon the upper floor. A series of stationary tubs is fitted up, steam closets for drying are arranged, and a closet for keeping irons and other articles is provided for each tenant. The drying is either done in the steam drying closet or upon the roof, according to circumstances. In connection with such an arrangement as this, very frequently an additional room is provided upon this upper floor, in connection with each suite, for an extra servant or for use as a trunk and storage room.

The description of one floor in a flat or apartment building serves for all. The difference between the accommodations of the tenants upon the fifth floor and those upon the first floor, consists only in the number of stairs to be climbed. Of late, elevators are being used to a considerable extent, even in moderate priced establishments; but in many of them nothing but the hard work of climbing stairs gets one to his home, if home it can be called, after a hard day's work in counting-room or office.

Still another feature incorporatad in some apartment houses is that of a restaurant upon the lower floor, with a general dining-room attached, to which families may repair for their meals, or from which meals may be ordered served in the rooms. A number of apartment houses are in existence which are fitted up with no provision at all for cooking in the several suites, all the meals being thus ordered from one common center. In others the general restaurant is provided, and a kitchen also with each suite, leaving the occupants their choice between the two plans.

The description of a flat or suite of rooms as above given applies particularly to those of a moderate rent. The principles upon which the more expensive flats are constructed and arranged are the same, the difference in price being made by the increased space afforded, by the style in which they are finished and kept, by the locality in which the building is situated, and by other reasons of a similar character. Our illustrations represent the "Osborne" one of the most stylish and best-appointed apartment houses in the city. We have introduced it in illustration of the system rather than the plans of some less pretentious building, because the cheaper apartments were the more easily described, and because such a building as this illustrates the system carried to the extreme of elegance and comfort. As soon as the system of apartment houses was introduced, it came into direct competition with dwelling houses of the better class, and while it was originally calculated to provide better accommodations at a low price than were afforded by the narrow dwelling houses of the city, it also of necessity exhibited a plan by which many of the annoyances of housekeeping could be overcome. It was only a question of the number of rooms and the appointments, then, to bring apartment houses into competition with the best separate dwellings. In the "Osborne" is exhibited a building in which the suites of apartments come in direct competition with high-priced dwellings.

The "Osborne," which is situated on the east side of Fifth avenue, between Fifty-second and Fifty-third streets, was erected a few years since under the management of, and to the design prepared by, Messrs. Duggin & Crossman, the well-known architects of this city. All the knowledge embracing the most recent improvements in buildings of this class was employed in the management and construction of this building. Each suite contains nine rooms, exclusive of bath-room and butler's pantry and larder. There is an additional room on the sixth floor, suitable for use as a bedroom for a servant or for a trunk room. The basement is provided with an abundance of coal accommodation. The kitchens are placed so that it is impossible for the fumes from cooking to reach those portions of the building occupied by the families, a great desideratum in apartment houses. The arrangement of the bedrooms for the servants, which are contiguous to the kitchen, is also considered desirable. It makes complete isolation of the kitchen apartment possible.

The main entrance is from Fifth avenue, and is made attractive by the introduction of flowers and plants in the front courts and at the stoop. The inside steps of the stoop are of marble, with rests provided for the reception of vases of plants and flowers. The first story hall is also laid with marble. The main entrance is for the exclusive use of the residents and their visitors. A separate entrance is provided in the rear for the convenience of servants and the delivery of furniture, trunks, ice, coal and wood. As will be seen by the plans, both a passenger and baggage elevator are provided. The former is kept in constant motion from an early hour in the morning until a late hour at night. The plan (Fig. 2) represents all the floors devoted to suites except the first. This is modified only so far as is necessary to furnish space for the front entrance. The sixth floor contains the wash-room, ironing-room and drying closets above alluded to, and the extra rooms suitable for servants or storage, as required.

Much more might be said descriptive of the flat system, its advantages and disadvantages, and the devices resorted to in construction and arrangement; but we have occupied more space already, perhaps, than the subject warrants. Flats are an acknowledged necessity in New York, and instead of their expediency being called in question, the problem now is to render them the most comfortable at the least cost in money and space. Many flats have smaller rooms even than those we have enumerated above. Some have dark rooms, which, of course, are objectionable. Location and neighborhood have a material influence upon prices. What we have especially described may be considered about an average of the moderate-priced flats, and which, according to location and general surroundings, would rent at $400 to $1000 per year, while apartments in buildings like the Osborne are very stylish and command much higher figures.

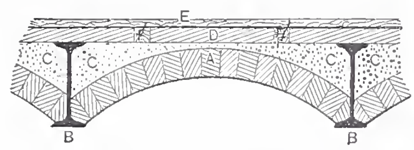
A Cleansing and Renovating Polish.—Take of olive oil 1 lb., of rectified oil of amber, 1 lb.; spirits of turpentine, 1 lb.; oil of lavender, 1 oz., and tincture of alkanet root, ½ oz. Saturate a piece of cotton batting with this polish, apply it to the wood, then, with soft and dry cotton rags, rub well and wipe off dry. This will make old furniture in private dwellings or that which has been shop-worn in warerooms look as well as when first finished. The articles should be put into a jar or jug, well mixed and afterward kept tightly corked. This is a valuable receipt, and not generally known.

How to Get Rich in Brazil.—Brazil consumes large quantities of North American timber, because she has very few saw mills upon her own territory. The streams wash away many trees, which mill owners at their mouths would have simply to capture and land. It is said that a Portuguese who built a mill a few years ago at the mouth of the Madeira River has recently retired with a large fortune, although he had employed only the rudest machinery and unskilled workmen. The cedar logs floating down supplied him in 5 months in every year with sufficient timber for the entire year's work.

Filling Mahogany.—Beeswax and rosin, colored with red to match the mahogany, serves as a good filling. Put in holes hot, and scrape level when cool. You cannot make a really "good job" of it, as the grain cannot be imitated.

Fire-Proof Construction.

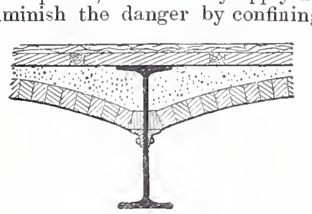
Probably there is no subject which has received more careful attention upon the part of architects and the building public generally than that of fire-proof construction; yet with all that has been done and all that has been published, there is still a lack of intelligent knowledge concerning it. Many buildings are popularly considered fire-proof which are rather fire traps, and much money is expended in so-called fire-proof construction which might be better employed in other directions. A careful consideration, then, of the subject of fire-proofing cannot fail to be of interest to the majority of our readers. We have nothing new to add to the subject. What we shall endeavor to accomplish is to present in convenient shape a brief description of the several classes of fire-proof buildings in use,



Fire Proof Construction.—Fig. 1.—A, Brick Arches Between B, Rolled Iron Beams. F, Strips of Wood 2 x 2 Inches, 16 Inches from Centers. E, Flooring Nailed to the Strips. D, Filling between Strips. C, Concrete Filling.

together with a few remarks concerning the properties and qualities of the materials employed.

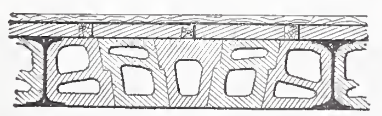
No material used in building construction, except brick or burnt clay, is practically fire-proof. A building constructed of incombustible material throughout, and stored with only small quantities of combustible and inflammable matter, can be considered fire-proof. Warehouses for the storage of miscellaneous merchandise cannot, with our present knowledge, be constructed absolutely fire-proof; we can only apply devices that diminish the danger by confining and



Fire-Proof Construction.—Fig. 2.—Showing Method of Using Deep Beams. The Arches may be Supported on Angle Irons Riveted to the Web of the Beams.

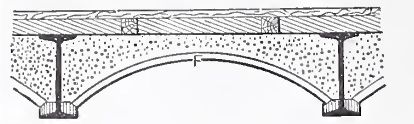
localizing the conflagration. Generally, public places of amusement, churches, schools, offices or dwellings do not contain so much inflammable matter, such as furniture, &c., as to materially injure or eudanger the safety of the building when properly constructed. Warehouses, when stored with inflammable matter, even if constructed entirely of brick, but without precautionary subdividing walls, forming compartments, will succumb to the heat, by reason of the great expansion causing a movement of the walls and ultimate collapse of the floor arches.

It is asserted that iron is unsuitable for fire-proof construction, by reason of its failure when exposed to a certain degree of



Fire-Proof Construction.—Fig. 3.—Flat Arch of Hollow Tile.

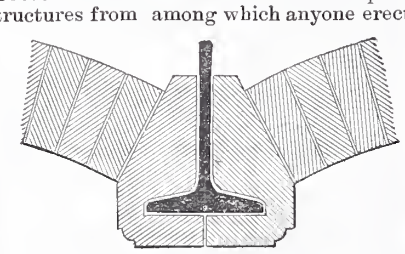
heat. That this is so is of course admitted; but, nevertheless, it is the only material at our disposal suited to modern requirements, and the architect will meet with more satisfactory results in devising means and methods for its protection against the destructive effects of fire than by discarding it. All constructive ironwork in buildings, except those having small quantities of combustible furniture in them, should be protected from the direct action of a fire by some fire-proof and non-conducting coating, securely fastened to the member it is intended to protect. Columns or girders of wood resist the destructive effects of fire much longer than if made of iron exposed. The necessary dimensions, however, except for comparatively light structures, are such as to make the use of wood for those purposes imprac-



Fire-Proof Construction.—Fig. 4.—Corrugated Iron Arches with Concrete Filling, with Flooring as in Fig. 1.

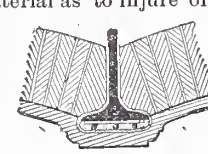
ticable; for example, a column of oak, 18 feet high aud 1 foot square, will support with safety 25 tons, while a hollow, cast-irou column, 1 foot square and 1 inch thickness of metal, will support 119 tons. So, also, will a beam of yellow pine 15 inches square, 15 feet span, and uniformly loaded, carry 16 tons, while three 15-inch light-rolled iron beams, lying side by side and occupying about the same space, will carry 69 tons.

With these preliminary remarks we will proceed to consider the classes of fire-proof structures from among which anyone erect-



Fire-Proof Construction.—Fig. 5.—Burnt Clay Skew-back, Formed to Lap Flange.

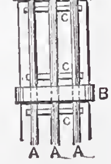
ing a building at the present time must make his selection. Fire-proof structures may be, iu a general way, divided into three classes. The first of these embraces those structures in the construction of which only non-combustible material is used, and in which all constructive ironwork is properly protected against the action of fire. The second class embraces those structures into the construction of which non-combustible material enters, but in which the ironwork is not protected by fire-proof and non-conducting coatings. Structures built upon this plan are suitable for any purposes which would not put into them so much inflammable material as to injure or weaken the



Fire-Proof Construction.—Fig. 6.—Lower Flange of Beam Protected by Plaster Carried by a Light Frame of Iron.

iron in case of fire. Classes 1 and 2 may be described together, the principles of construction being identical in the two, class 1 simply carrying them somewhat further than the other. The third class comprises all buildings in the construction of which combustible material is used, but in which all vital members are protected by fire proofing.

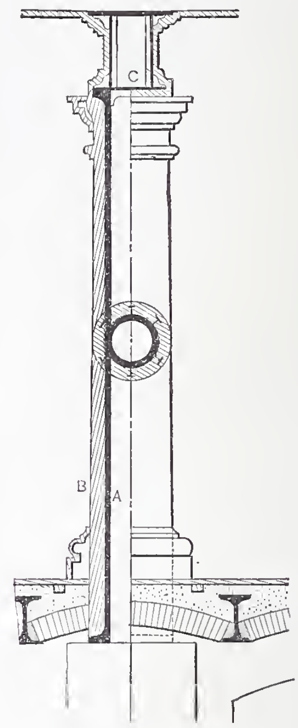
In the construction of such buildings as we have indicated in what we have called the first class, all combustible material is rigor-



Fire-Proof Construction.—Fig. 7.—View of Beam from Below. A, Iron Rods ½ Inch in Diameter. B, Flat Hoop Iron Bent Around Flange. C, Wedges.

ously excluded, except for doors, windows, sashes, stair rails, floors and skirting. The external face of outside wall may be either of brick, sandstone or granite. The backing should be of brick, with a hollow space 2 inches wide located one brick distant from the inner face of the wall. All openings in the brick wall are arched. The roof construction employs furring and lathing of iron. The floors are constructed of iron beams carrying arches of brick, as indicated in Figs. 1 and 2 of the accompanying engravings, or hollow tile, as shown in Fig. 3, or corrugated sheet iron, as indicated in Fig. 4. With the use of brick arches or of corrugated iron arches (Figs. 1, 2 and 4) the haunches and crown are filled with concrete leveled with the top of the beams.

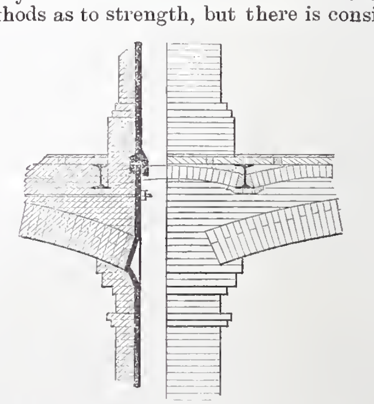
When floor tiles are used, they are bedded in about 1 inch of cement spread over the concrete. When the floors are laid of wood,



Fire-Proof Construction.—Fig. 8.—Protection of Cast-Iron Columns. A, Inner Shell of Shaft. B, Protecting Envelope of a Fire-Proof Non-Conducting Material.

strips 2 x 2 inches are bedded in the concrete, to which the floor is nailed. These strips should be from 16 inches to 2 feet apart. Spaces between the strips should be filled with cement mixed with fragments of porous brick.

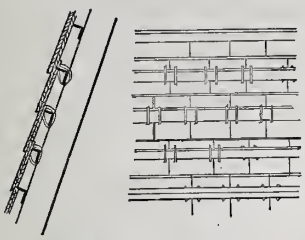
Referring now to the three plans of construction between the iron beams above enumerated, it may be remarked that practically there is no difference betweeu these methods as to strength, but there is consid-



Fire-Proof Construction.—Fig. 9.—Cast-iron Columns Protected by 4½ Inches of Brick. Instead of Girders, Brick Arches are Sprung Between Columns, for Supporting the Floors.

erable in weight. The lightest construction is shown in Fig. 3, which represents the hollow tile. The second in point of weight is shown in Fig. 4, which represents arches of corrugated sheet iron, while the heaviest is the brick arch, represented in Figs. 1 and 2. Where plastered ceilings are employed the plaster is applied directly to the brick arches and hollow tile. When corrugated iron arches are used the under surface is simply painted. Where flat ceilings are required in connection with iron arches, iron laths are riveted to small angle or T-irons that run from and rest on the bottom of the flanges of the beams. The hollow tile construction (Fig. 3) is probably the best for flat ceilings.

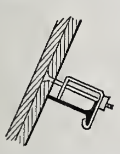
It is proper to remark in passing, concerning this construction, that it is very



Fire-Proof Construction.—Fig. 10.—*Inside View of Slated Roof, Showing Purlins. Slate are Fastened to Either Angle or T Iron by Copper Wire.*

important that the soffits of beams and lath to iron girders receive a coat of some good fire-proof non-conducting material, not less than 1 inch thick and securely fastened on. For this purpose a mixture of asbestos and pipe-clay is very effective. The soffits of beams may also be protected by the brick skew-backs, being made in such a form as to lap the lower flanges of the beams. Construction of this kind is shown in Fig. 5. Figs. 6 and 7 represent a method of protecting the lower flange of floor beams, by means of a light iron framework, to which is applied a coat of plaster.

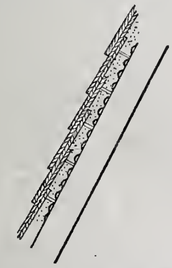
The shafts of cast-iron columns should be



Fire-Proof Construction.—Fig. 11.—*Another Method of Securing Slate. Wrought-Iron Countersunk Bolt and Hook Hanging to Purlin.*

continuous from middle to middle of the floor thickness, enveloped with not less than 1 inch of fire-proof non-conducting material, securely held to the shaft by buttons or ribs imbedded in the material. The capital and base should be of cast or sheet iron, fastened to lugs or bosses cast on the shelf, and long enough to pass through the envelope. Figs. 8 and 9 represent construction of this character.

If light partitions are required such as do not start from the foundation, and for which common brick would be impracticable by

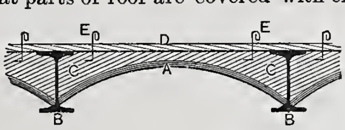


Fire-Proof Construction.—Fig. 12.—*Slate Fastened to Corrugated Sheet Iron by Wrought-Iron Countersunk Pins. Slate is also Bedded in a Layer of Cement Applied to the Corrugated Iron.*

reason of its weight, hollow terra cotta tile or brick can be used. Another method, more expensive, but admitting a construction which is self-supporting, consists of light I-beams, generally 4 inches deep, placed vertically 2 feet between centers, with the ends riveted or bolted to plates or channel irons secured to the floor and ceiling, to which iron laths are bolted for receiving the plaster. These partitions can be readily trussed, so that they add no weight to the floor from which they start.

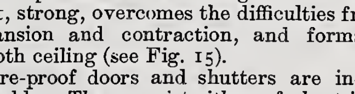
All steep parts of slated roofs should be provided with rolled iron purlins T or L shaped, weighing about 2 pounds per linear foot, riveted to the jack-rafters or trusses. The spans of these purlins should not exceed 6 feet for slate, weighing 10 pounds each. The distance between centers of purlins depends upon and is always equal to the weathering of the slate; one purlin is required for each line of slate. For example: A slate 12 x 24 inches, showing 10 inches to the weather, with 4 inches lap, requires the purlins to be 10 inches from centers. The slate is fastened to purlins by No. 16 Birmingham gauge copper wire, passing through two holes in the tail of the slate and around the purlin (see Fig. 10). Another method, more expensive, but in proportion to its greater security, consists of two 3-16-inch diameter bolts, with heads countersunk in the slate and fastened with a nut to a hook hanging to the purlins (see Fig. 11). Instead of purlins, corrugated sheet-iron is sometimes used, running from rafter to rafter; to this the slate is fastened by wrought iron pins, countersunk and passing through the slate and corrugated sheets, where they are bent so as to form a hook or clinch; the slate may also be bedded in a layer of cement applied to the corrugated iron (see Fig. 12).

Flat parts of roof are covered with either



Fire-Proof Construction.—Fig. 13.—*Method of Covering Flat Roofs with Metal Sheets or Cement. A, Corrugated Iron Arch. B, Rolled Beams. C, Concrete Filling. D, Layer of Cement. E, Metal Tags for Fastening Metal Cover.*

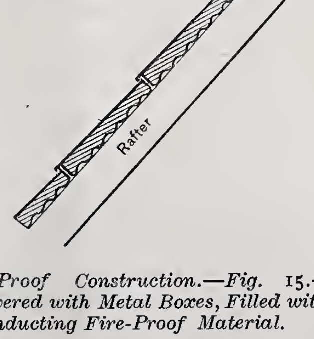
cement, copper, lead, zinc, tin or galvanized sheet iron; either one of the metal coverings is fastened to a layer of cement, about 1 inch thick, overlying concrete supported by corrugated sheet iron arches, by the tags imbedded therein (see Fig. 13). The supporting material may also consist of burned clay tile, resting on T-irons (see Fig. 14). Another very good method consists of metal boxes filled with fire-proof material; the boxes are about 2 feet wide, from 2 to 3 inches deep, and of lengths up to 8 feet spans; the bottom, sides and ends are



Fire-Proof Construction.—Fig. 14.—*Method of Constructing Flat Roofs by Means of (A) Burnt Clay Tile Resting on T Irons. E, Layer of Cement.*

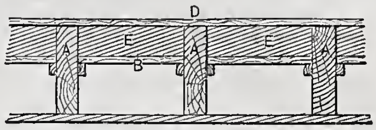
formed of galvanized sheet iron, and the top of copper or galvanized sheet iron; the boxes are placed alongside of each other and fastened to the beams of the roof. This method possesses an advantage in that it is tight, strong, overcomes the difficulties from expansion and contraction, and forms a smooth ceiling (see Fig. 15).

Fire-proof doors and shutters are indispensable. They consist either of sheet iron boxes filled with fire-proof material, or layers of corrugated sheet iron riveted together; they are also made of a sheet-iron plate sur-



Fire-Proof Construction.—Fig. 15.—*Roof Covered with Metal Boxes, Filled with Non-Conducting Fire-Proof Material.*

rounded by an iron frame, forming an open box, into which a fire-proof preparation is filled and secured by lath of a peculiar construction; this is an effective shutter or door, in that the fire-proof material is directly exposed to an encroaching fire, and no part of the metallic construction is in danger of warping and the material falling out. It is essential, to insure a proper working condition of shutters in warehouses or factories, to so construct the shutter that it can be attached to the glazed sash, and that both will slide on the same bar or track, so that the sash cannot be opened without also moving the shutter. In buildings where

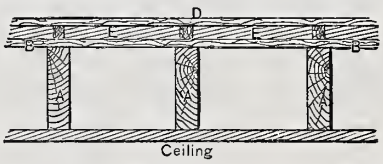


Fire-Proof Construction.—Fig. 16.—*Ordinary Floors. A, Joist. B, Counter Ceiling. D, Flooring. E, Fire-Proof Non-Conducting Filling.*

subdividing fire-walls are made use of, it would be well so to arrange the shutters that they can be operated from an adjoining room or compartment by means of rods or endless chains.

In the third class as above enumerated, all joists, struts and roof timbers are to be of wood, and if possible of large scantling. All floors are to be counter-ceiled, so that not less than two inches of non-conducting material will lie between the flooring and counter-ceiling. The spaces between the scantling of partitions are to be filled with mortar or a mixture of clay and cut straw, not less than one foot above the floor level (see Figs. 16, 17 and 18).

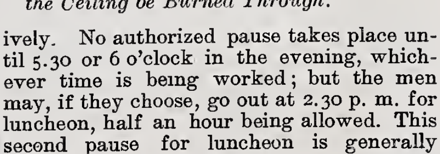
The roof construction may be of wood. For the slated parts strips of wood 2 x 2 inches are nailed horizontally to the sheath-



Fire-Proof Construction.—Fig. 17.—*Ordinary Floors.—A More Effective Construction than Shown in the Last Figure.*

ing boards; the spaces between strips being filled, level with their tops, by a mixture of clay and cut straw or any other fire-proof non-conducting preparation. The same method is also used for flat parts of roofs, the metal tags for holding roof covering being nailed to strips.

The Working Day in Paris.—The working day in Paris commences at 6 a. m. The first meal is taken at 10, and in some cases at 11 o'clock, varying in different quarters. Work recommences at 12 and 11 respect-



Fire Proof Construction.—Fig. 18.—*Wooden Floors.—Joists of Large Scantling from 4 to 8 Feet Apart.—Space Between Floor and Ceiling Filled with a Non-Conducting Fire-Proof Material.—A Wire Netting is Suspended Between Joists for the Purpose of Retaining the Filling in Place Should the Ceiling be Burned Through.*

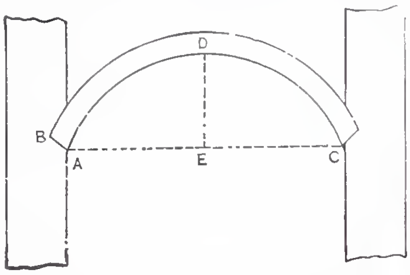
ively. No authorized pause takes place until 5.30 or 6 o'clock in the evening, whichever time is being worked; but the men may, if they choose, go out at 2.30 p. m. for luncheon, half an hour being allowed. This second pause for luncheon is generally adopted by those who work on till 6 p. m. Those who leave off at 5.30 p. m. do not, as a rule, adopt it.

Black Stains for Wood—Treatment for Veneers.—Heat the veneers for half an hour in soda-lye at 10 per cent., and let them soak in it for 24 hours. Prepare then a solution of copperas at 3 per cent., and plunge into it the veneers at 113° Fah., previously freed from soda by repeated washings, and dried after having been steeped for 24 hours in a hot and concentrated decoction of logwood. Veneers thus prepared are supple as leather, and have the shade of the finest ebony.

PRACTICAL CARPENTRY.

Groins, Pendentives and Niches.

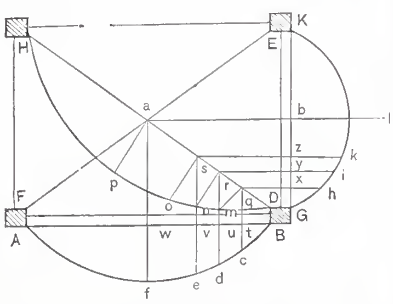
The term "groin" is employed in relation to the intersection of two or more vaults. Groins vary in their nature according to the forms of the intersecting vaults by which they are produced. They may be of equal, or of unequal, heights, for instance, and in either case the angle rib may be straight or curved. Arches are described as "semicircular," "elliptical," &c., according to their curves; and in like manner vaults are known by distinctive terms, according to the nature of the solids with which their concave surfaces would coincide. A cylindrical vault, for example, would coincide with a portion of a cylinder's surface; a



Groins, Pendentives and Niches.—Fig. 1.—Parts of the Arch Defined.

cylindroid vault would be agreeable to a cylindroid, or a solid cylinder which has elliptical ends. And so on with spherical, annular, and conical vaults.

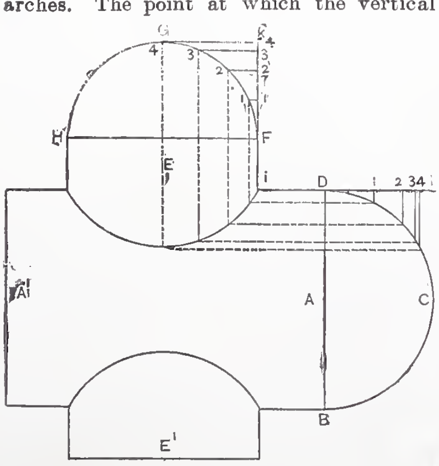
The method of finding the ribs for groined arches is similar, whether they are intended to form the "cradling," to which the plasterer nails his laths, or to support the boarding of centers for brickwork or



Groins, Pendentives and Niches.—Fig. 2.—Method of Describing the Sides of a Groin with Arches of the Same Hight.

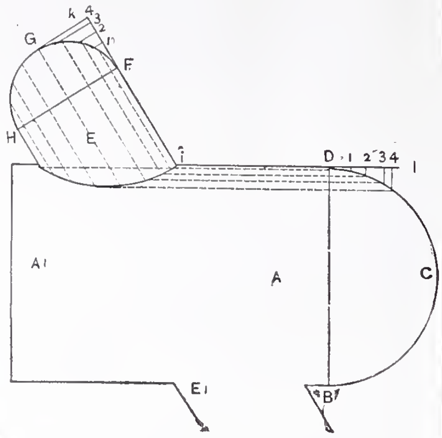
masonry to be laid upon, with the exception that, when for plastering, the inner edges of the ribs are brought to the required form, but when for centering the outer edge is so dealt with.

Before proceeding further it may be well to speak of some of the more useful terms employed to define the forms of vaults and arches. The point at which the vertical



Groins, Pendentives and Niches.—Fig. 3.—An Intersection of Arches called a Welsh Groin.

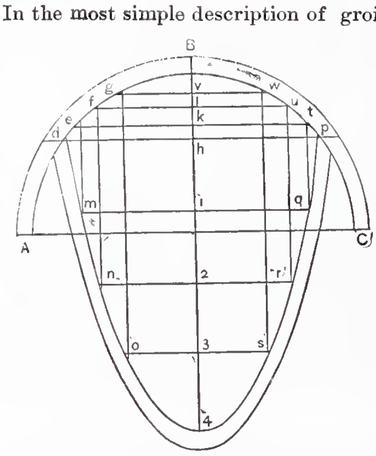
face of the pier ends, and from which the arch rises, is called the "springing of the arch," as at A (Fig. 1). That portion of the pier from which the arch springs is termed the "abutment," A B. The "span" of the arch is indicated at A C. The highest point of the under side, as at D, is the "crown" of the arch, the hight of which above the level of the springing, as at D E, forms the "rise" of the arch. The springings on the



Groins, Pendentives and Niches.—Fig. 4.—A Welsh Groin Upon an Oblique Plan.

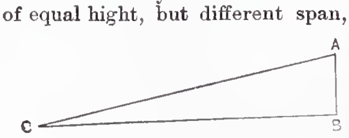
opposite sides of the arch are generally of the same level. Where, however, one springs from a higher level, a "rampant" arch is formed.

In the most simple description of groined



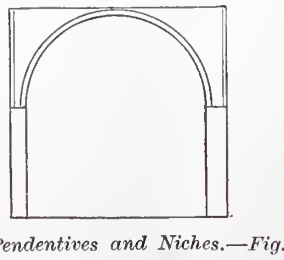
Groins, Pendentives and Niches.—Fig. 5.—Intersection of a Cylindrical Window Head with a Ceiling.—Plan.

arches—namely, that of the intersection of two semicircular vaults of equal dimensions—the problem is that of the intersection of the two identical cylinders. If the vaults are of equal hight, but different span, one



Groins, Pendentives and Niches.—Fig. 6.—Section Corresponding with the Preceding Figure.

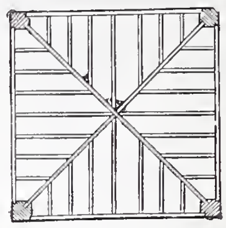
being of semicircular form, the problem is that of the intersection of a cylinder with a cylindroid. In cases where the vaults are of different hights, and the lesser is of semicircular form, the groin is known as a Welsh groin, and the problem is one of the



Groins, Pendentives and Niches.—Fig. 7.—Elevation of Ribs for Plaster Groins.

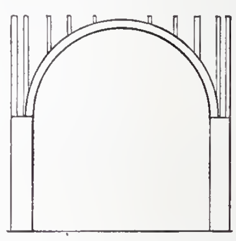
intersection of two cylinders of unequal diameters. If a coved ceiling has intersections formed by small window arches, the groins produced may be either Welsh groins or under pitch ones, and the intersecting arches are termed "lunettes."

The following plan may be adopted to describe the sides of a groin, with arches of the same hight, and intended to meet in the planes of the diagonals: Let *a f* and *a l* (Fig. 2) be the axes of the two vaults, meeting each other in *a*; perpendicular to *a f* draw A B, cutting *a f* in *w*, and, perpendicular to *a l* draw B K, cutting *a l* in *b*. Make *w* A and *w* B each equal to half the width of the larger vault, and make *b* K and *b* G each equal to half the width of the smaller vault. Draw A H and D E parallel to *a l*, forming the parallelogram D E H F. Draw the diagonals H D, F E. On the base



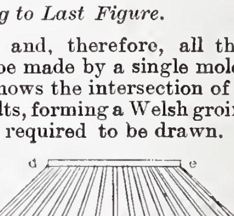
Groins, Pendentives and Niches.—Fig. 8.—Plan of Ribs for Plaster Groins Corresponding to last Figure.

A B, describe the curve B *c d e f* A, according to the given hight, *w f*, of the required form, which must serve to regulate the form of the other ribs. Through any points, *c d e*, in the arc B *c d e f* A, draw the straight lines *c q*, *d r*, *e s*, cutting the diagonal H D, at *q r s*. Draw *q h*, *r i*, *s k* parallel to *a l*, cutting the chord K G, at the points *x y z b*. Make *x h*, *y i*, *z k*, *b l* each, respectively, equal to *t c*, *u d*, *v e*, *w f*, and through the



Groins, Pendentives and Niches.—Fig. 9.—Elevation of Another Method of Constructing Ribs for Plaster Groins.

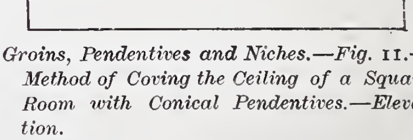
points, G *h i k l*, to K G, draw the curve G *h i k l* K. Draw *q m*, *r n*, *s o*, *a p* perpendicular to H D. Make *q m*, *r h*, *s o*, *a p*, respectively, equal to *t c*, *u d*, *v e*, *w f*, and through the points D, *m*, *n*, *o*, *p*, H, draw a curve, which will be the angle-rib of the groin to stand over H D; and if the groined vault is right-angled, all the diagonals will



Groins, Pendentives and Niches.—Fig. 10.—Plan of Ribs for Plaster Groins Corresponding to Last Figure.

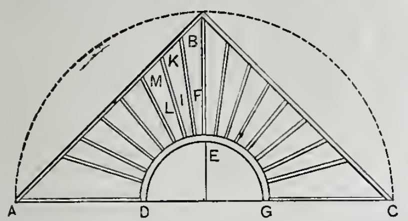
be equal, and, therefore, all the diagonal ribs may be made by a single mold.

Fig. 3 shows the intersection of two cylindrical vaults, forming a Welsh groin, of which a plan is required to be drawn. Let A A[1]



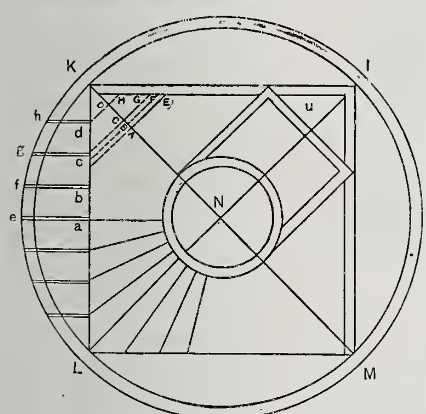
Groins, Pendentives and Niches.—Fig. 11.—Method of Coving the Ceiling of a Square Room with Conical Pendentives.—Elevation.

be the plan of the given main vault, of which the form is represented by the semicircle B C D. Let E[1] E be the plan of the cross vault, of which the form is represented by the semicircle F G H. Produce the line *i* F to *k*. Divide the semicircle into any number of equal parts—in this instance, say eight—and from the points thus marked draw lines parallel to F H, intersecting the line F *k* at 1, 2, 3 and 4. Produce the line



Groins, Pendentives and Niches.—Fig. 12.—*Method of Coving the Ceiling of a Square Room with Conical Pendentives.—Plan.*

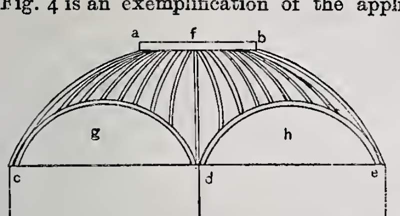
i D to *l*, and on the line D *l* mark the hights 1, 2, 3 and 4, respectively, equal to those on the line F *k*. From the points thus marked on the line D *l* draw lines parallel to D B, to intersect the semicircle B C D. From the points thus marked in the semicircle B C D



Groins, Pendentives and Niches.—Fig. 13.—*Method of Finding the Springing Lines of the Pendentives, the Section in a Vertical Plane being Given.*

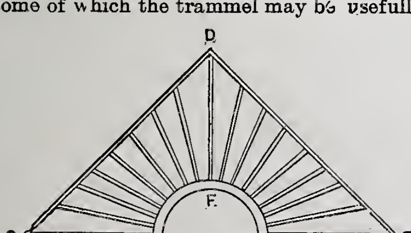
draw lines perpendicular to D B, as shown. Then, from the parts already marked in the arch H F G, draw lines perpendicular to F H, to intersect the lines last drawn in the manner explained in the figure. A line drawn through the points thus obtained will be the correct plan of the intersection of the vaults.

Fig. 4 is an exemplification of the appli-



Groins, Pendentives and Niches.—Fig. 14.—*Method of Covering a Square Room with Spherical Pendentives.—Elevation.*

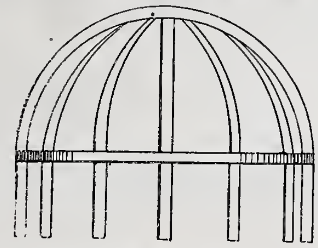
cation of of the system to a Welsh groin on an oblique plan. Space will not permit us to go further into the numerous problems connected with this subject, in working out some of which the trammel may be usefully



Groins, Pendentives and Niches.—Fig. 15.—*Method of Covering a Square Room with Spherical Pendentives.—Plan.*

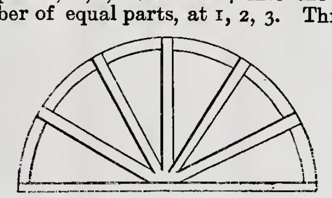
employed. Those who wish to see the subject treated at greater length are referred to Tarbuck's "Encyclopedia of Carpentry," and especially to Newland's "Carpenters' and Joiners' Assistant," in which it is dealt with exhaustively.

When a circular-headed window is above the level of a plane gallery ceiling—a church, for instance—the cylindrical form of the window is continued till it intersects the plane of the ceiling. To find the form of the curb employed for completing the arris, let *d p* (Fig. 5) be the breadth of the window in the plane of the ceiling. Bisect *d p* in *h*, and draw *h* 4 perpendicular to *d p*. Make *h* 4 equal to the distance the curb extends from the wall. Produce *h* 4 to B. Make *h* B equal to the hight of the window



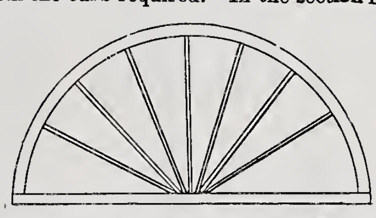
Groins, Pendentives and Niches.—Fig. 16.—*Elevation of the Cradling for a Semicircular Niche.*

above the ceiling, and through the three points *d*, B, *p*, describe the semicircle A B C, for the head of the window. Divide *h* B into any number of equal parts, as 4, at the points, *k*, *l*, *v*; and *h* 4 into the same number of equal parts, at 1, 2, 3. Through



Groins, Pendentives and Niches.—Fig. 17.—*Plan of the Cradling of a Semicircular Niche.*

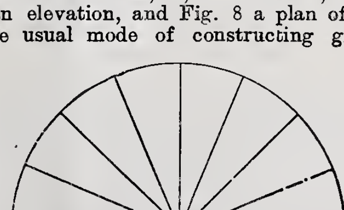
the points *k*, *l*, *v*, draw the lines *e*, *t*, *f*, *u*, *g*, *w*, parallel to *d p*; and through the points 1, 2, 3, draw the lines *m*, *f*, *n*, *r*, *o*, *s*. Make 1 *m*, 2 *n*, 3 *o*, respectively, equal to *k*, *e*, *l*, *f*, *v*, *g*; as also 1 *q*, 2 *r*, 3 *s*, equal to *k t*, *l u*, *v w*—that is, equal to *k e*, *l f*, *v g*. Then, through the points *d m n o* 4, and also through *p q r s* 4, draw a curve, which will form the curb required. In the section Fig.



Groins, Pendentives and Niches.—Fig. 18.—*Plan of the Cradling of a Hemispherical Niche.*

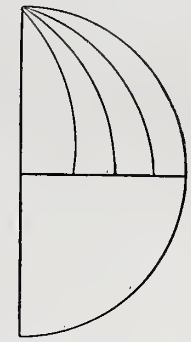
6, A C shows the ceiling line, the hight of which is equal to *h* 4, and A B is the perpendicular hight of the window. Hence B C is the slope.

The ribs for plaster groins may be framed by various methods, as, for instance, Fig. 7 is an elevation, and Fig. 8 a plan of the more usual mode of constructing groins



Groins, Pendentives and Niches.—Fig. 19.—*Section of the Cradling of a Hemispherical Niche.*

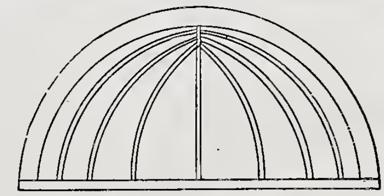
which have to be finished in lath and plaster. The laths for the vaulting are supported by straight ceiling joists, fixed to curved angle ribs and to curved main ribs. Fig. 9 is an elevation, and Fig. 10 a plan of an arrangement where the cradling is composed entirely of curved ribs. We may note here that Price gives the following method for finding a groin: Erect a straight piece of board on the corner of the pier whence the groin springs, and drive a nail at the meeting-point of the groins; fasten on this one end of a chalk-line, straining it tight; slide it down the side of the said straight



Groins, Pendentives and Niches.—Fig. 20.—*Elevation of the Cradling of a Hemispherical Niche.*

piece, and it will form the groin, so as to stand perpendicularly over its line.

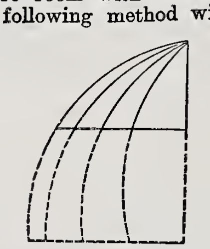
When a room formed on a square plane has a vertical wall, and has its ceiling formed by a surface corresponding to a portion of a sphere of a diameter equal to or greater than the diagonals of the room, the



Groins, Pendentives and Niches.—Fig 21.—*Plan of the Cradling of a Niche which is Semicircular, the Elevation being Segmental.*

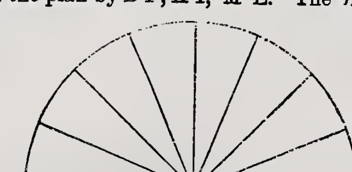
characteristic arches formed by the intersection of the vertical and spherical surfaces are termed pendentives. There are many varieties, dependent upon the shape of the room—which may be a square, a parallelogram, or a polygon in plan—and the form of the ceiling, which may be spherical, conical, ellipsoidal, &c.

If it is required to cove the ceiling of a square room with conical pendentives, the following method will give the



Groins, Pendentives and Niches.—Fig. 22.—*Elevation of the Cradling of a Niche which is Semicircular in Plan and Segmental in Elevation.*

lines: Let A B C (Fig. 11) be half the plan of the room, and D E G the half plan of the curb, at whose top the ribs are all fixed. The hyperbolical arches *a g b*, *b h c* (Fig. 12) on each of the four sides are of equal hight. The straight ribs are shown on the plan by B F, K I, M L. The hyper-



Groins, Pendentives and Niches.—Fig. 23.—*Section of the Cradling of a Niche which is Semicircular in Plan and Segmental in Elevation.*

bolical curves are explained in Fig. 13, which shows the manner of finding the springing lines of the pendentives, the section in one of the vertical planes being given. Bisect the diagonal line L K, as the point N, by the perpendicular N W, which make equal to the hight of the cone, and draw the sides L W and K W. Bisect the side W K of the square at a, and on N, with the radius N a, describe an arc a A, cutting the diagonal L K at A ; then take any points B, C, D, between A and K, and with the several radii N B, N C, N D, describe the arcs B b, C c, and D d, cutting K W at the points d, c and b. From the points A, B, C and D, draw A E, B F, C G and D H perpendicular to the diagonal K L, cutting the side, W K, of the section of the cone at E F G H. At the points a b d erect perpendiculars a e, b f, c g, and d h, to the side M L, making each equal to their corresponding distances A E, B F, C G and D H, which will be one-half of the curves for that side, from which the other can be traced.

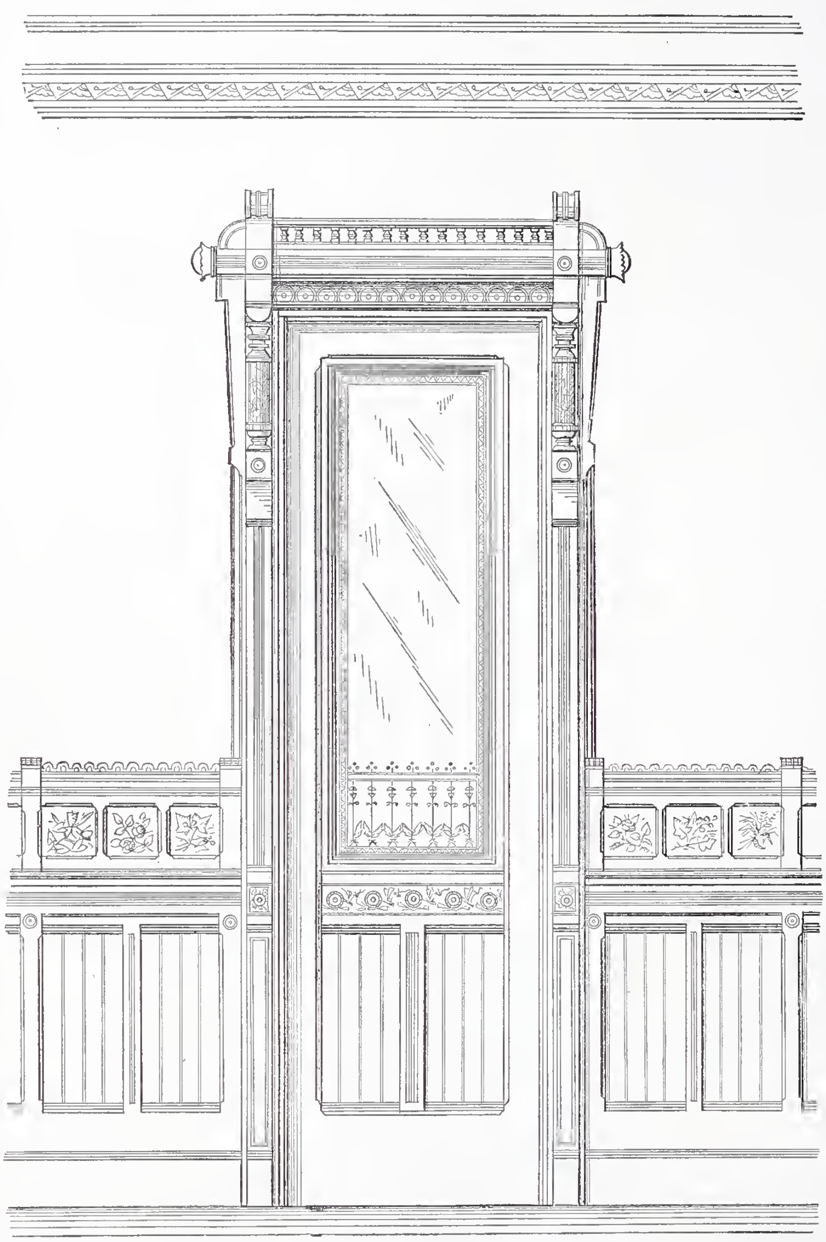
Figs. 14 and 15 show the method of covering a square room with spherical pendentives. In Fig. 15, C D and D E are two sides of the plan. A F B is half the plan of the curb. In the elevation (Fig. 14) is shown the method of fixing the ribs (which in projection are portions of ellipses) on two sides of the plan. The elevation of the curb A F B is shown at a b; c f d and d g e are ribs on each side of the plan, supporting the vertical ribs that form the spherical surface, which vertical ribs support the curb a f b. A lantern or skylight may be placed on the top if required. In this, as in other pendentives and groins for plastering, the ribs should not be more than about 12 inches apart.

In the formation of niches, the arrangement should be such as to require as few lines as possible. We can only give two of the more simple forms. Fig. 16 is the elevation and Fig. 17 the plan of the cradling for a semicircular niche. One of this kind corresponds with a quarter of a sphere, and the lines of the elevation and plan plainly coincide with semicircles, as shown at Fig. 18. Fig. 20 shows lines of elevation, Fig. 18 those of plan and Fig. 19 those of section of a hemispherical niche. In framing the cradling, the upper end of each of the back ribs will require to be cut so as to fit against the front rib, and the degree of bevel can be got from the plan. Figs. 21, 22 and 23 show the lines for a niche semicircular in plan, but the elevation of which is formed of the segment of a circle, and serve to show how a niche of this form corresponds with a portion of a sphere. Here Fig. 21 is the plan ; Fig. 23, lines for same ; Fig. 22, side elevation.

To Stain Wood with Logwood by Aid of Heat.—In 2¼ to 2¾ lbs. hot water 9 ounces logwood are well boiled ; 1¼ ounces of blue stone is added, and the clear liquid, after settling, is decanted, and in this is steeped, while hot, the wood to be stained, and allowed to remain for 24 hours, after which it is exposed to the air, to permit the oxidation of the coloring matters. The wood is then steeped in a hot solution of nitrate of iron at 4° Baumé. If not perfectly black, it must be steeped for some hours in the first bath.

Design of Door, Door Trimming and Wainscoting.

We present our readers herewith engravings of the elevation and scale details of a beautiful door and wainscoting, for the originals of which we are indebted to Messrs. Warren, Ward & Co., the well-known furniture and cabinet makers of this city. The parts are so carefully shown in the engravings, that we feel justified in referring our readers to them rather than to any extended description of the design which we might write. Yet there are one or two points to which we desire to direct particular attention.



Design of Door, Door Trimming and Wainscoting.—Fig. 1.—Elevation. Scale, ½ Inch to the Foot.

In this design is an illustration of how the effect of curves may be obtained by means of straight lines. In the elevation, for example, the lines of the back molding and of the parts which form the side finish of the cap, are so managed that the spread which is given to them at the angles in combination with the ornament which surmounts the side finish, gives the outside of the door the effect of a long, delicate curve. The part which may be called the curved part, bears relation to the straight part in about the proportion of two to five, which is a complex ratio and adds materially to the beauty.

The design is favored by the great hight of the door. Or it might be put otherwise, the design was made expressly to suit a door of unusual hight. A very pleasing feature is the quarter circles at the upper corners, serving to unite the vertical and horizontal finish. Decoration has been well considered in this design throughout, and while it is very rich, it has been used as though it was something valuable and not to be wasted. The pillar-shaped parts forming the front support to the cap are highly carved ; the cove member below the cornice or cap is likewise richly carved—and these members together make an unusually rich effect in the upper portion, while the plain glass panel below relieves the whole from an appearance of over ornamentation, yet in itself is relieved by a delicately engraved ornament. Across the lock-rail of the door is a rich line of marquetry work, which in character is in entire harmony with the other parts of the design.

While the door is large and plain, and of proportions somewhat unusual, it is so decorated and enriched at points where the eye naturally rests, that the whole composition becomes very beautiful. In effect the door is much more richly ornamented than it would appear to be had the carvings been carried all the way down on the sides. In the latter case the eye would become wearied with seeing so much.

Above the wainscoting in the elevation is shown a tiling course, which is not represented in the detail. This is simply a framing of wood in which tile panels are inserted, and may be used in connection with the design or not, at option. The design will look well in almost any of the fancy woods adapted to cabinet finish. Mahogany, walnut, butternut or cherry are adapted to use in it. The panel, as indicated on the detail, and also as alluded to above, is of enameled glass. A delicate tracing, almost like lace work, is engraved at the bottom and along its margins, giving it a fine effect.

The Pine Tree.

Of this tree there are many species, some of which furnish timbers of the most valuable kind. Of American pine there are several varieties, the most important of which we shall attempt a description. As a rule, all of them are clean, free from all defects, and easily worked.

American red pine (*Pinus rubra*) also *Pinus resinosa*, takes its name from the red color of its bark, and is known generally as Canada red pine, being found in Canada. It is reddish white, with clean, fine grain. It is used by cabinet makers for veneering, and for the internal fittings of houses. The timber is small, very solid in center, not much sap or pith, does not warp or split, moderately strong, few large knots, very durable when well ventilated, adheres well to glue, and does not lose much in conversion.

American white pine (*Pinus strobus*) is produced from a straight and lofty tree found in various sections of North America. It is called white pine from the color of its bark. In England it is sometimes known as "Weymouth pine," because it was introduced into that country by Lord Weymouth ; the English often call it "American yellow pine."

Its leaves grow in tufts of five. The cones are long, with loosely arranged scales. The wood, when freshly cut, is of a white or pale straw color, but becomes a brownish yellow when seasoned. The annual rings are not very distinct; the grain is clean and straight; the wood is very light and soft; when planed has a silky surface, and is easily recognized by the short detached dark, thin streaks, like short hair lines, which always appear running in the direction of the grain.

The timber is, as a rule, clean, free from knots, and easily worked, though the top ends of logs are sometimes coarse and knotty; it is also subject to cup and heart shakes, and the older trees to sponginess in the center. It adheres to glue, but does not hold nails well. In a moist climate it is subject to dry rot, and so is not very durable in England, but it lasts well in this country on account of the dryness of the climate.

It is much used here for carpenter's work of all kinds. It is also used in Scotland and in some large English towns, but in London Baltic timber is preferred. The great length of the logs causes this timber to be extensively used for masts and yards.

For joining, this wood is invaluable, being wrought easily and smoothly into moldings and ornamental work of every description. It is particularly adapted for panels on account of the great width in which it may be procured, and it is also extensively used in making patterns for castings.

Quebec yellow pine (*Pinus variabilis*), is imported chiefly from the place after which it is named, and is used for the masts and yards of large ships, but not much for other purposes.

The long-leafed pine, known in this country as yellow or Southern pine (*Pinus australis*), has very long leaves in their cones 8 inches in length, and rough bark. It comes from our Southern States, being shipped from the ports of Savannah, Darien and Pensacola. The wood has a reddish-white or brown color; the annual rings are wide, strongly marked, and form beautiful figures when the wood is wrought and varnished. The timber is full of resinous matter, which makes it extremely durable, but sticky and difficult to plane. It is hard, heavy and very strong, free from knots, but contains a large proportion of sap wood. It is subject to cup and heart shake, and soon rots in a moist atmosphere. The wood is brittle when dry, and its elasticity, strength and durability are often reduced by the practice of "bleeding" or tapping the tree for the sake of the turpentine it contains. It is too full of rosin to take paint well.

Pitch pine (*Pinus rigida*) is used for the heaviest timber structures in engineering works, where great strength and lasting qualities are required; also by shipbuilders for deep planks; by builders for floors (being very durable under wear), for window sills and for ornamental joinery of all kinds. The heartwood is good for pumps.

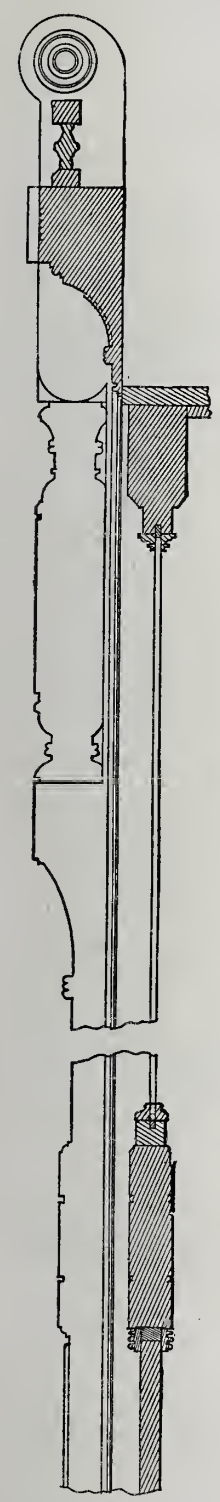


Fig. 2.—Vertical Section.

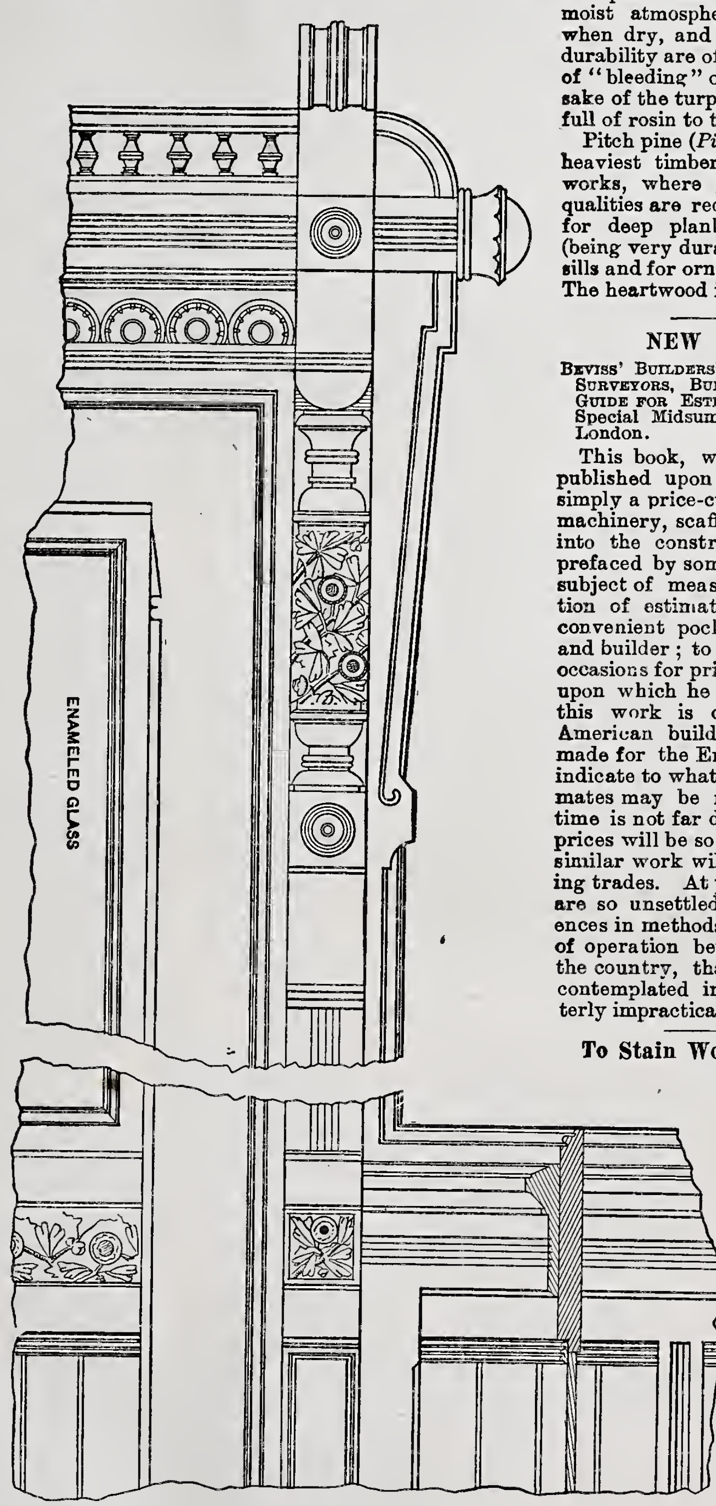


Fig. 3—Details.

Design of Door, Door Trimming and Wainscoting.—Scale, 1½ Inches to the Foot.

NEW PUBLICATIONS.

BEVISS' BUILDERS' PRICE BOOK, FOR ARCHITECTS SURVEYORS, BUILDERS AND CONTRACTORS. A GUIDE FOR ESTIMATES. By Henry C. Beviss. Special Midsummer Edition. Beviss & Co., London.

This book, which differs from anything published upon this side of the Atlantic, is simply a price-current of all the materials, machinery, scaffolding, &c., which enters into the construction of a building. It is prefaced by some general remarks upon the subject of measurements and the preparation of estimates. It is intended to be a convenient pocket-book for the contractor and builder; to be consulted at all times and occasions for prices upon the different items upon which he may be figuring. Although this work is of small practical value to American builders, because the prices are made for the English market, it serves to indicate to what system the matter of estimates may be reduced; and doubtless the time is not far distant in this country when prices will be so settled that the issue of a similar work will be called for by our building trades. At present, however, our prices are so unsettled, there is such wide differences in methods of construction and plans of operation between different sections of the country, that one uniform system, as contemplated in the book before us, is utterly impractical for the use of builders.

To Stain Wood with Logwood in the Cold.—Mix in a copper vessel 11 lbs. rasped logwood, 8¾ lbs. galls in powder, and 35 lbs. wood vinegar. Digest for eight days with frequent stirring, add 11 lbs. water, evaporate down to one-half and decant. In the meantime mix in an earthen bowl 2¼ lbs. iron filings and 8¾ lbs. wood vinegar, and when the liquid, by spontaneous evaporation, stands at 13° or 14° Baumé, decant and mix it with the other liquor, stirring well. Let it settle and decant afresh, so as to obtain a clear liquor, in which the wood to be stained is steeped for a longer or shorter time, according to its hardness. The oxidizing action may be hastened by adding about 15 grains of oxalic acid. A similar dye, sold under the name of tincture of Paris, is prepared by dissolving solid extract of logwood in hot water till it stands at 10° Baumé, and then to every 8¾ pints add 4⅓ pints black liquor at 11° Baumé and 17 fluid ounces of acetic acid at 2° Baumé. Heat for a quarter of an hour; let it settle; decant and use cold.

A prominent lumber merchant, discussing saw-dust puddings, is reported to have said he considered such fare very fine board.

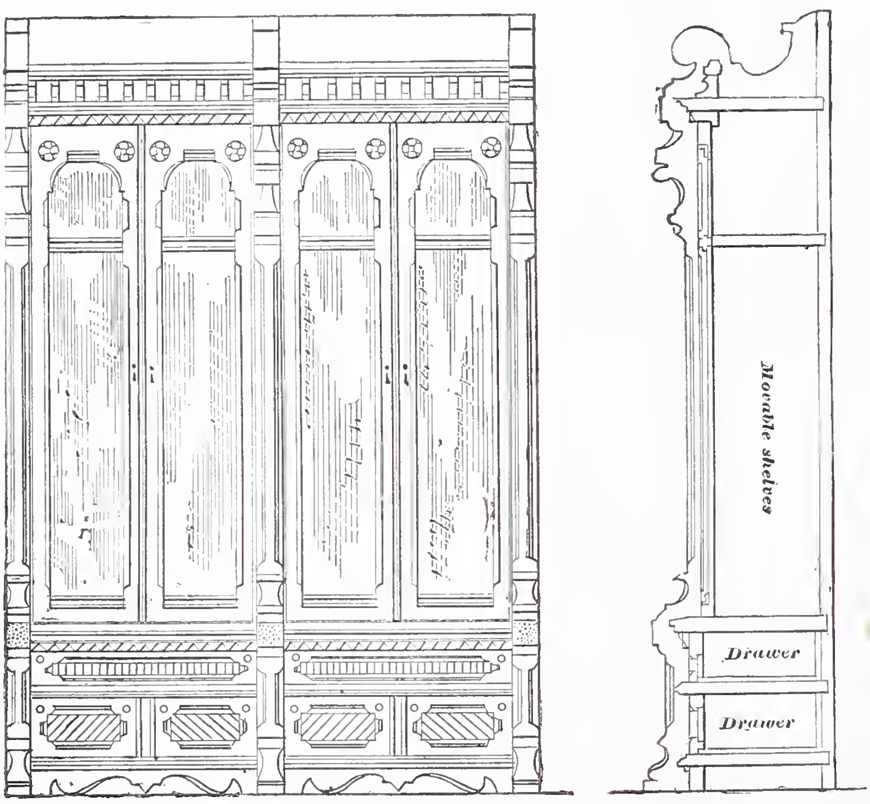
Design of Book Case.

In the accompanying engravings is shown the elevation, section and details of a book case suitable for use in a library, or in the general living room of a house. The style is good, and in its general features embodies those characteristics of design and construction now so generally sought after in cabinet work and furniture. One fixed shelf is employed, being located at a point opposite the bar dividing the panels in the doors. The other shelves are intended to be movable, constructed upon any of the plans in use in such places. The panels in the doors are of glass. Two broad, shallow drawers are provided, and below them are four narrower drawers, thus affording an abundance of room of this description.

The design is adapted to construction in any of the cabinet working woods, and will not look badly if executed in pine. A very pretty effect may be produced by using two woods of different colors, thus forming a contrast.

Jacobean and Neo-Jacobean Styles in Furniture.

The Jacobean style in architecture and furniture followed, in England, immediately



Design for Book Case.—Fig. 1.—Elevation and Section.—Scale, ½ Inch to the Foot.

on the Elizabethan; it was an outgrowth from it, with an ever-increasing tendency toward the pure classic. The date of its introduction was the accession of James I to the throne of England, and its end came with the fall of James II, when, flying to the protection of the French King, he left the English throne to be filled by his daughter Mary and her husband, William of Orange, who modified furniture and architecture with Dutch taste, and brought into fashion the style which often takes its name from the succeeding reign of Queen Anne, the younger daughter of James II. The Elizabethan age was England's great age; splendor was the order of the day. The Queen, with her 3000 gorgeous dresses, her wealth of jewels, her magnificence of furniture and drapery, loved brilliancy of intellect as well as she loved outward splendor. The superb Leicester, the brilliant Essex, the prodigal Buckingham, with his velvet cloak covered with seed pearls, so loosely sewn that they fell among the crowd as he walked—these were her favorites; but she had Shakspeare and rare Ben Jonson, and Bacon, "wisest and brightest of mankind." Spencer wrote for his "Fairie Queene;" Raleigh founded her colonies, and made her supreme upon the seas; wise men and great from all lands clustered around her; and in the midst of this splendid court romance and chivalry culminated, for there was the beautiful captive Queen of Scots, powerful over men's hearts as ever was Egypt's Queen, the Serpent of old Nile, the voluptuous Cleopatra herself, plotting Elizabeth's death, plotting her own coronation (for was she not granddaughter of Henry VII as well as Elizabeth herself, and so own cousin to the great Queen?) and drawing to her service, by the charm of her glorious beauty, every young cavalier who came within the sphere of her influence. The splendor of furniture and decoration was suited to the men and women of that splendid court. It was in accordance with the rich dressing, the huge starched ruffs, the slashed, puffed sleeves, the enormous farthingales, the high heels of the ladies, and the bedecked and beswordeds cavaliers who thronged the vast rooms where the vastness and ponderousness of the furniture dwindled and were almost lost in contrast. The table legs were solid enough to support a roof, and the chairs would have held up the bloated weight of bluff Hal himself without a groan. The head of the beautiful Scottish Queen fell beneath the headsman's ax. Elizabeth was dead, huddled in the corner of her room, afraid to be laid on her gorgeous bed, because it had been foretold that she would die there, and she fancied death could not find her in any other place; and James, the son of the beheaded Mary—the pedant, the sot, mean and despicable in thought and life—sat on the English throne, by right of succession and by the will of the great Queen.

The coronation must be gorgeous indeed; the new hopes of a new reign were budding around a new individuality. What splendor could match the splendid future that spread out before the young king? and when was splendor ever found at home? Is it not always brought from afar? And so at this time a flood of foreign furniture and foreign decoration swept into England, and made sad havoc with the remnant of Gothic that still held its own there. In the preceding reign the shield had been used in ornament, the strap being preferred, but now the shield was made prominent and became the center of all ornamentation, and the distinguishing feature of the Jacobean style. It was lavished everywhere, in a tangle of flourishes and curves; and straps and buckles, and all the trappings of "glorious war," surrounded it and were worked in with it.

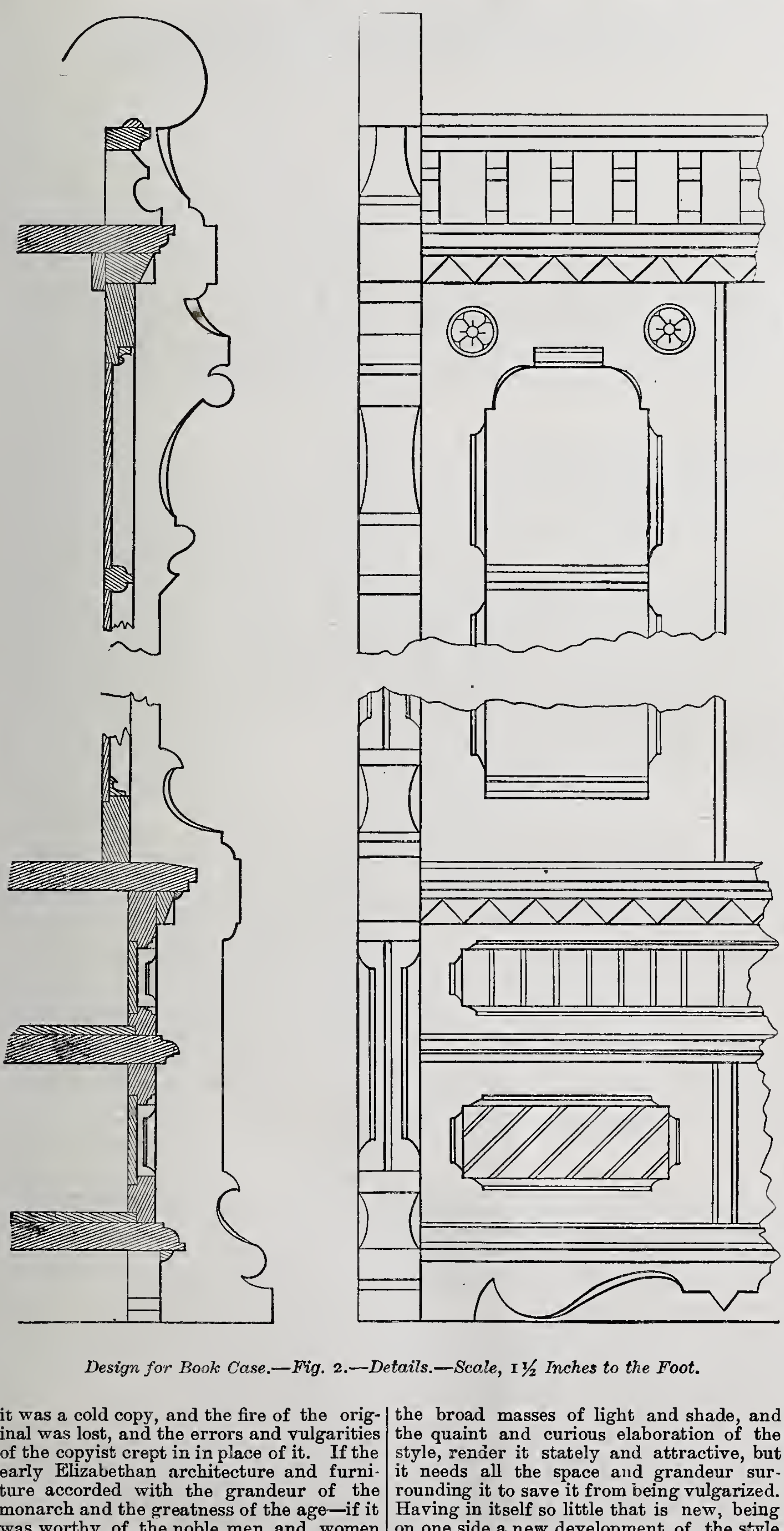
But the Jacobean did not content itself with this simple form; in other characteristics it inclined to the pure classic, though it never arrived at it. In construction it constantly mingled the horizontal of the antique with the vertical of the mediæval, and we see in its architecture the volute of the Ionic style supporting the pointed arch of the Gothic; the Tudor leaf is put upon the Grecian frieze; and the furniture of this style is architectural in all its outlines, the tables and cabinets, the chairs and sideboards, have columns and capitals and arches and architraves as much as do the palaces and churches. Pure classic was not understood in England for 100 years after the Jacobean style was introduced. Flemish furniture had always been largely imported into England—so largely that, in the reign of Richard III, a law was made against it as prejudicial to English manufacturers. This Flemish furniture was very like the furniture of England during the Jacobean period; in fact, the Flemings seem to have had a monopoly of furnishing the great English mansions, and we find their quaintly carved chests and cupboards in many an old Elizabethan and Jacobean dwelling.

The French and German carving is less graceful and airy than more southern work; they tell quaintly, but with some awkwardness, the old classic and Bible stories on their carved chests and cabinets, but they are always picturesque. The Flemish work was much modified by Italian forms, and these filtered through very perceptibly into the Jacobean of the English, while French furniture retained the stately and somber character of the Henri Quatre and Henri Treize periods. And not only did this Italian influence come into England through the Flemings, but it was brought direct by many Italian workmen, cabinet makers, who came at this time into England, and whose work was modified by the requirements of English taste and by the methods of the workmen among whom they were domiciled.

The scallop shell is a peculiarity of the ornament of this Jocobean style, and we are told of a large scallop shell that at this time attracted a great deal of public attention and was gladly seized upon by the decorators. This form could not have been new to English decorators and designers, for every Crusader had brought home a scallop shell in his hat; it was a heraldic sign on the shield of every one who had made the pilgrimage to the Holy Sepulchre, and saunterers (*saint-terrers*) from Palestine had long ago made the form familiar to the English public. Bernard Palissy had also used every variety of shell in ornamenting his well-known and highly prized Palissy ware; but it is nevertheless the fact that at this time this particular shell form was seized upon and used at every turn. If, in taking a chair, you did not sit down on the back of some dragon or griffin, whose head looked over your shoulder, whose wings supported your arms, and whose claws formed your footstool, you sank, oyster-like, into some huge shell, with a scallop at your back and another inclosing you in its gaping valves. This form of furniture is merely curious; it cannot be considered either worthy or beautiful to have a couch modeled like the shell of Venus floating over the sea, though sometimes in a vast drawing-room, sumptuous with tapestries, it may have had a pleasing effect. For furniture made to be looked at one might say "Yes," but for use, only an emphatic "No!" can be uttered. The same thing may be seen at the Grand Trianon at Versailles, where there is a curious collection of sleighs and carriages used by Louis XIV. These are all in the forms of dragons, sea-monsters, shells, &c., superbly gilded, grotesque, quaint—Jacobean, in fact, but not usable.

When you see in furniture or chimney-piece this curious shell decoration, mingled with straps and shields, with cartouch and scroll, with griffins and mermaids whose tails divide into scrolls and are carried right and left in curious convolutions, you may be sure that the Jacobean style is before you. Whatever the shapes, and however questionable the taste, the carving is always rich and has a magnificent effect. This period has been called the Cinque-cento period of English art, but it was rather the grotesquerie of the Cinque-cento with all its loftier beauty left out; it was the grotesque in its ordinary meaning, the monstrous, the ludicrous rather than the lovely. The Italians had made splendid use of it, but when it was transplanted to England it took the characteristic of the English mind, so much harder and more matter-of-fact than the Italian; it was poetry translated into prose; the conceit of King James himself. The faults of this style are never likely to be repeated, and the custom of 200 years has worn away much that is objectionable in it till it has come to be regarded as a memorial of the past, interesting and picturesque. It is also valuable as showing the movement of the English mind in one of the many processes of art.

Some very stately houses of England are decorated in the Jacobean style, notably Crewe Hall, Audley End, and Holland House. The scale of its use in these houses,



Design for Book Case.—Fig. 2.—Details.—Scale, 1½ Inches to the Foot.

it was a cold copy, and the fire of the original was lost, and the errors and vulgarities of the copyist crept in in place of it. If the early Elizabethan architecture and furniture accorded with the grandeur of the monarch and the greatness of the age—if it was worthy of the noble men and women for whose use it was created, then the Jabobean, with the quips and quirks and conceits of its outline, the profuseness of its gilding, its affectations, its pedantic ignorance in its misuse of classical details, reflects as in a mirror the vanity, the arrogance and the broad masses of light and shade, and the quaint and curious elaboration of the style, render it stately and attractive, but it needs all the space and grandeur surrounding it to save it from being vulgarized. Having in itself so little that is new, being on one side a new development of the style of the preceding reign, and on the other an ill-adapted use of the Italian, the Jacobean is not often considered a thing by itself, but it is rather a freak, and perhaps a debasement of the less pretentious but more pleasing Elizabethan. Of late years a revival of this style has taken place under modifications that entitle it to the name of neo-Jacobean, modern ideas being applied to the fashions of 250 years ago to adapt them to modern wants, and modern art doing its best in the design and coloring, daring and exquisite in arrangement, of paper hangings, which were unknown for nearly half a century after the original Jacobean came into vogue. The principle modification in the style, as adapted to modern use, is in the reduced size of its articles and their members, so that the huge acorn becomes something much more like a long, slim vase, and chimney pieces ornament a room without crushing it with their importance. The shield has been dismissed. The tiny classical balustrade is beautifully rendered whereever it is introduced, and the old Gothic cove at the top of sideboard and mantle is not forgotten.

There are many mantel-piece arrangements, with shelves and nooks for the display of knick-knacks, in this new form of the style, a form whose endeavor seems to be to produce solidity without losing grace, though, perhaps, by losing the size which gave a certain grandeur to the old Jacobean, it does not escape stiffness, while its general effect is pleasing.

Large Auger Holes.

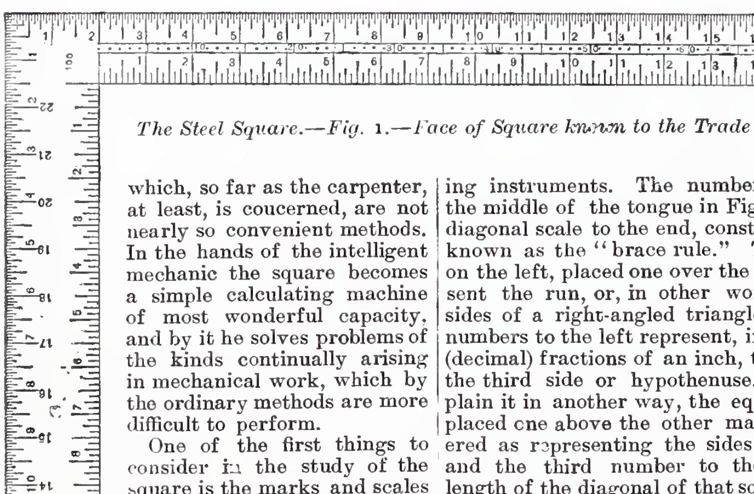
We have heard of various kinds of big bores, but we think the following a little ahead of anything that has come within our knowledge:

The repairs being made at the Pettaconsett pumping station of the Providence (R. I.) Water Works necessitated the boring of holes 10 inches in diameter through a platform of hard pine timbers 4 feet thick, for pile-driving purposes. The kind of auger, and how to use it—that was the question; and it was one that the average auger manufacturer could not solve. City Engineer Gray undertook it, and with the assistance of the Providence Locomotive Works accomplished his object. The tool consists of a shaft or shank, the lower end of which is 1½ inches in diameter, and has a thread cut in it. The upper part is some 2 inches in diameter. The whole is about 4 feet in length, and there is an extension shank to give more length as the shank disappears in the wood. Through the shank, just above where the thread commences, is a slot, into which is fastened the cutter or planer, or it may be called both. This extends out a sufficient distance from the shank to make a hole of the size required, and on the extreme end is a lance extending downward about one-sixth of an inch, while the remainder is more like the knife of a planer. As the shank turns, the lance cuts the fiber at the circumference of the whole, just its length in advance of the planer, while the knife, which, though moving with the lance, follows one turn behind in its work, lifts off the chips, which are 10 inches across and one-sixth of an inch thick. This auger is guided by a wrought-iron spider or frame fastened to the platform through which the shank works. Before boring the hole, a hole is bored with a common auger a little smaller than the thread on the lower part of the shank, in which this thread works, thus not only guiding and regulating the whole, but drawing the larger auger in just so much at every turn. With this auger 40 or more 10-inch holes were bored in that platform, and that by human power, and without material difficulty. It took only five men to work it, and with these the hole was bored through the 4 feet in two hours from the commencement. This includes the setting of the auger, &c., but the actual boring time, at least in some instances, was one hour and 20 minutes.

To Soften Putty.—Slack 3 pounds of stone quicklime in water, then add 1 pound of pearlash, and make the whole about the consistence of paint. Apply it to both sides of the glass, and let it remain for 12 hours, when the putty will be so softened that the glass may be easily taken out of the frame.

The Steel Square.

From conversations with carpenters, and from letters which have been addressed to *Carpentry and Building*, it seems that carpenters, as a general thing, are not thoroughly familiar with the marks upon this most useful tool, to say nothing of the applications of which it is capable. There is probably no other tool in use among mechanics which has half the capacity for usefulness, or, to put it in another form, of which half as many applications can be made, as the square. A mere list of the operations which may be performed with it, and of the purposes for which it may be advantageously employed, would occupy more space than we shall devote to this article, while to explain in detail the manner of using it to accomplish the many results of which it is capable, might occupy space equal to the whole of our paper for several numbers. We believe the square, with which by long association every one thinks himself familiar, is a much underrated tool, and that it is entitled to very much more attention and study than is usually bestowed upon it. In the articles entitled, "Some Problems in Framing," which were published in the volume for last year, we showed incidentally the usefulness of this tool in the matter of determining bevels and other framing lines. It is equally applicable in the solution of a large number of geometrical problems which are ordinarily performed in other ways, but



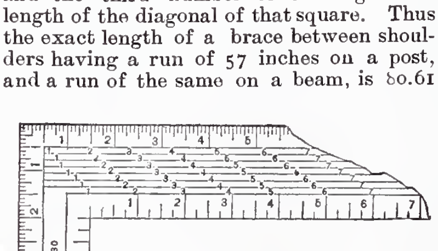
The Steel Square.—Fig. 1.—Face of Square known to the Trade as No. 100.

which, so far as the carpenter, at least, is concerned, are not nearly so convenient methods. In the hands of the intelligent mechanic the square becomes a simple calculating machine of most wonderful capacity, and by it he solves problems of the kinds continually arising in mechanical work, which by the ordinary methods are more difficult to perform.

One of the first things to consider in the study of the square is the marks and scales upon it. The only matter demanding prior attention is the names of the parts of the square itself. The long arm of the square is called the blade. The short arm is called the tongue. The junction between the blade and tongue is called the heel. The blade of the square is 24 inches long, and the tongue from 14 to 18 inches. The blade in good squares is 2 inches, while the tongue is 1½ inches wide. With inferior tools the tongue is sometimes narrower.

In the accompanying engravings Figs. 1 and 2 show a steel square of the best grade, being known in the hardware trade as No. 100. The cuts show the tool and all its divisions at one-fourth full size. The first marks which attract our attention, and which are also the best known, are the divisions into inches and fractions of inches. The heel of the square is the point from which it is most convenient to measure, both along the blade and also on the tongue, and hence in numbering the inches the figures commence at the heel, running toward the end of the blade and tongue respectively. The inch marks along the inside edges of the square commence numbering likewise with the interior angle. Since the width of the blade is in even inches, the inch marks upon the two edges of the tongue correspond, but because the width of the tongue is in other than even inches, the inch marks along the two edges of the blade do not correspond. Commencing at the end of the blade upon the face (Fig. 1) and corresponding to the inch divisions marked along the outer edge, is a set of figures by which the distance from the end of the blade may be read, which adapts this part of the tool for use in measuring the depth of mortices, &c. The different edges of the square are variously divided into fractions of inches. The outside edges, as shown in Fig. 1, are divided into sixteenths, while the inside edges are divided into eighths. The outside edges, as shown in Fig. 2, are divided into twelfths, while the inside edges are divided into eighths.

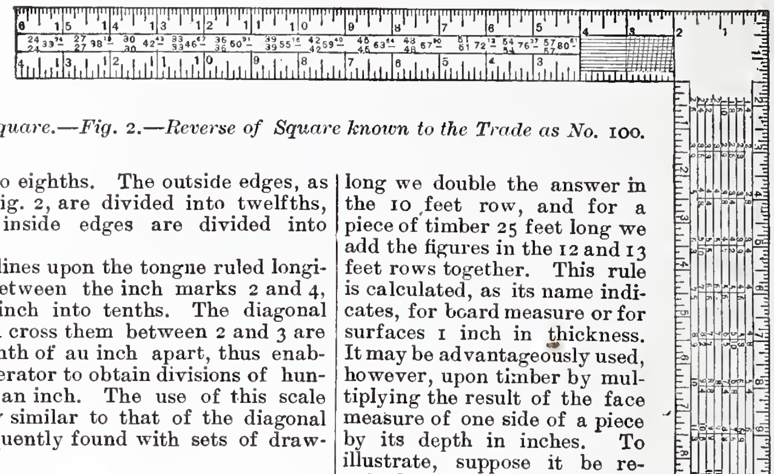
The fine lines upon the tongue ruled longitudinally between the inch marks 2 and 4, divide an inch into tenths. The diagonal lines which cross them between 2 and 3 are also one-tenth of an inch apart, thus enabling the operator to obtain divisions of hundredths of an inch. The use of this scale is precisely similar to that of the diagonal scales frequently found with sets of drawing instruments. The numbers occupying the middle of the tongue in Fig. 2 from the diagonal scale to the end, constitute what is known as the "brace rule." The numbers on the left, placed one over the other, represent the run, or, in other words, the two sides of a right-angled triangle, while the numbers to the left represent, in inches and (decimal) fractions of an inch, the length of the third side or hypothenuse. Or, to explain it in another way, the equal numbers placed one above the other may be considered as representing the sides of a square, and the third number to the right the length of the diagonal of that square. Thus the exact length of a brace between shoulders having a run of 57 inches on a post, and a run of the same on a beam, is 80.61



The Steel Square.—Fig. 3.—Face of Square, showing Old Style of Board Measure.

inches. The brace rule varies somewhat in the matter of the runs expressed in different squares. Some squares give a few brace lengths of which the runs upon the post and beam are not equal. For example, $\begin{matrix}18\\24\end{matrix}$ **30**, will be found among others.

The parallel rows of figures along the blade in Fig. 2 constitute what is called board measure. The manner of using it is as follows: Under 12 of the inch marks along the outer edge of the blade will be found the figures 8, 9, 10, 11, 12, 13, 14 and 15, which represent the length of the board or plank to be measured. The contents in feet and inches will be found under the several inch marks along the outer edge of the blade, corresponding to the width of the piece being measured. We can make this plainer by a simple illustration. Suppose we desire to ascertain the contents of a board 14 feet long and 10 inches wide. Find 14 under 12 of the inch marks along the edge. Follow the space in which it is placed back to the figures under 10 of the inch marks, where will be seen 11.8, which is read 11 feet and 8 inches. In like manner if the board is 16 inches wide, the result (under 16 of the inch marks) is found to be 18.8, or 18 feet and 8 inches. In the same way the measure of boards of any width from 2 inches up to 24 inches, and of either of the lengths above enumerated, may be quickly and accurately determined. By combining figures, lengths may be calculated which are in excess of those above given. For example, if we have a board 20 feet



The Steel Square.—Fig. 2.—Reverse of Square known to the Trade as No. 100.

long we double the answer in the 10 feet row, and for a piece of timber 25 feet long we add the figures in the 12 and 13 feet rows together. This rule is calculated, as its name indicates, for board measure or for surfaces 1 inch in thickness. It may be advantageously used, however, upon timber by multiplying the result of the face measure of one side of a piece by its depth in inches. To illustrate, suppose it be required to measure a piece of timber 25 feet long, 10 x 14 inches in size. For the length we will take 12 and 13 feet. For the width we will take 10 inches, and multiply the result by 14. By the rule a board 12 feet long and 10 inches wide contains 10 feet, and one 13 feet long and 10 inches wide, 10 feet 10 inches. Therefore, a board 25 feet long and 10 inches wide must contain 20 feet and 10 inches. In the timber above described, however, we have what is equivalent to 14 such boards, and therefore we multiply this result by 14, which gives 291 feet and 8 inches, the board measure.

On some squares the board rule is arranged in the shape indicated by Fig. 3 of the accompanying engravings, that is, the numbers representing coutents instead of being feet and inches are even feet, and instead of being placed in regular rows under the several inch marks, are arranged diagonally, as in the cut. The use of this form of the rule is the same as that of the one above described, save that all the answers give the nearest approximate even number of feet, instead of expressing the actual contents in feet and inches. However, by the position of the numbers either a little to the left or right of the line under the inch mark indicating the width, the operator is supposed to determine in his mind the fractional part of a foot contained. From all the information we have been able to obtain concerning the origin and use of this rule, which at present is almost entirely superseded by the later and better form above described, it seems that it came into existence at a time when fractional parts of a foot in measuring lumber were disregarded, and when things generally were conducted upon a broader and more liberal basis than at present. It does not answer at the present day to calculate a board at 18 feet when in reality it contains 18 feet 3 inches.

Along the center of the tongue upon the face, as shown in Fig. 1, will be noticed a number of dots, and a row of figures numbering them by tens. This is known as the "octagonal scale," the use of which is as follows: Suppose it is required to reduce a square timber, say, for example, 12 x 12 inches, to octagon shape. First draw a center line along each face, which, of course, will be

6 inches from the several edges. With the compasses, take twelve of the divisions in the octagon scale, and set off this space on the faces of the timber, measuring each way from the center lines. The points thus obtained will be correct for the gauge lines. The rule always to be observed is as follows: Set off from each side of the center line upon each face as many spaces by the octagon scale as the timber is inches square. For timbers larger in size than the number of divisions in the scale, the measurements by it may be doubled or trebled, as the case may be.

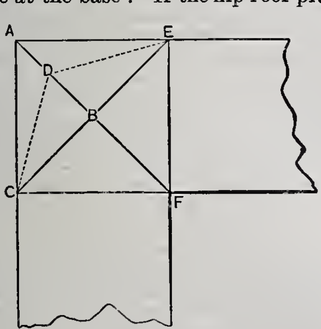
We have now described the marks and scales upon one of the best grades of steel squares in use, but we have not described all that is to be found upon the many different makes of squares which, in the hands of our readers, are being daily employed in workshops and upon buildings. This article was primarily suggested by the inquiry of Z. Y. K., of Dodgeville, Wis., whose question was published in the September number. Our correspondent did not indicate what square he was using, and therefore we have no means of determining whether we have answered his query satisfactorily or otherwise. We hope he and all others of our readers who are at all interested in this subject will, as they read this article, examine their own squares, and at convenience send us specific questions concerning anything they find thereon not here anticipated. We shall be glad to continue this subject until every figure upon the squares in use is made intelligible, and thereby of practical use.

In this connection we are pleased to acknowledge our obligations to the following correspondents: W. F. P., of Berea, Ohio, who sent us a drawing of his own square, together with a lucid explanation of all the marks found thereon, showing that he is not employing this tool blindly, and C. H. E., of Mexia, Texas, who, in the shape of a letter above his own signature, sent us an accurate copy of both text and drawings of portions of an article upon the square published by one of the mechanical journals of this city some two years since, which shows that he not only reads but remembers where he sees a thing, so as to be able to turn to it in case of need.

CORRESPONDENCE.

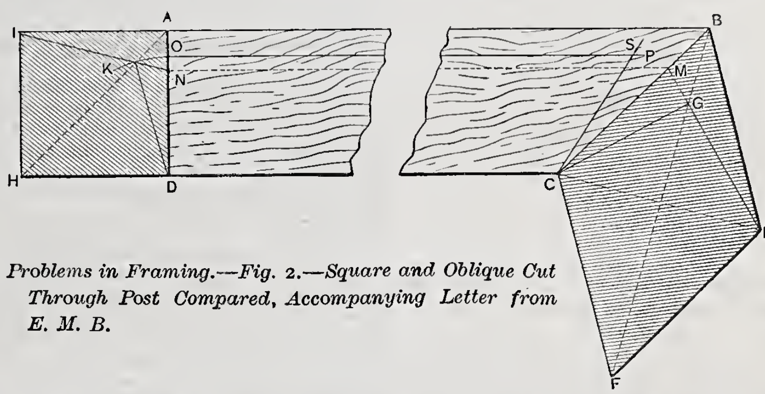
Problems in Framing.

From J. H. P., *Paterson, N. J.*—I desire to inquire if there is a length, bevel, backing, cut, or line in the inclined structure you have so eloquently, minutely and profusely illustrated and described, that cannot be as easily and accurately obtained by the system usually employed in good practice for framing ordinary hip roofs with purlins? Would not some of your lines be a little out if the structure were 8 x 12 feet at the top instead of 12 feet square, retaining the 24 feet square at the base? If the hip roof practice will not frame the structure complete, will you kindly state the reasons why? Will a bevel set by the drawing, as shown in Fig. 7, page 133, applied to a post, fit the sill accurately?



Problems in Framing.—Fig. 1.—Comparison of Face and Diagonal Bevels, Accompanying Letter from A. B.

Answer.—In attempting to reply to our correspondent's first question, we are at a loss to know what he means by a "system usually employed in good practice for framing ordinary hip roofs with purlins." Various plans or systems are in use, all, of course, based upon the same geometrical principles. The system which we have shown in the articles entitled "Problems in Framing," is applicable to the construction of a hip roof quite as well as to any other kind of work, and it is in use in good practice by many mechanics in different sections of the country. Our correspondent seems to forget that the inquiry which we attempted to answer in this series of articles came from a man who asked for a plan by which to construct the frame in question. Accordingly, we undertook in answering to present the best plan with which we are acquainted, and it is the one which we would use in framing a hip roof, or, for that matter, any other structure. We have no means of determining what system of framing hip roofs is employed in our correspondent's neighborhood, and, therefore, we cannot answer yes or no to his question whether or not the lines could be as well obtained in some other manner than we have described. They may be obtained in other ways; but no way with which we are acquainted has the same advantages, according to our ideas, as the one we presented.



Problems in Framing.—Fig. 2.—Square and Oblique Cut Through Post Compared, Accompanying Letter from E. M. B.

With reference to our correspondent's second question, if the top of the structure were 8 x 12 feet, instead of 12 feet square, the lines which we have shown would not be right, but the principles which we have used in getting the lines may be applied in the case he supposes just as well as in the case set forth in the article. In applying the system in such a case the bevel must be set to each pitch.

Our correspondent's third question is already answered. With reference to his fourth question, concerning the bevel as set in Fig. 7, page 133, we would say that Fig. 8, same page, represents the manner of using the bevel. The description in the text also covers the point at issue. We quote: "Set the T-bevel by the drawing, an enlarged section of which is shown in Fig. 7, as indicated. Mark one face of the timber to be cut by it, as shown in Fig. 8, then an adjacent face, commencing where the first terminated, carrying the line around the timber, as indicated in the engraving by the dotted lines." A post cut in the manner here described and placed in position will fit accurately upon the sill.

From A. B., *Camden, N. J.*—If all the readers of *Carpentry and Building* were to stand in a circle around that inclined corner post, it is probable that each one would see it differently, in both shade and position, from all the others, and probably would give some idea concerning it peculiar to himself.

I would like to criticise the explanation in regard to the manner of applying the bevel to the foot of the post. In the November number it is proven very clearly that the bevel applied to the corner gives the same angle in any direction on the face of the post, but it is equally clear that we use the bevel on the face of the post only as a means to an end.

The real object is to find the difference in length between the outer corner A, Fig. 1, of the post and the inner corner F. In other words, what we are after is the bevel of the diagonal line A F. But, as it is impossible to follow that line through the post, we are compelled to go around it in such a manner as to touch the longest and shortest points A and F, making the other two corners, C and E, of equal lengths. Now, it is evident by inspection of the sketch, Fig. 1, that the points B and C must be equal in length, hence it follows that in applying the bevel from from A to C we only resort to the indirect way of finding the difference in length between A and B. The difference in length between the point D, located somewhere between A and B, must be less than that between A and B. This shows perfectly that the face bevel changes with the shape of the angle A in the process of backing.

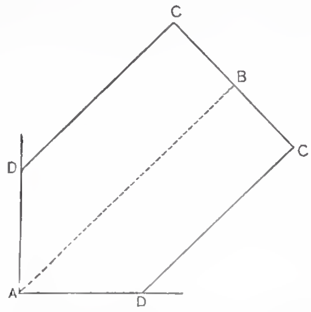
From E. M. B., *Kent, Ohio.*—I am a constant reader of *Carpentry and Building*, and can say that I have found some very good things in it, and likewise some things quite ridiculous. Of the good things I shall have nothing to say in this letter.

Among what I term ridiculous things, I notice the assertion that it makes no difference, using a bevel set to a given angle, whether that bevel be applied to the post before or after backing. In other words, it seems to be claimed that after cutting the foot, then backing, the post, if the bevel by which it was cut be applied in the same manner, will fit to the angle the same as it did before backing, providing, of course, that the stock does not slip down the adjacent face of the post.

Assuming this to be the position of *Carpentry and Building*, and supposing that it really knows no better, I shall endeavor to set it on the right track, as it has so kindly invited the unbelievers to do. The making of experiments has been advised in *Carpentry and Building* in order to demonstrate propositions. Experiments with imaginary lines and cones were used as arguments in the November number, in which only one fact seems to have been kept in mind. What that fact is will probably be apparent before I have done. It is evident that the writer did not realize that the cones were to be intersected by another plane besides the plane forming the faces of the posts, namely, by the horizontal plane of the plan. It is a fact, however, that the plane which intersects the post at the foot also intersects the cone and the axis of the cone at the apex, but does it intersect the axis at the same angle in all cases? Examine Figs. 2, 3 and 4, page 216, November number. It is evident that, in case the post is square, the cone is cut at just the right angle to remove one-quarter of the envelope of the cone. In case the post has been backed the cone is cut at a sharper angle, removing less than one-quarter of the envelope, hence it follows that the corner of the post being the imaginary line or axis of the cone, is not intersected at the same angle in both cases, and, therefore, that both posts will not stand at the same pitch or inclination.

If this does not convince, I suggest an experiment which I think will clear up all doubts. Take a stiff piece of paper, say six inches square. Fold it so as to make two thicknesses 3 x 6 inches. Set the bevel and go to framing; that is, take a pair of scissors and commence at one of the folded corners, cutting off enough to make it one inch shorter on the opposite edge; or, in other words, make it 6 inches on one edge and 5 inches on the other. Now bend it so that the two face sides of the post will come together at a right angle. Set it upon the table with the bevel end down, and you have a post in position and pitch as framed while square. Open the paper still wider, or wide enough to have the bevel conform to the square plan, or the square corner of the sheet of paper, and there is represented another post, or one framed after being backed. This is not the same post framed and then backed, because backing a post already framed does not alter the pitch, but rather alters the bevel at the foot to what it would have to be cut in order to stand at the same pitch with it when framed, after backing.

To illustrate the exact variation I inclose a sketch, Fig. 2, in which A B C D



Problems in Framing.—Fig. 3.—Comparison of Face Bevels in a Post 6 by 10 Inches.—Letter from J. H. P.

shows an elevation of one of the faco sides of a square post after cutting the foot (C B) and before backing. C B E F is a diagonal section at the foot. C G and G E are the lines after backing on the foot end of the post, in which D K and K D are the backing lines, determined by using the gauge mark from M to N. It will be seen at a glance that the lines I K and K D give the width of the face sides, after backing. By transferring the length K D of the line A D with the stationary point of the dividers at D, D O is obtained, which gives the width of the side in elevation. Strike the line O P parallel with C D; connect the lines O P and D C by a line the length of C G, as shown by C S; then will C D O S be an elevation of one side of the post, after backing. Now compare the angles at A and S.

From J. H. P., *Paterson, N. J.*—The illustrations and description of the cone in the November number are remarkably clear and scientific demonstrations, but, pardon my impudence, do not at all cover the point really at issue—the one raised by G. H H. All the bevels of the "Tank-Frame Problem" have been applied to the corners of the post, and have been obtained from those points, not from a center line practically inaccessible and not under consideration. It requires but a slight knowledge of lines to know that all the radiating lines of a cone are alike when the angles are the same, but when the lines do not radiate to a common center the angles are dissimilar—a statement which can be easily proven. For example, incline a line two ways, apply the bevel, and in its revolutions keep the blade coincident with the top of the level sill. This is the theory, and is the bevel of the cone required in the solution of the tank problem.

A post inclined two ways at a given maintained angle cut at the foot to accurately fit upon a level sill, can be backed or dressed to any conceivable shape on any of its faces, without destroying the joint of the bottom against the sill; but if the post is backed or dressed before the foot is cut or the bevel applied, then for any change in any of the planes or faces of the post a new bevel must be obtained, either from a special drawing or from the frame itself. The bevel taken from the elevation, as shown in Fig. 7 of the "Problems in Framing" (page 133), will not obtain the joint except in one position or plane of the face.

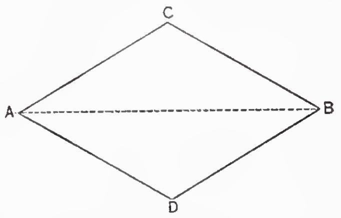
This may not be exactly clear. Suppose, therefore, I endeavor to state the case in a plainer form. Assuming the post is properly backed before the bevels are applied, it must be evident that the bevel required to cut the two faces C D of Fig. 3 parallel to the diagonal A B, is very different from that required to cut the two faces A D parallel to the face of the sill; and, further, that if the post be dressed to a line drawn from A to C, still another bevel would be required, totally different from either of the ones already mentioned. It is evident also that but one bevel, namely, the one that will cut the face C D, would be required if cut square through from the face of the post.

In all these cases the bevels must be applied to the angles of the post, and not referred to vertical lines, and in all of them the joint at the foot is unaltered, and the bottom of the post would be a perfect plane. The problem assumes that the post is unbacked. The difference between the line before or after backing is not clearly distinguished, and between the statements in *Carpentry and Building* and those of some of its correspondents there seems just here to be a void.

Take Figs. 2, 3 and 4 of the cone demonstration (page 216); it will be impossible to apply any one bevel to the faces of these three posts, after backing to the shape shown, that will cut to fit accurately on the sill. Each one will require a different bevel on the faces in order to fit some angle; but if each post be cut directly through the center of the diagonal, as shown by A B, Fig. 4, and a bevel be applied to the outside corner and across the face made by the cutting, then one bevel will cut all three sections, and all three of the sections will fit against the sill. Even in this case, for each section a different bevel will be required to cut the other face A D, or A C (Fig. 4), as the case may be.

To sum up, any inclined post, after the foot is cut to fit a sill, may be backed and dressed to any face or plane without at all altering the foot joint; but if the foot is to be cut after the backing, for any change whatever in any face, even the slightest, a new bevel must be obtained, or the joint will not be perfect. This is both common sense and science, and can be as easily and as accurately demonstrated as any problem in constructive geometry.

I only take exception to the demonstrations published in *Carpentry and Building* in the interest of the younger readers who are seeking after light. Unless these points



Problems in Framing.—Fig. 4.—Face Bevels Compared with the Diagonal Bevel.—Letter from J. H. P.

are cleared up, some one might be led into grave and serious error—perhaps might lose some of his loose change in a bet on a "sure thing" with some hard "old chip" who had "been there before."

From X. Y. Z., *Springfield, Ill.*—Having had a great deal of experience in framing structures of various kinds, both regular and irregular, and knowing by experience the difficulty of conveying to the mind unfamiliar with framing an idea of the shape a stick of timber will assume when cut to put in position, and also the difficulty which a beginner has in comprehending the lines necessary to make before the cuts are produced, I have read with great interest the problems in framing, and have admired the simplicity of the plan, or rather plans, for there are really two of them, which have been explained. But not less have I admired the patience which has been manifested in describing the position of every stick, and the reason or philosophy for every line made. It would have been so much easier to have adopted the stereotype style and laid down the lines, saying: "Fig. 1 exhibits the mode of framing a truncated structure, whose base and apex are both parallelograms. A is the plan, B the posts, C the girt," &c., &c., without further explanation. All this doubtless would be very plain, and entirely satisfactory to that portion of the readers of *Carpentry and Building* who are experts in such matters, but it would be of no use whatever to that larger portion of readers who have as yet but little light on this subject, and who are most in need of assistance. I doubt not that many a one will have occasion through life to be thankful to *Carpentry and Building* for explaining so fully the principles by which framing lines are obtained. But after every principle has been explained and every question that may arise been answered, there is still a great deal which of necessity must be left to the judgment of the workman to settle in his own mind. The best application to make in each particular case as it arises, must be a question of judgment to be settled at that time. It would be impossible to anticipate every variation.

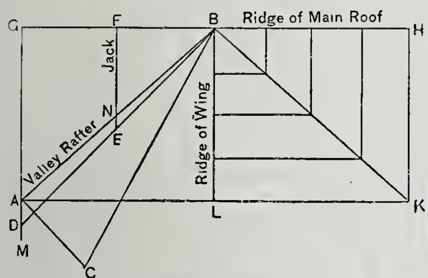
I have taken much interest in the discussion of these problems with G. H. H. After reading all that has been said on both sides, I have come to the conclusion that you are talking at cross-purposes, or possibly that you do not fully understand G. H. H.'s question. I have no difficulty in finding a point at which you are right, and another point at which he is right, but I am unable to find a common standpoint upon which both are right.

G. H. H. asks, in his first communication, how the bevels thus obtained (referring evidently to Fig. 7 of the "Problems in Framing") are to be applied to square posts with the right effect. Now, G. H. H. will find that the bevel so obtained can be applied only to the square post with the right effect. For if the outer face sides of the posts be dressed to the required shape, leaving the inner side square, and the bevel be applied as obtained by Fig. 7, it will be discovered that it is impossible to cut to all the lines with an ordinary framing saw. One pitch will be from the front corner to the middle corner of the post, and another from the middle corner to the rear corner, and a straight edge placed upon the end of the timber from corner to corner, from front to rear, would show an open joint in the center. To get the correct bevel for the face of the post after it is backed, let him apply the principle as shown in Fig. 14, or 15 and 16. Many workmen will get the bevel and apply it to the back of the post on both sides, and saw to these lines to the middle corners, and then depend upon their eye to carry it through the other half of the post straight, the only guide being the part already cut. I do not approve of such practice. I think it always better to get correct lines and then work to them.

The illustration of the principle involved, as given in the November number, is good. I think, however, it must have been unsatisfactory to G. H. H., as apparently he was talking of bevels applied to the side of the post, while you seem to have been considering those taken through the center. Applying the bevels to the side of the post is but a means to an end, the end being to obtain a line that shall correspond exactly with the seat of the post. This line being obtained, and the post cut, it is evident that any amount of backing or chamfering will not change the joint, unless the inclination of the post is changed, and that a bevel placed on the post in the direction of its longest to its shortest corner, will fit the same both before and after backing.

Note.—It affords us pleasure to publish these letters from our correspondents. In the first place, it indicates that interest is being taken in *Carpentry and Building* by men well advanced in the trade and who are able, in case we stumble, to demonstrate the error of our conclusions to the last degree. It is a matter of especial satisfaction to us that some "old chips" who have "been there before," are willing to give the readers of *Carpentry and Building* the benefit of their experience. We are always glad to publish both sides of every discussion which may arise, and because we have championed one line of argument we are not the less ready to admit to our columns such communications as might seem to prove us in error. Our willingness to publish criticisms of ourselves has already been commented upon by one of our correspondents, who considered the fact a desirable feature in our paper. We accepted his remark as being a very pleasing compliment; we allude to it now only for the sake of encouraging others to write in the same frank spirit manifested by the correspondents whose letters appear above, whenever they shall see anything in our columns which deserves attention in the way of comment and criticism.

It seems to be assumed by each of the writers above that the assertion has been made at some time in *Carpentry and Building* that it is immaterial whether the bevel, after being set to a given angle, is applied to the post before or after backing. In other words, that the bevel set and applied in the usual way to the timber before backing, and



Joining Wing Roof to Main Roof.—Accompanying Letter from C. S. P.

also after backing, will produce coincident lines. Now, all this is a mistake. We have made no such assertion, although by implication it may have appeared that this idea was in mind. In our reply to G. H. H., page 177, September number, we said: "The method of obtaining the bevel for the foot end of the timber, either by applying the bevel of the drawing, as illustrated in the first article, or by use of the square, as also illustrated in that article, is available whether applied to the timber before or after backing. To the average beginner, however, we think it would be much clearer if performed upon the square timber than upon timber which had been backed."

It must be evident to any one that two distinct operations were in mind when the above was written. If applying the bevel to the timber after being backed were the same as applying it before being backed, the beginner could have no more trouble in comprehending or making use of the one than the other.

A little further on we wrote as follows: "Our correspondent is obviously incorrect when he questions the possibility of applying these bevels to the square post with the right effect." In support of the assertion that they could not be applied to any other than a square post, we continued: "The extreme outer corner of the post, either as originally square or after it has been backed, assuming the shape of a rhombus, is a straight line. The bevel resulting, therefore, will be the same whether the plane over which it is drawn be in one position or another," &c. Here, it will be noticed, we made the extreme outer corner of the post the line by which the bevel was to be applied. In other words, we attempted by that description to indicate the direction of the bevel upon the diagonal line A F, Fig. 1, of the sketch sent in by A. B., and upon the lines A B, Figs. 3 and 4, of the sketches sent in by J. H. P.

The next thing which occurred was the letter from G. H. H., published in the November number (page 216), in which he says: "In the note the assertion is made that, in applying a bevel to a post, it makes no difference in the result whether it be while the post is square or after it has been backed." In our answer to this we wrote: "Our remark in the September number was as follows: 'The extreme outer corner of the post, either as originally square or after it has been backed, assuming the shape of a rhombus, is a straight line. The bevel resulting, therefore, will be the same, whether the plane over which it is drawn be in one position or another; whether the angle upon the corner, as indicated by a square cut at the end, is 45, 40 or 50 degrees.'" We then proceeded to prove this assertion by a demonstration in which the cones were employed, maintaining throughout that the axis upon which the bevel was revolved should be the extreme outer corner of the post. It is easy to be seen how our correspondents have fallen into the error of understanding that we had asserted that it made no difference whether the bevel be applied to a post before or after backing as to the resulting angle. The only step in our course which was different from what we believe it should have been, is in our answer to G. H. H.'s letter in the November number, in the fact that we did not distinctly state that a difference did exist, instead of confining ourselves simply to the assertion made in proof of the direction of the diagonal bevel previously made. Hence, we say that all this has arisen by implication rather than by direct assertion. Our correspondent X. Y. Z., and also A. B., seem to have understood the matter correctly, and their letters are of especial interest to our readers accordingly. Nor are the other letters without interest and usefulness. They all call out features which, but for them, might have remained undisclosed. We agree with one correspondent, that as many different views of the inclined post are possible as there are persons to view it. Another thing is also true—there is nothing more difficult than to convey to another person one's conception of lines. It is seldom that any two persons can converse upon the subject of lines, particularly when bevels are involved, and see the subject from like standpoints. A difference is almost sure to exist, and to exist in such a subtle manner that each will suppose the other understands until the final conclusion is reached and results are shown to be entirely dissimilar.

Joining Wing Roof to Main Roof.

From C. S. P., *Concord.*—In answer to the inquiry of L. R. C., Tribe's Hill, I inclose you a diagram of my plan of construction in joining the roof of a wing to that of the main building. In the inclosed sketch G H represents the ridge of the main roof. B L represents the roof of the wing. B H and B K are the valleys. For the true length of the valley rafter from H, erect A C perpendicular to B A, making A C equal to the rise of the roof. Connect B and C. Then B C is the length of the valley rafter and the angle at C is the bevel of the same. Draw the line B D in length equal to B C, in such a manner that the point D, corresponding to C, shall fall in the line G N. Extend the jack-rafter F N until it meets the line B D in the point E. Then E F is the length of the jack, and the angle at E is the top bevel of the same. The bevel will be the same as the main rafter.

From A. J. H., *Lowell, Mass.*—I inclose you an answer to the inquiry of L. R. C., which I think is correct; if not, I will be obliged if some of the readers of *Carpentry and Building* will show me wherein I am wrong. The main roof in the sketch is shown constructed to one-third pitch. No. 1 represents a wing joining the main roof whose pitch is also one-third. No. 2 represents a wing joining a main roof in which the rise is the same as that of the main roof.

C represents one valley-rafter extended through to the ridge. D represents the other valley-rafter butted square against the first. E and E are the lengths and B and B are the side bevels of the jacks, found by applying the length of gable rafter F. A represents a side bevel of valley-rafter against the ridge, and is found by applying the gain of the same as shown. The same letters of reference represent corresponding parts in the one marked No. 2.

Note.—Since our correspondent desires to be set right in case he is wrong, and as this subject is a desirable one for discussion in the columns of *Carpentry and Building*, we publish his letter as received and invite criticisms upon it. The plan pursued by this correspondent obtains results which are such close approximations to the correct lines that, in all probabilty, by actual practice he would not soon discover his mistake. However, we are anticipating the question. We desire to refer it to our readers for discussion, and shall be glad to have communications early, so that we may be able to engrave the sketches in time for publication in our next issue.

Bitumen.

From C. W., *Des Moines, Iowa.*—Will you please give in *Carpentry and Building* the origin of bitumen and its uses?

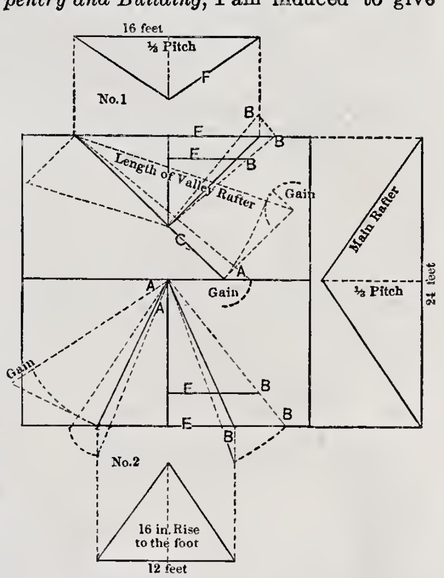
Answer.—The term bitumen, as used generally in the arts, applies to a variety of mineral pitch of varying grades of hardness. Correctly speaking, it is applied to certain pitches or tar—for they more nearly resemble tars than they do pitches—which are found in the old world. The earliest mention of them is in the Bible. The pitch that is so frequently mentioned in the Old Testament was probably the bituminous matter found in what are called pitch springs or pitch pools. These springs or pools are sometimes boiling and at other times quiet lakes of melted pitch. In Arabia and Asia Minor and in some other localities, in connection with oil wells, there are bituminous deposits in the ground, which frequently come to the surface, and in appearance are not unlike soft coal. Dr. Ure uses the word in the same sense as asphaltum.

Bitumen in general, then, is a mineral—classing all things which are obtained out of the ground, and which are not organic substances, under that head. In the Island of Trinidad there is a large lake of pitch which is quite different in composition from that of other deposits, but which in its general characteristics is similar.

The uses of bitumen are numerous. It is used for a great many of the purposes for which tar and pitch are employed. The coarser grades are probably not very different in their mechanical properties from coal-tar. The harder grades, it would seem, are more enduring than many kinds of coal tar, which makes them more desirable for many purposes than the coal tar commonly used.

Warped Chimneys.—A Remedy.

From G. W. S., *New York.*—Perhaps some others of your readers have noticed the fact to which I am about to call attention, but not having seen mention of it in *Carpentry and Building*, I am induced to give

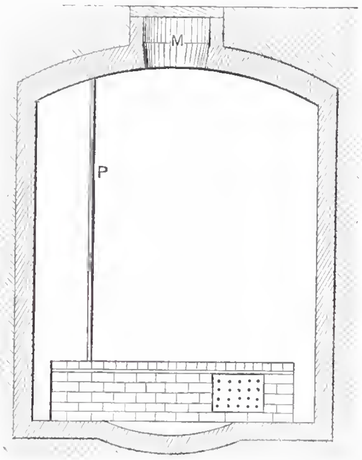


Joining Wing Roof to Main Roof.—Accompanying Letter from A. J. H.

you my views. The elevated railroads of this city have afforded me means of observation, from which position I have noticed that about nine-tenths of all the chimneys in sight in this city are warped, particularly those having their flat sides north and south, and that all of the chimneys incline to the north. This latter fact I am disposed to attribute to expansion, the north side of the chimney being the coldest. To overcome this difficulty I suggest that when chimneys are being built they should have a piece of 3 or 4-inch angle iron placed in their southern corners. The chimneys should be topped out with a cast-iron cap, with a flange at least the depth of a brick all around. The cap should be bolted down at each corner, upon the inside, to cross-pieces built in the chimney below the roof. This cap would prevent the top bricks from loosening, and would be a safeguard for falling bricks. I respectfully submit this to the readers of *Carpentry and Building*, and hope to see an expression of opinion upon this subject from them.

Pure Water.

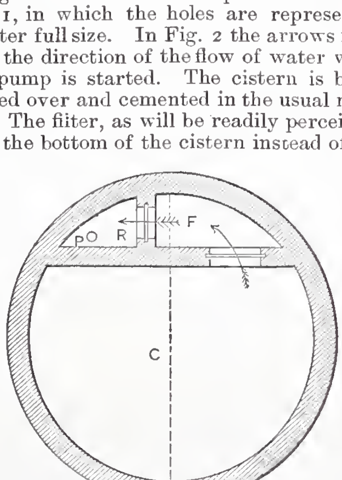
From G. W. B., *Chatham, N. J.*—Pure water is a grand thing, and to get it with the least expense is very desirable. I was conversing with a friend the other day, a mason of a neighboring town, concerning filters for cisterns. My friend said he had one of his own invention, which he had used for the last 15 years or more, and which had always given the best satisfaction. Other



Pure Water.—Fig. 1.—*Vertical Section through Cistern, Showing Elevation of Filter at Bottom.—Letter from G. W. B.*

filters have been taken out and his put in their places. He furnished me a description of it, and assented to having it published in *Carpentry and Building* for the benefit of those who wish to secure pure cistern water at a small expense. Accordingly I have made the inclosed diagrams, to which the following explanation refers.

In Fig. 1, which represents a vertical section of the cistern, M is the manhole, P is the pump pipe. In Fig. 2, which represents a horizontal section of the cistern, P is the pump pipe shown in section, R is the reservoir, F is the filter, and C is the main cistern. Fig. 3 is an enlarged section of the galvanized iron filter plate shown in Fig. 1, in which the holes are represented quarter full size. In Fig. 2 the arrows indicate the direction of the flow of water when the pump is started. The cistern is built, arched over and cemented in the usual manner. The filter, as will be readily perceived, is in the bottom of the cistern instead of the



Pure Water.—Fig. 2.—*Horizontal Section through Cistern near Bottom, Showing Compartments in Filter.—Letter from G. W. B.*

top, which in my estimation constitutes a great advantage over the one given in the April ('79) number of *Carpentry and Building*. This filter is much easier of construction and considerably stronger. It is also less expensive. The walls separating the cistern from the filter and reservoir are 4 inches thick. One course is laid all the way on the bottom, as indicated in Fig. 1. The size of the plates used are 11 x 16 and 11 x 12 respectively. The ends of the bricks are slightly notched to receive the edges of the plates and to hold them. After the walls are carried up to the bottom of the plate the compartments are cemented inside and out, so that no water can get through except by way of the perforated plates. The filter is filled with charcoal broken to nut size and sifted to remove all dust. Great care is taken to eliminate all pieces of bark and wood that are not well charred. The filter and reservoir are finally covered over with slate at a point indicated by the double line in Fig. 1. Iron bars are laid across where the pump enters. A course of headers is then laid on and the whole is covered over with cement, rendering it perfectly tight. The water is first run into the cistern, and, by the construction above described, whatever is pumped out must pass through the charcoal in the filter. All the filters of the construction here described which are in use, and a number of them have been employed for quite a term of years, have given entire satisfaction.

Note.—Without criticising the construction of the filter and cistern above described—which we are certain some of our readers who have practical experience with such things can do much better—we desire to call attention to an objectionable feature—namely, the use of the galvanized iron plate. It is a well-known fact that zinc is altogether unsatisfactory for use in connection with water which is to be used for drinking purposes or cooking. The intent of such a cistern as our correspondent describes is no doubt to provide water for drinking and culinary purposes. The presence of zinc—and galvanized iron is simply iron coated with zinc—in such a place is likely to do material harm to those who use the water. The effect may be such as not to be readily noticed, but it is, nevertheless, sure in its working. Many cases of diarrhœa, and other bowel disorders and sicknesses of a more serious character are traceable directly to the presence of zinc in water. Why manufacturers will persist in using galvanized iron, and, in some cases, zinc plates, in such positions as these, is beyond our comprehension. The construction of the filter above described in no way depends upon the use of the galvanized iron plate. Something else will answer the purpose quite as well, and may be substituted for it to the advantage of the health of those who use the water

Slate Roofs.

From E. C. M., *East Hampton, Vt.*—I notice the communication, in a recent number of *Carpentry and Building*, containing objections to the use of slate for roofing purposes. I desire to make a few remarks concerning the same general subject, although the conclusions which I shall draw may differ from those of your former correspondent.

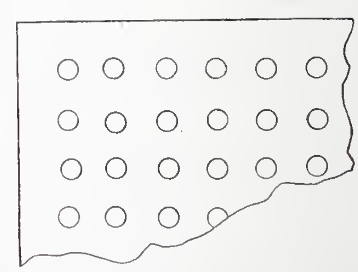
Several circumstances have combined to render the trade in roofing slate somewhat unsteady, and at the same time have tended to degrade the quality of the roofs which have been laid. There has been a great deal of cheap or inferior slate put upon the market. Quite an amount of "green" slate, having a limestone or soapstone quality, which, upon exposure to the atmosphere, becomes air-slaked and soft, thereby losing its original color and texture, has been thrown upon the market. A sad mistake has been made by many quarry-masters—that of splitting their slate too thin. This has been done to a great extent in order to supply the Western trade. By splitting slate very thin, manufacturers have been enabled to load some 50 squares to a car, when ordinarily 40 squares would constitute a car load. A very considerable quantity of slate is sold, delivered at distant points. Getting a larger number of squares in the same weight has, of course, been to the manufacturer's advantage. The same has undoubtedly reacted to a greater disadvantage on account of the inferior roofs produced

I am convinced that slate too large in size are frequently laid upon roofs ; in fact, that a great share of the slate quarried is manufactured into sizes too large for satisfactory use upon roofs. A slate 24 inches in length lies 11 inches to the weather, while one 14 inches in length lies 6 inches to the weather. By experience I am led to believe that a slate laid 6 or 7 inches to the weather is less liable to injury by frost than one which lies 11 inches to the weather. At the same time, the slate having the smaller exposure is less liable to damage by wind than a longer one. In each case the reason is the same. The leverage of the frost or wind getting below the slate has much less chance to act with the shorter slate than with the longer one. In the use of short slates, in the event of one being broken, there is a leak of but 6 or 7 inches, while on the other hand, in the use of long slate, there are some 11 inches of surface exposed. A still further objection to the use of large slate is in the fact that all slates run in seams, which the frost is liable to open at any time. There will, of course, be fewer seams in a small surface than in a large one. Therefore, to secure a durable slate roof, first procure a quality of slate which is tough and even. Second, select a small-sized slate, and last, but not least, secure the best care and workmanship in laying. In addition, I recommend laying slate over paper. If these directions are followed and the work is properly done, a roof is secured which, after the first 3 years, is good for a century. Whatever flaws there may be in the slate will show themselves during the first or second winter, and therefore I have said that after the first 3 years (as an outside period), supposing that such defective slates as show themselves are replaced, the roof is good for an indefinite period of time.

I believe slate roofs constructed of the best material, and laid in a careful and workmanlike manner, to be the most desirable of all roofs before the building public. The objections mentioned by your former correspondent I consider of little moment. I believe I have stated the principal points to be observed in a slate roof. Snow slides may be prevented by a simple guard, with the construction of which every roofer is familiar.

Pumice-Stone vs. Emery for Keeping Tools Clean.

From W. G. S., *Chattanooga, Tenn.*—I have been reading *Carpentry and Building* ever since its publication, and am satisfied that it fills the wants of the trade better than any other publication in the country,



Pure Water.—Fig. 3.—*Section of Galvanized Plate, Forming Entrance to Filter.—Quarter Full Size.—Letter from G. W. B.*

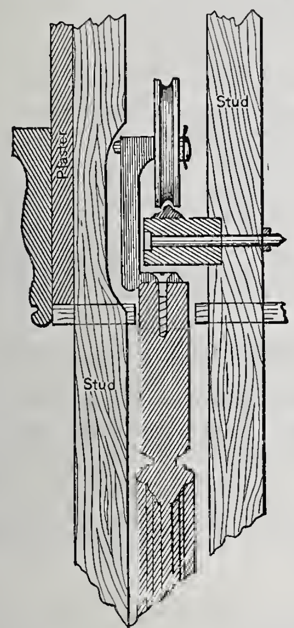
and I have seen and read most of them, and subscribed for some of them, but never got the satisfaction out of any of them that I have out of *Carpentry and Building.*

In the May number an article says "to keep tools clean and bright" use kerosene oil and emery. Now, the kerosene is all right, but I find from experience that the emery is all wrong ; the emery will take the rust off and make the tool look bright, but it will also leave fine scratches which will cause the rust to eat in much worse the next time it is exposed to the action of the atmosphere. What is wanted is something that will take off the rust and stains and leave a polish. Now, there is nothing that will do this better than pumice-stone and kerosene ; any oil will do, but kerosene is the cheapest, and will penetrate the rust the best. I usually rub a little sweet oil on tools after cleaning them, and let it stand an hour or so, then rub off clean, as if allowed to remain long it will form a gum. I have never used paraffine. Five cents will buy enough pumice-stone to last a year. I buy it in the lump and rub the tools with it in that shape.

Construction of Sliding Doors.

From A. A., *New York*.—In a recent number of *Carpentry and Building* my attention was attracted by a query with regard to the construction of sliding doors. I do not remember seeing it answered.

I think the best plan for the management of sliding doors between apartments is this: Hang the doors from the top by means of two



Construction of Sliding Doors.—Diagram Accompanying Letter from H. W.

hangers, with a wheel or roller running on a track placed directly over the door. The door should be hung to run clear of the floor, with space underneath sufficient for the carpet. The accompanying sketch represents my idea of the construction. It is necessary in arranging for doors of this kind that everything about the partition be true, square, plumb and level; and also that it be trussed or supported so as to remain in proper shape. Another feature of very great importance, although not generally attended to, is that the space or pockets into which the doors slide be made tight, so that there shall be no draft of air coming through the openings into which the doors slide. Very frequently, by carelessness in construction in this particular, rooms are made cold in winter and in windy weather. Proper attention will overcome this difficulty effectually.

Cooper Institute.

From G. S., *Chicago, Ill.*—I would like to ask you a few questions about Cooper Institute. How may I obtain admittance to it if it is a free school? Do the students board there? What examination must one pass to become a student? Are physics, algebra and geometry taught? Could you send me a circular or give full information in regard to the lessons taught, methods of obtaining admission, &c.

Answer.—Our young friend evidently mistakes the general scope and object of the famous Cooper Institute of this city. Its work is chiefly devoted to the art education of women. There are, however, a large number of evening classes for males, in which a great variety of the common and higher branches are taught. Admission to these evening classes is free, as it is to all branches of the school, and is obtained by applying at the office of the institute or to the teachers themselves before the term begins. As there are a great number of applicants, the classes are usually all filled long before the term commences. This is especially the case with the classes in drawing, chemistry and other popular studies. Except that the teachers are aided by better apparatus, the school is not so very different from the ordinary free night schools to be found in any of our larger cities.

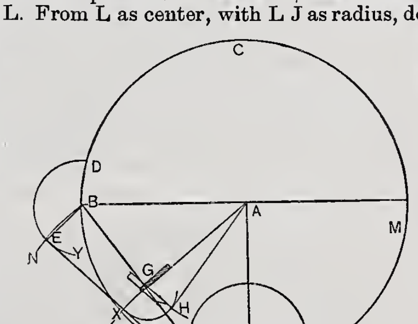
From the tone of our friend's letter we judge that he thinks of coming to the city to enjoy the advantages of the institution. In algebra and geometry he can, in all probability, get just as good instruction in free schools in Chicago as in New York, and the amount he would have to pay for the best of teachers would be far less than his fare to this city. Cooper Institute, it seems to us, does not offer such advantages to young men as to make it desirable to come from distant cities to enjoy its benefits. There is no boarding department connected with the school. Further information can be obtained by addressing Secretary, Cooper Institute, New York City, N. Y.

Young people are very prone to overlook the advantages afforded them in their immediate neighborhood, and think they could do vastly better if they could get away to some other place. In most cases they would be better off at home. We would not advise any young man to come to the city of New York for the sake of enjoying the privileges of any of our schools, except, perhaps, those devoted to art. The cost of board alone in this city would pay for the very best of evening instruction in any of the larger cities of the Union, and the young man could attend to his business during the day and be earning something toward paying his expenses. While here he might find little or nothing to do, and the cost of living would be very high.

Circular Bin Linings.

From J. S. R., *Charles City, Iowa.*—I have a solution, which I inclose herewith, of the problem of tapers and bevels in connection with circular bins.

From A as center, with radius A B equal to the radius of bin, describe the circle B C M, which divide into parts equal to the width of the pieces to be used for the lining. From any point, as B, draw the line B A. Erect the perpendicular A L. Upon A L lay off the A K equal to the required hight of the slanting side. From K erect a perpendicular, K J, equal to the radius of the base of the conical section in center. Draw B J, which produce until it intersects the line A L in the point L. From L as center, with radius L B, describe the arc B N. From B as center, with radius B D, which equals the width of one of the pieces used to form the lining, describe the arc D Y, intersecting the arc B N in the point E. Draw E B; also draw E L. From L as center, with L J as radius, de-



Circular Bin Linings.—Diagram Accompanying Letter from J. S. R.

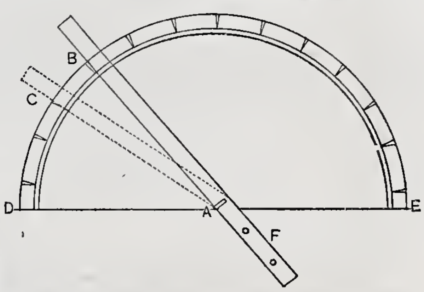
scribe the arc J I. Connect J and I by a straight line. Then will E B J I be the shape of one of the pieces on the outside. From the point A let fall the perpendicular A G, meeting B L in the point G. With L G as radius, and from L as center, describe the arc G R, intersecting E L in the point X. From G as center, with G X as radius, describe the arc X H. From A as center, with A G as radius, describe the arc G H, intersecting the last arc drawn in the point H. Draw H G and H A. Then will A G H be the required angle or bevel, which may be transferred from the drawing by setting the bevel as shown in the figure.

The end bevel may be obtained by applying the tool to the angle A L B. The dimensions of the center pieces may be obtained in the same manner. The draft may be constructed to any scale required or to full size.

Kerfing.

From J. B. J., *Indianapolis, Ind.*—From the columns of *Carpentry and Building* I have obtained many valuable hints as to the method of doing various kinds of work. I have been using for a number of years a rule for kerfing, which I am sure will be found valuable to many of your readers, and therefore I send it forward for their benefit. The accompanying sketch represents the method in a way to make it easily comprehended at first glance.

Suppose the stuff to be 1¼ inches thick, take a strip 1¼ inches wide, make one cut to the gauge line that forms the veneer. Lay the strip upon the plan as indicated in the sketch, keeping the cut opposite the center, as shown at A. Fasten the end below A in any convenient manner. It is



Kerfing.—Diagram Accompanying Letter from J. B. J.

quite usual for me, in laying out work of this kind, to draw the plan upon the floor, and accordingly in such cases I fasten the strip in place by a couple of nails, as indicated in the sketch. Move the strip until the cut is closed, the motion being as shown from B to C. This space B C determines the width to be allowed between the cuts. The saw which made the cut in the strip must be used for the curfing. Take the greatest care in cutting down to the gauge line. Accuracy may be ensured by fastening two pieces of stuff on the saw by putting a screw in each end, the object being to form a stop.

I might add that, before bending, it is well to wet the plane side with hot water. Have the cylinder ready to the required circle, bend the board over this and fill the cuts with thin strips of wood, gluing them at the same time. Fasten at each end, to hold it in place until ready for fixing.

Use of Certain Braces in Truss Roofs.

From J. R. W., *Bloomington, Ill.*—Referring to the question of E. H. C. concerning the use of braces in truss roofs, which was published in the November number, I would say that I employ the brace in question in order to stiffen the truss against the wind and also to strengthen it to resist the weight of the snow.

Proportions of a Diamond.

From F. S. P., *Wilkesbarre, Pa.*—Referring to the inquiry of W. M., who asks as to the proper proportions of a true diamond or lozenge, I would state that, in my opinion, the four sides bounding the figure and the short diagonal should be equal. Figures of this proportion will be noticed in any Gothic church where lozenge-shaped glass is used.

Neo-Jacobean.

Our correspondent E. S. M., of Waterbury, Ct., who inquired about Neo-Jacobean style in the October number, will find his question answered in part by the article upon the Jacobean and Neo-Jacobean styles of furniture, which appears in another column of this issue.

Value of Recorded Estimates.

From J. R. W., *Bloomington, Ill.*—Referring to the subject of estimates, I would state that I have followed the plan recommended by R. W. in the November number and from the experience of several years I am prepared to say that it is the only real safe plan of estimating. I fully indorse his remarks. By reference to my books and papers I can tell the exact cost, and also the number of days' labor consumed in the construction of all the buildings I have had under contract. The advantage of such information will be seen at once.

Difficulty in the Use of India Ink.

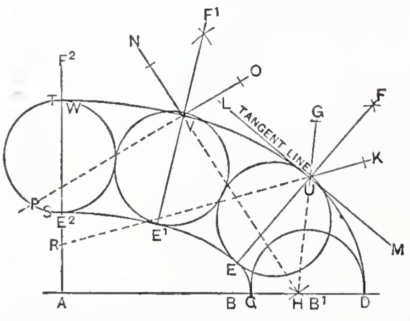
From B. and N., *Worcester, Mass.*—If W. H. C. will rub over the tracing cloth with a little powdered chalk or whiting, by means of a piece of flannel or chamois skin, he will find it will deaden the gloss and that afterward he will be able to make as clean and sharp lines as upon paper.

From J. D. S., *Middletown, Conn.*—Referring to the difficulty of your correspondent W. H. C., in the use of India ink upon tracing linen, it gives me pleasure to relate my experience. I labored for a long time under the same difficulty, and was led to denounce tracing cloth and its makers for the trouble. I tried various brands of ink, but to no purpose. Finally, in removing some pencil marks with a rubber, I discovered the remedy. Now I use the dull back of the tracing cloth, and after stretching it upon the drawing simply go over it lightly with the rubber. After doing this I have no trouble in the use of ink.

From F. S. P., *Wilkesbarre, Pa.*—I would suggest that W. H. C.'s difficulty in the use of ink upon tracing linen will be removed by getting his drafting-pen well sharpened. This is always essential to first-class work. Let him employ the best vellum for his tracings and use the best Chinese ink, freshrubbed and rather thick. Add a little Prussian blue to increase the blackness.

Parallel Ellipses.

From R. J., *Toronto, Canada.*—I have been much interested in the subject of parallel elliptical lines, which has received at-



Parallel Ellipses.—Sketch Accompanying Letter from R. J.

tention in past numbers of *Carpentry and Building.* While admitting that a line parallel to an elliptical line may be drawn, I beg leave to inform H. D. C., whose communication concerning the use of string and pencil for drawing elliptical lines I have carefully read, that it cannot be done by the plan he recommends. His explanation, which was to put the question to rest for ever. is not sufficient. I inclose you a drawing showing wherein his system fails, likewise showing the lines upon which it is proper to measure. The inaccuracy of the drawing which is made by the method recommended by H. D. C., is shown by drawing four circles in different places. It will be noticed that the space between the lines is considerably greater at the sides than at the ends of the figure. I am disposed to think that H. D. C. is still in the dark.

In regard to the loop on the string, that is nothing new. Any one can see that by winding around the pin the string must become shorter. However, for rough arches such as plasterers use, it is not worth the trouble, the discrepancy being too small to be noticed.

Note.—Our readers will recall that the plan of drawing parallel ellipses by string and pencil, so far as the columns of *Carpentry and Building* are concerned, did not originate with H. D. C. In the August number, in answer to J. H. M., we published a diagram showing the method of drawing parallel ellipses with string and pencil. H. D. C.'s letter, published in the October number, supplemented our reply to this correspondent, and called special attention to the methods and advantages of using string and pencil for drawing ellipses in general.

We have engraved and printed herewith the sketch sent in by the correspondent whose letter appears above, which, so far as we have examined it, comes far short of proving that H. D. C. or our reply to J. H. M. was wrong. We have no doubt that many of our readers, upon examination of this subject, will notice the fallacy of R. J.'s arguments, and will be glad to show him wherein he is wrong. The subject of parallel ellipses and of elliptical lines in general is one of considerable interest and great practical importance in the building trades. We leave it open, therefore, for further discussion, and invite letters from all of our readers who may feel disposed to write to us.

Drawing Semi-Ellipses.

From H. D. C., *Philadelphia.*—Thinking I might give our friend W. S., of Toronto, some further information in the matter of drawing elliptical lines, I have drawn two problems showing how this figure may be constructed from three points. These rules will be found very convenient for numerous mechanical purposes. I have no doubt they will be greatly appreciated among the many readers of *Carpentry and Building.*

In Fig. 1, A B is the given long diameter, and C D one-half of the short diameter, or it may be called the rise of the arch or frame, if the shape is being described for such a purpose. Draw C D at right angles to A B, squaring up from its center point C. Draw A E equal to C D, and likewise at right angles to A B. Ascertain the center point in A E, as N, and from it draw a straight line to D, as N D. Determine the middle point of A C, as H, and draw the straight line H E, cutting N D, previously drawn in the point V. Determine the middle point in V D, as F, through which draw a straight line at right angles to V D, prolonging it indefinitely in the direction of O. Produce D C also in the same general direction until it meets the last line drawn in the point O. Draw the straight line O E, cutting the long diameter in the point L; then L is the center and L A the radius of the arc representing that part of the ellipse indicated by A V. Upon the opposite end set off B P equal to L A, and strike the arc B L. From O as center, with radius O N, describe the arc V L, thus completing the half ellipse. A parallel line, either within or without this line, may be struck by using the same centers, but diminishing or increasing the two radii as the case may be.

In Fig. 2 let A B represent the long diameter of the figure. Divide it in the center, and from the point C thus obtained square up, making C D equal to half the short diameter, or the rise. From the point C, on C B, set off C E, in length equal to C D. From C, on C D, set off C N, equal to E B, and on C A set off C J, also equal to E B. Draw J N, which bisect, obtaining the point V. From N set off N S, equal to V N, and from J set off J L, also equal to V N. Produce D C indefinitely in the direction of O. With C L for a radius, and from C as center, describe the circle, as indicated by the dotted line, thus establishing the points S E and O. Then O, L and T are the centers from which the arcs composing the figure are to be struck. From O, through the points L and T, draw lines, which produce indefinitely in the direction of G and F. Then from L and I as center, with radius L A and T B respectively, strike arcs from A and B, to meet the lines drawn through their centers from O, all as shown. From O as center, with radius O D, strike the arc connecting the two arcs just described, thus completing the half ellipse. As in the case of Fig. 1, a parallel curve may be drawn, either within or without, by using the same centers, varying the radii to suit.

I hope this communication may meet as much favor as my former letter. If so I will have something additional for another issue.

Joining a Wing Roof to a Main Roof.

From C. R. J., *Evergreen, La.*—Referring to L. R. C.'s inquiry in a recent number of *Carpentry and Building*, would say that the method of joining a wing roof to a main roof is quite simple. The principle is the same as used in getting the length and bevels for jack rafters on a hip roof. The rafters forming the valley are simply inverted jacks for the hip. He will find illustrations and methods for forming and joining roofs of this and other descriptions in "Monckton's Carpentry and Joinery," the best authority upon the subject with which I am acquainted.

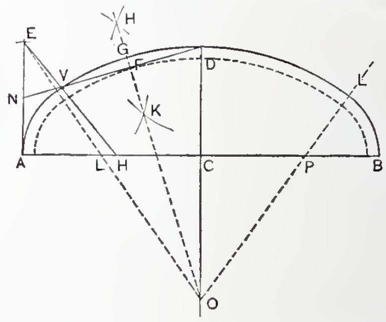
Cement for Use Around Chimneys.

From F. G., *Albion, N. Y.*—I notice a correspondent asks for a cement for leaks around chimneys. Take white lead and mix to the consistency of putty with clean fine sand. It hardens in a few days and is reliable. I have proved its utility by using it for upward of seven years. This same recipe is given in Trautwine's "Engineer's Assistant."

REFERRED TO OUR READERS.

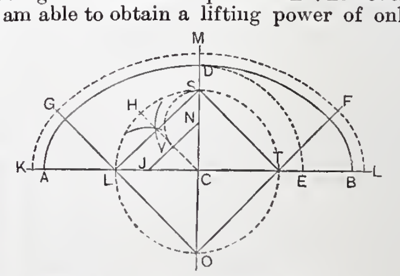
Construction of Dumb Waiters.

From W. H. B., *Cincinnati, Ohio.*—Will some of the readers of *Carpentry and Building* contribute for my benefit (and possibly others of your readers are interested in the same subject) a design and details of construction for a dumb waiter? I require one



Semi-Ellipses.—Fig. 1.—Rule for Constructing the Figure from Three Centers.—Contributed by H. D. C.

that shall have a lifting power equal to 6 buckets of coal, say 192 pounds. The waiter is required to run 3 stories, or a distance of about 50 feet. I have an article already in use, consisting simply of a box at one end of a rope, which passes over a large wheel at the top, the box being counterbalanced by a weight at the other end. The box and weight each are 42 pounds. I undertook to improve upon this construction by placing an extra wheel at the top and one at the bottom, running a second rope down the side by which to pull, fastening one end of the rope to the top of the box and the other to the bottom of the box, it passing over the extra wheel at the top and the one at the bottom in its course, thus giving a continuous rope. I find, however, I am able to obtain a lifting power of only



Semi-Ellipses. —Fig. 2.—Another Rule for Constructing the Figure from Three Centers.—Contributed by H. D. C.

62 pounds. My ropes are plumb over each other, and as I have a wheel large enough to carry the rope to the center and to the line of the side rope, there is no loss in point of friction. Will some practical reader of the paper help me out of my difficulty?

Calculating Floor Joists.

From W. G., *Chicago*.—I am a subscriber to *Carpentry and Building*, and I am much pleased with the amount of useful information obtained from it. In looking over the October number I notice an application for some method of finding the requisite size of floor joist. As I have felt the same want myself, I should be glad if a number of your readers would give us the benefit of their experience. The simplest method I have been able to find is taken from "Newland's Practical Carpentry and Joinery." I have practiced it and have reason to be satisfied with the results. I will give it here for the benefit of those who have not had access to any such work, and if you consider it sufficiently valuable please publish it :

Rule.—Divide the square of the length in feet by the breadth in inches, and the cube root of the quotient multiplied by 2.2 for pine and 2.3 for oak will give the depth in inches.

Example.—Required the depth of a joist when it has 24 feet between bearings and its thickness is 3 inches. $24 \times 24 \div 3 = 192$, the cube root of which is 5.76. Therefore $5.76 \times 2.2 = 12.672$, or nearly 12¾ inches.

But I think the rule was never meant for joists having more than 20 feet between their bearings, therefore I should make them 3 x 14 inches and place them 12 inches between centers. These calculations are made for dwellings and audience rooms where the greatest weight to be carried, when loaded with people, is not more than 150 pounds to the foot.

Calculating the Bearing Strength of Timber.

From C. B. R., *Los Angelos, Cal.*—In the July number of *Carpentry and Building* was published an article upon the bearing strength of timber, by Prof. Carpenter, of the Michigan Agricultural College. I have given the same much attention, and in studying it have encountered difficulties which I trust some readers of the paper will assist me in overcoming. The fourth proposition, as laid down in the article, I find to be the same as given by other authorities, or, in other words, the result obtained is the same, using either the method given by Prof. Carpenter or that given by others. When I come to use the sixth proposition, however, I am puzzled. My figures do not tell the same story in connection with it that they do in the fourth proposition. This one is the reverse of the other, or at least ought to be. But the figures do not prove it. Prof. Carpenter states, in connection with his sixth proposition, as a result, that a stick of timber 16 feet long and 1 3-10 inches by 3 inches will safely sustain a load of 1000 pounds. In other words, five times that weight is its breaking weight. Now, if a piece of timber 16 feet long and 1 3-10 x 3 inches has 1000 pounds suspended at its center, I do not want to stand under it, if it is safe according to rule. Take a beam, for example, 3 by 8 inches and 16 feet long (pine); by proposition fourth we multiply $3 \times 8^2 = 3 \times 64 = 192$, and $192 \times 90 = 17280$. This divided by the length 16 is $17280 \div 16 = 1080$ pounds, the safe load of a beam 3 by 8 inches by 16 feet. Here, surely, is some difference as between it and a piece 1 3-10 by 3 inches by 16 feet. Now, take proposition sixth. What is the sizo of a beam 16 feet long that will safely carry 1000 pounds at its center? $1080 \div 90 = 12$. Assume the depth to be 8 inches, its depth is 64; $12 \div 64 = .187+$. Now, that makes my beam less than 1 inch in breadth, while I started out with 3 inches in breadth. Will some reader please set me right? These are important points to all builders. No doubt the professor is correct, but I am so dull I cannot get these beams of a thickness. Perhaps the professor himself will cast some light upon the subject for my benefit.

Foundations on Quicksand.

From J. M. C., *West Middlesex, Tenn.*—I see by the correspondent's column of *Carpentry and Building* that it is open for anything which will benefit the readers. Availing myself of the privilege, I desire to ask the opinion of practical readers of the paper as to the best mode of putting down foundations on quicksand. We have been troubled in this vicinity in making foundations on account of quicksand. Quite recently, in putting down the foundation for a brick store room, to be two stories in hight, we encountered quicksand in digging the ditch for the footing stones. The mechanics in charge overcame the difficulty in this way: First, as large stones as possible were pounded into the sand, and upon this were laid a course of sprauls about 4 inches thick, after which the whole was covered with a grouting of cement. The footing course was put on after the cement had set, and clay was tamped in on each side to keep the sand from coming up, after which the wall was laid. I desire to ask, in view of the above, is the foundation so made likely to be satisfactory or not? If not, what is the proper way of making a foundation under similiar circumstances?

Bath Room and Water-Closet in a Suburban House.

From C. A. W., *Evart, Mich.*—Will some one of the readers of *Carpentry and Building* supply full particulars concerning the erection and furnishing of a bath-room in a house that has connection with neither sewer nor water works? At the same time I shall be pleased to have information concerning the use of a water-closet in the same house. Is it practicable? If so, what are the best fixtures to use, and how shall I go to work to get them in place in a satisfactory manner without the assistance of an experienced plumber? I can get the necessary mechanical assistance in placing the fittings, making joints, &c., but the knowledge requisite for planning the work and for intelligent supervision, which comes from experience, I hope to obtain from some fellow subscriber to *Carpentry and Building.*

Lessons in Wood Turning.

From G. D. B., *Pittsford, Vt.*—Will some of the readers of *Carpentrg and Building* furnish us a few lessons on hand turning? It seems to me that this is something which would be useful to many readers of the paper. I have a lathe which runs by water power, but I find a great deal of practice is needed to enable me to produce a good job. Perhaps a few hints from practical turners would save me and other green hands a considerable amount of trouble. Among other difficulties, I find it beyond me to turn a perfect ball or sphere. I suppose there is a way to do it. Then again, my chisel will slip sometimes in spite of me. Probably there is a way to remedy this. I hope some one among your many readers will give me assistance on this and other points.

Design for Gate.

From G. W. C., *Yolo, Yolo Co., Cal.*—I am a constant reader of *Carpentry and Building.* I believe I get more in return for the dollar paid for it than for any other dollar I ever spent.

I wish to build a picket fence around a yard, using 1½-inch square pickets. The pickets are to be mortised through a 2 x 4-rail at the top, and half into the same size piece at the bottom. The base will be directly under the lower scantling and let into the side of the post. Now, will some reader of *Carpentry and Building* furnish me a good design for a gate to use in this fence; also, a design for ornamental posts to use in connection with the gate and at the corner; also, state the hight the fence should be, and what distance apart the pickets should be placed. How far should they extend above the top rail?

Bank Barn.—Framing Used in the Prize Designs.

From W. A. McC., *Tippecanoe, Ohio.*—I desire to ask a few questions, which I trust some of the readers of *Carpentry and Building* will see fit to answer:

1. I desire to know the best method of framing a bank barn, with stable in the basement. The barn to be 40 x 60 feet, and so constructed that there will be no cross timber in the center from floor to roof. I should be glad to see plans of an entire frame, together with the bill of timber suitable for such a structure.

2. How are the frames of the prize design arranged in order to allow shingling on the sides?

Home-Made Wood Turning Lathe.

From J. F. W., *Danville, Pa.*—I will be under many obligations if some of the readers of *Carpentry and Building* will furnish for publication a design for a wood turning lathe. Please accompany it by a specification which will enable an ordinary carpenter to construct the tool.

Note.—We shall be pleased to publish answers to our correspondent's request if any are received, but at this day no mechanic who can earn money at any regular trade can afford to spend time in building a lathe. He can buy from regular manufacturers a better article than it is possible for him to construct, at a price representing the earnings of a much shorter time than he would spend in building one.

Modeling in Clay.

From C. W. B., *New York City.*—The article on modeling in clay, published in the September number, has been very useful to me. I do not think I am the only subscriber who has appreciated the information therein contained. I would like to see the subject continued in *Carpentry and Building*, and to that end I respectfully propound the following questions to your readers, asking the benefit of their replies :

How shall I prevent clay models from cracking when left at rest for a few days?

What points are to be observed in the selection of boards and tools for use in modeling?

What kind of a stand is most convenient for use in modeling?

Construction of Mansard Roofs.

From F. M. C., *Marshall, Texas.*—I desire a design and detail for constructing a mansard roof. I want to cover a building 40 feet square. The building is already erected, is of brick and two stories high. It is desired to remove the present roof, which is deck, and substitute therefor a mansard, in order to make a third story suitabe for sleeping rooms. Will some reader of *Carpentry and Building* give me the necessary information how to proceed in this case intelligently?

Sound of Horses' Feet.

From J. N. R., *Brooklyn.*—I desire to appeal to the experience of builders and architects among the readers of *Carpentry and Building* for help in my present difficulty. I would like information in reference to deadening the sound of horses' feet in a stable. I am annoyed each night by the sound of their tramping. The stable in question is frame, the floor upon which the horses stand is above the ground. Is there any plan by which such a building and floor can be modified to overcome the difficulty named?

Truss Roof.

From R. E. M., *Richmond, Va.*—Will some of the readers of *Carpentry and Building* contribute a design for a truss roof, 60-foot span, together with details of construction?—the roof to be built of wood, covered with slate. Also mention the least thickness of brick wall sufficient to sustain the roof. I think such a communication would be of interest to other readers as well as myself.

Saw Filing and Setting.

From W. G. S., *Chattanooga, Tenn.*—Will some of the readers of *Carpentry and Building* give us some practical hints on filing and setting the saw, the position of the saw, how to hold the file, whether to file toward or from the handle, how to file a rip saw, the best set to use, hammer or lever?

Fire Escapes and Stairs in Tenement Houses.

Every tenement house must be supplied, under the requirements of the law, with permanent fire escapes sufficient to furnish effective means of egress for all persons who dwell in the upper stories, and the iron ladders which mount from story to story on the street front of so many of these houses are made to meet this need. But they do not meet it. They are an inadequate protection to the persons whom it was intended to protect when the law was made. The house in Cannon street, the scene of a recent tenement-house tragedy in this city, was supplied with a set of these iron ladders. Yet four persons were suffocated on the fourth story, two were killed in attempts to jump to the street, and only an almost miraculous chance prevented the additional deaths of the children who were thrown from the third story windows. Under the official theory of tenement-house construction all these persons should have had an easy and safe descent to the street. Why was the ladder useless on this occasion? No details will ever be known, we presume, of what passed in the apartment on the fourth story, since not one remains alive of those who lived there, and so it cannot be said that they tried the fire escape. They may have been unable to get through the dense clouds of smoke that filled the room they would have had to cross to reach it. But this much is known—the iron rungs of the ladder were red hot, for a fireman who tried to go up by it found them so. The rush of the flames out of the rear windows of the apartment in which the fire began played on the ladder and made it worthless as a means of escape.

These contrivances are placed where they are in order to facilitate ready and immediate access to them from the apartments on each floor; but the fact of their proximity to the windows—that is, to one of the loopholes though which the flame rushes in every fire—tends to prevent access to them and to make them useless by heating the iron. Other more effective plans must be tried to prevent these horrible deaths, and one of the simplest and cheapest would be to supply our Fire Department with effective movable fire escapes. These are in regular use in London. But the best plan is to compel the adoption of a special structure for staircases in tenement houses. All stairways in such houses should be constructed of stone or brick. This should be made by law as indispensable as brick or stone for chimneys. It is a great many years since the erection of frame houses in this city was forbidden by law, but houses are now but little less combustible than they were before that change, because that law has changed only the material of the shell of every fabric. All the beams, floors, joiner's work and stairways are of the most highly inflammable material. Therefore the purpose for which that law was made is not accomplished by its requirements, and it is time to take a further step in compelling the use of incombustible material. This step should be with regard to stairways as suggested.

Prices of Building Materials in New York, December 20, 1879.

Blinds.—OUTSIDE.

Per lineal, up to 2.10 wide....$	.... @ 0.24
Per lineal, up to 3.1 wide	.... @ 0.27
Per lineal, up to 3.4 wide	.... @ 0.30
Per lineal, paint'd and trim'd	0.40 @ 0.50
INSIDE.	
Per lineal, 4 folds, Pine	.... @ .45
Per lineal, 4 folds, ash or chestnut	.... @ .72
Per lin'l, 4 folds, cherry or butternut	.... @ .86
Per lineal, 4 folds, bl'k wal't.	.... @ 1.00

Add 20 per cent. to above prices.

Bricks (afloat).

Pale	℔ M.	$6.50 @ 7.00
Jersey		8.00 @ 8.25
Long Island	"	8.50 @ 8.75
Up-River	"	7.75 @ 8.00
Havers'aw Bay, 2ds.	"	8.00 @ 8.25
Havers'aw Bay, 1sts.	"	8.25 @ 8.50
FRONTS.		
Croton—Brown	℔ M.	.... @ $9.00
Croton—Dark	"	.... @ 10.25
Croton—Red	"	.... @ 10.25
Philadelphia	"	.... @ 22.00
Trenton	"	18.00 @ 19.00
Baltimore	"	.... @ 38.00

Yard prices 50c. ℔ M higher, or, with delivery added, $1.50 per M for Hard and $2.50 per M for front Brick.

FIRE BRICK. (yard prices).

Red Welsh	$35.00 @ ....
Scotch	30.00 @ ....
English	30.00 @ ....
Silica	45.00 @ 55.00
Stourbridge	55.00 @ ....
American	27.00 @ 30.00

Afloat, 500 ℔ M less

Cement.

Rosendale, ℔ bbl	$ 0.95 @ 1.00
Portland Saylor's American, ℔ bbl	2.55 @ 2.65
Portland (imported) ℔ bbl..	2.75 @ 2.85
Roman "	2.75 @ 2.85
Keene's coarse "	5.75 @ 6.25
Keene's fine "	9.75 @ 10.00

Doors.

RAISED PANELS, TWO SIDES.

2.0 x 6.0	1¼ in.	$0.67	....
2.6 x 6.6	1¼ in.	.95	....
2.6 x 6.8	1¼ in.	1.00	....
2.8 x 6.8	1¼ in.	1.15	....

MOULDED.

Size.	1¼ in.	1½ in.	1¾ in.
2.0 x 6.0	$1.23	....	....
2.6 x 6.6	1.52	1.93	....
2.6 x 6.8	1.57	1.95	....
2.6 x 6.10	1.59	2.01	....
2.6 x 7.0	1.62	2.09	....
2.8 x 6.8	1.63	2.32	2.57
2.8 x 7.0	1.69	2.17	2.69
2.10 x 6.10	1.79	2.26	2.84
3.0 x 7.0	1.87	2.45	3.80

2nd quality 15 cts. less.

Add 20 per cent. to above prices.

Drain and Sewer Pipe.

Discount 50 to 60 per cent. according to quality and size of order.

Pipe, per foot.		Bends & Elbows, Each.	Branches Sing.	D'bl. & V.	Traps, Each.
2 in.	$ .13	$ .40	$ .48	$ ...	$1.00
3 "	.16	.50	.61	...	1.25
4 "	.20	.65	.75	1.30	1.75
5 "	.25	.85	.90	1.55	2.50
6 "	.30	1.15	1.05	1.80	3.50
7 "	.35	1.50	1.20	2.05	5.00
8 "	.45	2.00	1.45	2.45	6.00
9 "	.55	2.50	1.70	2.85	7.00
10 "	.70	3.00	2.00	3.30	8.00
12 "	.80	3.75	2.52	4.24	10.00
15 "	1.25	5.00			
18 "	1.60	7.50			

Longer than 1 ft. charged as pipe.

House Branches pr. lin. ft.		Sewer Branches pr. lin. ft.	
15x6	$1.75	15 in.	$2.25
18x6	2.50	18 "	3.00

Glass.—(American.)

Prices current per box of 50 feet.

SINGLE. Sizes.	1st.	2d.	3d.	4th.
6x 8—10x15....	$7.50	$6.75	$6.25	$5.75
11x14—16x24....	8.50	7.75	7.25	6.50
18x22—20x30....	10.75	9.75	8.75	7.75
15x36—24x30....	12.25	10.75	9.00	8.50
26x28—24x36....	13.00	11.50	9.75	9.00
26x36—26x44....	14.50	13.25	10.75	9.50
26x46—30x50....	15.00	14.00	11.25	10.50
30x52—30x54....	16.00	14.50	12.00	...
30x56—34x56....	17.25	15.50	13.50	....
34x58—34x60....	18.25	17.25	15.00	....
36x60—40x60....	20.75	18.75	17.25	....
DOUBLE.				
6x 8—10x15....	$12.00	$11.00	$10.00	$9.25
11x14—16x24....	13.75	12.50	11.75	10.50
18x22—20x30....	17.25	15.75	14.00	....
15x36—24x30....	19.75	17.25	14.50	....
26x28—24x36....	21.00	18.50	15.75	....
26x36—26x44....	23.25	21.25	17.25	....
26x46—30x50....	24.00	22.50	18.00	....
30x52—30x54....	25.75	23.25	19.25	....
x56—34x56....	27.75	25.00	21.75	....
34x58—34x60....	29.25	27.75	24.00	....
36x60—40x60....	33.25	30.00	27.75	....

Sizes above—$10 per box extra for every five inches.

An additional 10 per cent. will be charged for all glass more than 40 inches wide. All sizes above 52 inches in length, and not making more than 81 inches, will be charged in the 84 united inches' bracket. Discounts: 50 @ 50 & 10 %

French

WINDOW, PICTURE AND CAR GLASS.

Prices current per box of 50 feet.

SINGLE. Sizes.	1st.	2d.	3d.	4th.
6x 8—10x15....	$8.00	$6.75	$6.25	$5.75
11x14—16x24....	8.75	8.00	7.50	7.00
18x22—20x30....	11.25	10.50	9.75	8.75
15x36—24x30....	12.75	11.50	10.00	..
26x28—24x36....	13.50	12.25	11.25	..
26x36—26x44....	14.75	13.75	11.75	..
26x46—30x50....	16.25	15.00	13.00	....
30x52—30x54....	17.25	16.00	13.50	...
30x56—34x56....	18.75	16.75	15.00	...
34x58—34x60....	19.50	18.00	16.00	....
36x60—40x60....	21.00	19.50	18.00	..
DOUBLE.				
6x 8—10x15....	$12.00	$11.00	$10.00	$9.25
11x14—16x24....	14.75	13.75	12.75	11.75
18x22—20x30....	19.00	17.75	16.00	....
15x36—24x30....	21.50	19.25	16.50	....
26x28—24x36....	23.00	20.75	18.25	....
26x36—26x44....	25.00	23.00	19.25	....
26x46—30x50....	27.00	25.00	21.25	....
30x52—30x54....	28.50	26.00	22.25	....
30x56—34x56....	30.00	27.75	24.75	....
34x58x34x60....	31.75	30.00	27.00	....
36x60—40x60....	35.50	32.50	30.25	....

Sizes above—$10 per box extra for every five inches.

An additional 10 per cent. will be charged for all glass more than 40 inches wide. All sizes above 52 inches in length, and not making more than 81 united inches, will be charged in the 84 united inches' bracket.

Discounts: Single, 40&10; Double, 60%.

GREENHOUSE, SKYLIGHT AND FLOOR GLASS.

Per square foot, net cash.

1/8 Fluted plate	18 @ 20
3-16 Fluted plate	20 @ 24
1/4 Fluted plate	24 @ 26
1/4 Rough plate	24 @ 26
3/8 Rough plate	@ 35
1/2 Rough plate	@ 45
3/4 Rough plate	@ 60
1 Rough plate	@ 70

Hair.

Cattle	℔ bushel..$	@ 0.12
Goat	"	@ 0.15

Lath.

Cargo rate	℔ M $	@ 2.25

Lime.

Glen's Falls, or Keenan's common, cargo rate ℔ bbl	.75 @ .80
Glen's Falls, or Keenan's finishing Jointa	.90 @ .95
Rockland, common	.85 @ .90
Rockland, finishing	1.00 @ 1.05
Ground	.80 @ .85

Add 25c. to above figures for yard rates.

Lumber.—(Yard prices.)

Market firm with upward tendency.

Pine, very choice and ex. dry, ℔ M. ft. thick	$60.00 @ $65.00
Pine, clear	50.00 @ 60.00
Pine, selects	40.00 @ 50.00
Pine, selected, box	18.00 @ 20.00
Pine, common box	16.00 @ 18.00
Pine, common box, 5/8	13.00 @ 15.00
Pine, 1¼x10, 13 ft., matched, each	.40 @ .43
Pine, 1¼x10, 13 ft., culls	.25 @ .28
Pine, 1x10, 13 ft., good matched, each	.28 @ .30
Pine, 1x10, 13 ft., common, matched, each	.20 @ .22
Pine, 1x4½, clear, match'd, each	.22 @ .25
Pine, 1x4½, merchantable, matched, each	.16 @ .18
Pine, 1¼x4½, cl'r, match'd, each	.33 @ .35
Pine, 1¼x4½, merchantable, matched, each	.28 @ .30
Spruce, 1x9, 13 ft., rough	.18 @ .20
Spruce, 1x9, 13 ft., matched, each	.20 @ .22
Spruce, 1¼x9, 13 ft., rough	.20 @ .22
Spruce, 1¼x9, 13 ft., matched, each	.23 @ .25
Spruce, 2x9, 13 ft., rough	.35 @ —
Spruce, 2x9, 13 ft., match'd, each	.40 @ .42
Spruce, 2x4, 13 ft.	.12½ @ .13
Spruce timber, flat, ℔ M ft	18.00 @ 20.00
Spruce timber, square, ℔ M ft	20.00 @ 25.00
Hemlock, 1x10, 13 ft., each	— @ .16
Hemlock, 2½x4, 13 ft., each	.14 @ .15
Hemlock, 3x4, 13 ft., each	@ .16
Hemlock, 4x6, 13 ft., each	.40 @ .43
Ash, good, ℔ M ft	40.00 @ 45.00
Oak	45.00 @ 55.00
Oak, quartered	70.00 @ 90.00
Maple, cull	20.00 @ 25.00
Maple, good	30.00 @ 45.00
Chestnut	45.00 @ 60.00
Bl'k walnut, good to choice	85.00 @ 100.00
Black Walnut, 2d	55.00 @ 65.00
Black walnut, 5/8	70.00 @ 80.00
Black walnut, selected and seasoned	110.00 @ 150.00
Bl'k walnut counters, ℔ ft.	.12½ @ .20
Cherry, wide, ℔ M ft	85.00 @ 100.00
Cherry, ordinary	60.00 @ 80.00
Whitewood, or Poplar 1 to 1½ inch	35.00 @ 4.500
Whitewood, or Poplar 5/8 in.	30.00 @ 35.00
Whitewood, or Poplar 5/8 panels	35.00 @ 40.00
Shingles, extra sawed pine, 18 in.,	5.00 @ 6.00
Shingles, clear sawed pine, 18 in., 2 md	4.00 @ 5.00
Shingles, cypress, 7x24	14.00 @ 18.00
Shingles, cypress, 6x20	12.00 @ 14.00
Shingles, Cedar, 6x24, No. 1	— @ 22.00
Shingles, Cedar, 6x24, A's	— @ 16.00
Shingles, Cedar, 6x20, No. 1	— @ 12.50
Shingles, Cedar, 6x20, A's	— @ 10.00
Yellow pine dressed flooring, wide, ℔ M ft	28.00 @ 30.00
Narrow ditto	30.00 @ 35.00
Yellow pine girders	30.00 @ 45.00
Locust posts, 8 ft., ℔ in	.18 @ .20
Locust posts, 10 ft.,	.24 @ .25
Locust posts, 12 ft.	.25 @ .30
Chestnut posts, ℔ ft.	.3 @ .3½
Mahogany, ¼ in. ℔ ft	.5 @ .7
Mahogany, 3/8 in. ℔ ft	.8 @ .10
Mahogany, ½ in. ℔ ft	.10 @ .12
Mahogany, 5/8 in. ℔ ft	.12 @ .14
Mahogany, ¾ in. ℔ ft	.14 @ .16
Mahogany 1 in. ℔ ft	.16 @ .18
Rosewood, 1 in. ℔ ft	16 @ .22
Rosewood, 1/8 in. ℔ ft	.11 @ .15
Rosewood, ¼ in. ℔ ft	.16 @ .20
Rosewood, 3/8 in. ℔ ft	.24 @ .28
Rosewood, 5/8 in. ℔ ft	.40 @ .45
Rosewood, 1 in. ℔ ft	.50 @ .65
Satin wood, ½ in. ℔ ft	.16 @ .30
Satin wood, 1 in. ℔ ft	.30 @ .40
Cedar (Cuban and Mexican) ℔ ft	.10 @ .14
Cedar (Florida)	@
Less than 1 inch	.6 @ .24
1 inch and over	.25 @ .35

Moldings.

50c. to 60c. per inch per 100 feet, according to quality.

Paper.

Rope, waterproof building, ℔ lb.	.16 @ .17
Rosin Sized Sheating, ℔ lb.	.4 @ .5
Dry Sheating ℔ lb	.3 @ 3½
Tarred Felt. ℔ lb	.... @ .2¼

Plaster.

Calcined City........Mill rate..$0.95 @ 1.00

Sash.

GLAZED.

Dimensions of windows.	12 Lights. 1¼ pl.	12 Lights. 1¼ c.	12 Lights. 1½ c.	8 L's. 1½ c.	4 Lights. 1¼ c.	4 Lights. 1½ c.
2.1x3.6	$0.87	.92	....	....	....	....
2.4x3.10	.96	1.02	....	....	1.11	....
2.7x4.6	1.18	1.24	1.35	.	1.37	1.46
2.7x4.10	1.25	1.32	1.44	....	1.48	1.59
2.7x5.2	1.35	1.42	1.53	1.84	1.75	1.87
2.7x5.6	....	1.56	1.65	1.93	1.88	2.03
2.7x5.10	....	1.65	1.74	2.01	1.99	2.15
2.10x4.6	1.29	1.35	1.47	....	....	....
2.10x5.2	1.45	1.52	1.70	1.87	1.89	2.06
2.10x5.6	1.53	1.59	1.79	2.01	1.97	2.19
2.10x5.10	1.74	1.80	2.01	2.07	....	2.30

c. means counted checked—plowed and bored for weights.

Hot bed sash, glazed.......3.0x6.0....$1 90

Add 30 % to above prices.

HEAD LIGHT.

Two or three Lights, Glazed.

Size.	1¼	1½	Size.	1¼	1½
2.6x1.0	45	55	2.10x1.10	45	59
2.6x1.6	55	63	2.10x1.6	59	67
2.8x1.0	45	55	3.0x1.0	50	63
2.8x1.6	55	67	3.0x1.6	72	86

Add 30 % to above prices.

Slate.

By car load, delivered in New York.

Purple roofing slate, ℔ sq're.	$5.00 @ $5.50
Green slate	5.00 @ 5.50
Red slate	.... @ 9.50
Black slate, Pennsylvania	.... @ 4.00
Tiles, 1¼ in. rubbed, ℔ sq. ft.	.20 @ .25
	℔ sup. ft.
Steps and platforms, 1 in. thick	28c
" " 1½ "	35c
" " 2 "	42c
Risers, 1 inch thick	27c
Coping, 1½ "	27c
" 2 "	31c
	Lineal ft.
Window sills, 4x7	45c
" 3x7	36c
Window caps, 4x10, plain	65c
" 4x8, "	50c
" 3x10, "	47c
" 3x8, "	42c

Stair Material.

BALUSTERS.

Black Walnut.	1½ in.	1¾ in.	2 in.	2½ in
Fancy Turned	7c	9c	10c	16c
Neck Turned	9c	10c	12c	19c
Fluted or Octagon	12c	14c	17c	25c

OCTAGON PANELED NEWELS.

Panels Veneered with French Walnut.

8-inch Newels, with Cap	$6.12
9 " " "	6.88
10 " " "	7.60

SOLID NEWELS, WITH CAPS.

Black Walnut.	5 in.	6 in.	7 in.	8 in.
Fancy Turned	$1.60	$1.90	$2.50	$3.40
Octagon	2.10	2.40	3.00	3.90

STAIR RAIL.

Worked out and finished ready to put up. Easements and cylinders counted double. Price per foot (Newels and Balusters not included).

Black Walnut.	3 in.	3½ in.	4 in.	4½ in
Molded	40c	45c	50c	53c
Toad Back	45c	50c	63c	68c

STAIR RAIL, UNFINISHED.

Price per foot.

Black Walnut.	3 in.	3½ in.	4 in.	4½ in
Molded	11c	13c	15c	17c
Toad Back	12c	14c	16c	18c

Stone.

Cargo rates, delivered at New York.

Amherst freestone, in rough, ℔ C ft	$.... @ $0.85
Berlin freestone, in rough	.... @ .85
Berea freestone, in rough	.... @ .70
Brown stone, Portland, Ct.	1.25 @ 1.50
Brown stone, Belleville, N. J.	1.00 @ 1.50
Granite rough	.50 @ 1.00
Dorchester, N. B., stone, rough ℔ foot.	.... @ 1.00
BLUE STONE.	
Rubbed hearth, 10 ft. or under	20c
Rubbed hearth, 20 ft. or under	30c
Rubbed hearth, 3 ft. or under	45c
Rubbed hearth, 40 ft. or under	55c
Rubbed sills, imported	28c
Rubbed sills, domestic	33c
Sills and lintels	.... @ 17c
Sills and lintels, fine quarry cut sills	.... @ 35c
Coping, 11 to 18 in. wide	18c @ 30c
Coping, 20 to 28 in. wide	35c @ 55c
Coping, 30 to 36 in. wide	60c @ 75c
Steps, 8 in.	.... @ 55c
Steps, 7 in.	.... @ 40c
Steps, 6 in.	.... @ 25c
Steps, door, per in. wide	.... @ 2c
Platforms, promiscuous, 4 in.	.... @ 32c

Vault Lights.

Platform, sq ft	$3.00
Step and risers, sq. ft	3.25
Floor light, sq. ft	2.25
Roof light, sq. ft	2.00
Platform, 2d quality, sq. ft	2.60

COVERS.

Diameter.	Round.	Hexagon.
14 inch	$3.00	$0.00
16 "	3.75	4.00
18 "	5.50	6.00
20 "	8.00	8.50
24 "	14.00	15.0
26 "	16.00	17.0
30 "	23.50	25.0
36 "	31.00	33.0

Window Frames.

Up to 3.4 x 7.2, put together... @ 2.40

CARPENTRY AND BUILDING

A MONTHLY JOURNAL.

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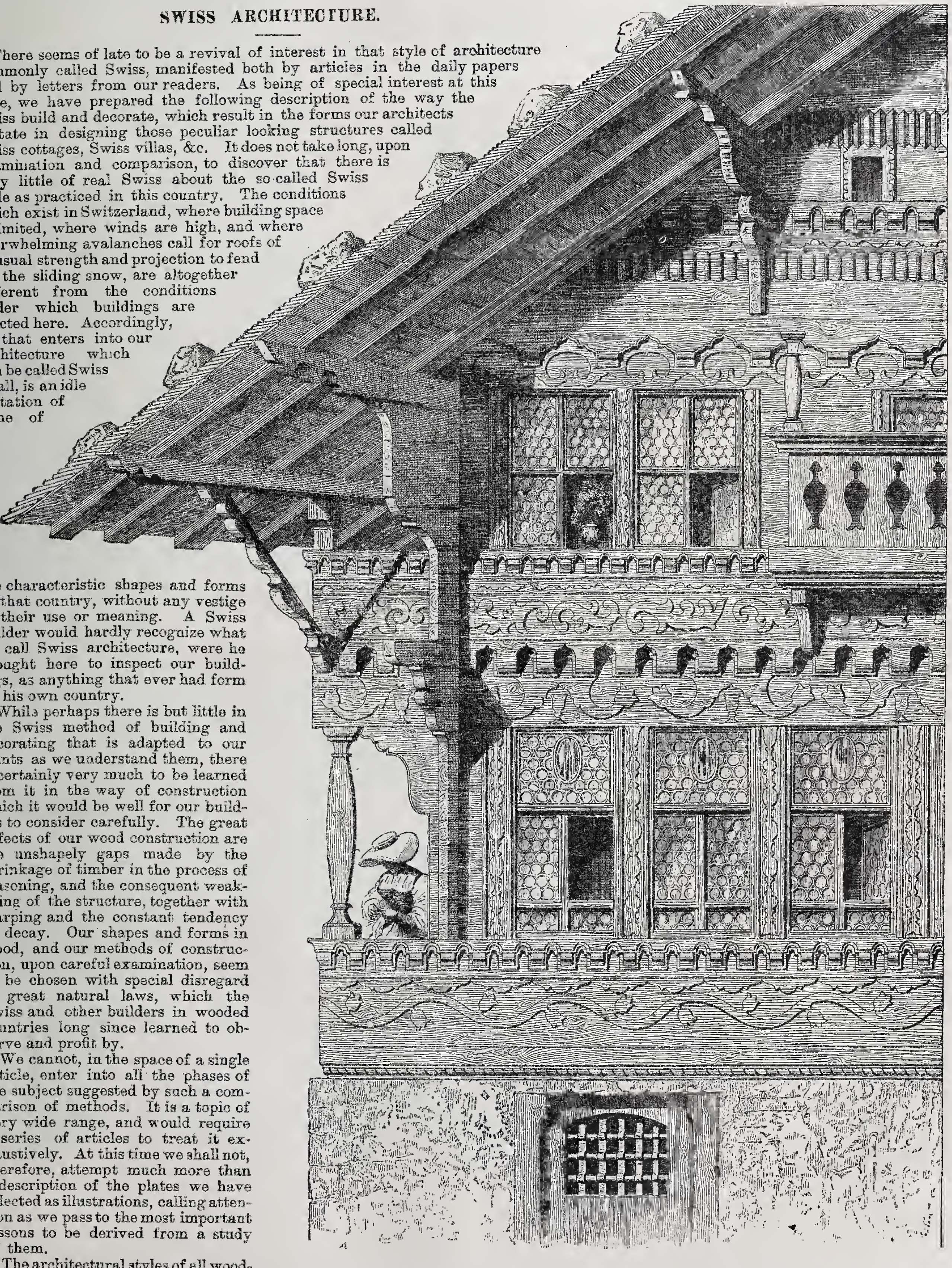
SWISS ARCHITECTURE.

There seems of late to be a revival of interest in that style of architecture commonly called Swiss, manifested both by articles in the daily papers and by letters from our readers. As being of special interest at this time, we have prepared the following description of the way the Swiss build and decorate, which result in the forms our architects imitate in designing those peculiar looking structures called Swiss cottages, Swiss villas, &c. It does not take long, upon examination and comparison, to discover that there is very little of real Swiss about the so-called Swiss style as practiced in this country. The conditions which exist in Switzerland, where building space is limited, where winds are high, and where overwhelming avalanches call for roofs of unusual strength and projection to fend off the sliding snow, are altogether different from the conditions under which buildings are erected here. Accordingly, all that enters into our architecture which can be called Swiss at all, is an idle imitation of some of the characteristic shapes and forms of that country, without any vestige of their use or meaning. A Swiss builder would hardly recognize what we call Swiss architecture, were he brought here to inspect our buildings, as anything that ever had form in his own country.

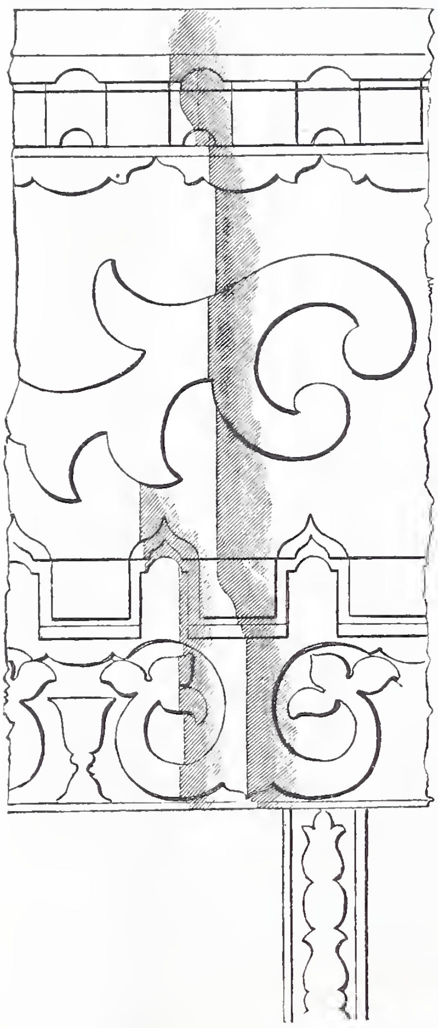
While perhaps there is but little in the Swiss method of building and decorating that is adapted to our wants as we understand them, there is certainly very much to be learned from it in the way of construction which it would be well for our builders to consider carefully. The great defects of our wood construction are the unshapely gaps made by the shrinkage of timber in the process of seasoning, and the consequent weakening of the structure, together with warping and the constant tendency to decay. Our shapes and forms in wood, and our methods of construction, upon careful examination, seem to be chosen with special disregard of great natural laws, which the Swiss and other builders in wooded countries long since learned to observe and profit by.

We cannot, in the space of a single article, enter into all the phases of the subject suggested by such a comparison of methods. It is a topic of very wide range, and would require a series of articles to treat it exhaustively. At this time we shall not, therefore, attempt much more than a description of the plates we have selected as illustrations, calling attention as we pass to the most important lessons to be derived from a study of them.



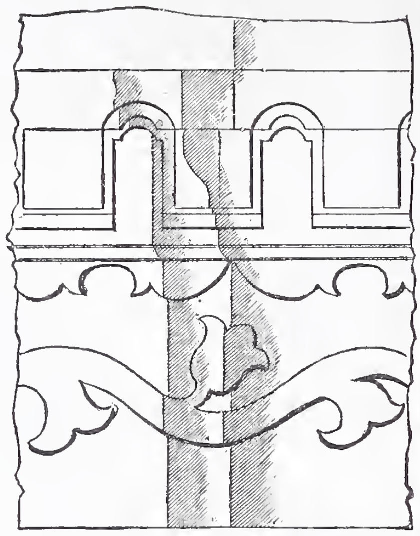
Swiss Architecture.—Fig. 1.—Elevation of House in the Canton of Berne, Switzerland.

The architectural styles of all wooded countries have certain marked features in common. This is true whether we compare the buildings of primitive times in America with those of a corresponding period in the wooded countries of Europe, or whether we compare together different districts of the same continent, as, for example, Norway with Switzerland. The only restriction in such comparisons at all necessary to be observed, is to choose countries in which the same general climatic conditions prevail. If a country in which the climate is cold, and in which wood is abundant, and therefore the principal building material employed, be shut off by any means from intercourse with wider communities, and thus left to itself for any considerable length of time, so as to develop an architecture of its own, it will be noticed that its builders follow out, in a general way, the use of wood in its best and most ligitimate forms. Switzerland is a conspicuous example of this kind. The architecture of that country, which is often spoken of and written about as a fashion, or, at most, a style, upon examination proves to be something more than the estimate put upon it. The builders of Switzerland began with wood as their only available building material, and, by simply using it in the best possible manner, they developed what may be justly called a national architecture. Norway, with its wooden buildings, differing in appearance from those of Switzerland as much as its people in style and character differ from the Swiss people, is another example of the same kind. While the shapes



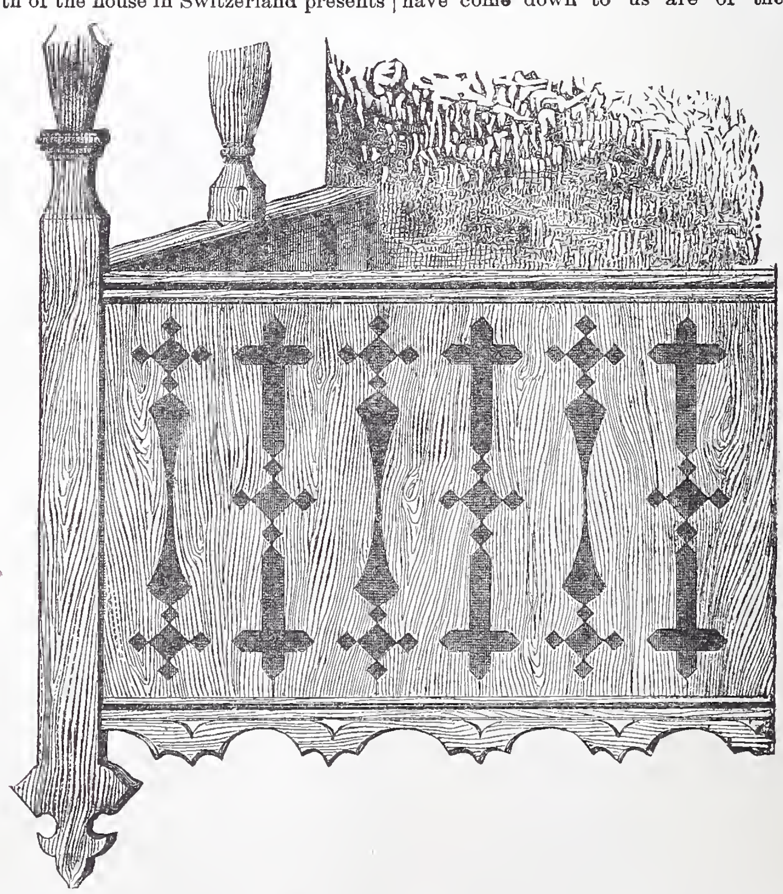
Swiss Architecture.—Fig. 2.—Detail of Belt Course between Stories of House shown in Fig. 1.

and forms are somewhat different in the architecture of these two countries, the underlying principle of construction is the same; for those who use wood without violating its nature, whether in Norway or in Switzerland or at the equator, must use it in some similarity of manner. The external appearance and the arrangement of parts may be changed as demanded by the varying climatic conditions of the countries, and the special needs and tastes of the different people, but the governing principles which must be observed remain the same in all cases. In the architecture of Switzerland, then, we have examples of primitive building which, in some respects, exhibit features common to the buildings of all wooded countries, and also material by which to form some idea of a style of architecture which, in part at least, had its origin in a constructional necessity, and in the development of which builders were careful to use the principal material they had in the best and most legitimate manner. Further, there is exhibited in Switzerland how men have built architecturally and artistically without architectural precedent—in other words, how they have learned to build up mere material both constructively and ornamentally.



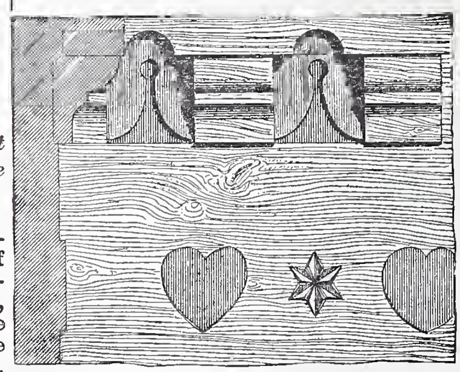
Swiss Architecture.—Fig. 3.—Detail of Belt Course below First Story Windows of House shown in Fig. 1.

It may be of interest, in passing, to consider for a moment the probable growth of the house in Switzerland. The first buildings in that country, as well as in Norway, were, in all likelihood, simple log huts, of the same general character as employed by the early settlers in America. They were square, box-shaped structures, built of logs notched at the corners in order to make joints. The second step in the development of the house was hewing the logs on two sides, by which means close horizontal joints between the various layers were secured, and a still further stage in its progress was hewing them on all four sides. Slabs, or logs split in halves, naturally came to be employed for the roof covering. Up to this point the growth of the house in Switzerland presents



Swiss Architecture.—Fig. 4.—Example of Balcony from House in Canton of Appenzell.

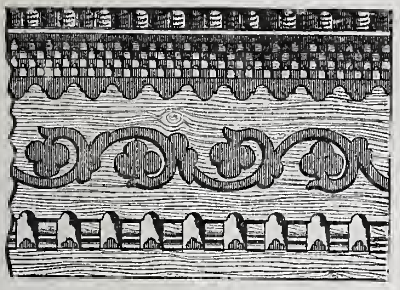
no features specially different from the early houses in other wooded countries, but the high winds of that country, and the abundance of stone convenient to its building sites, called into being a feature peculiar to Swiss houses, and one which is quite as picturesque as any other single part that can be selected. Its people found it convenient to hold the roof boards in position upon the buildings by placing stones upon them. In the natural order of thiugs, from simply building foundations of stone, the Swiss, in the progress of time, came to constructing the entire lower story of this material. This, however, was only a device for raising the structure a little higher, for the house proper was always built complete above it. In Switzerland there are the climatic conditions of cold wind and snow to guard against, which was one of the prime requirements of the house. The building material of the country was easily obtained in great masses; in fact, the larger the more easily it was worked. The first great necessity before the minds of its builders, then, was to make comfortable houses, and in putting their plans into execution they were not obliged to spare material. In the progress of



Swiss Architecture.—Fig. 5.—Detail of Belt Ornament across Gable Ends of House in Canton of Berne.

time they came to desire beautiful houses, and, quite naturally, they commenced to decorate with the same material out of which they had been constructing, Those examples of ancient Swiss buildings which have come down to us are of the best class of both material and construction, for only those have endured the lapse of years which were built in the best manner, and in which the construction and decoration was of shapes and kinds most nearly conforming to the laws of the materials out of which they were made.

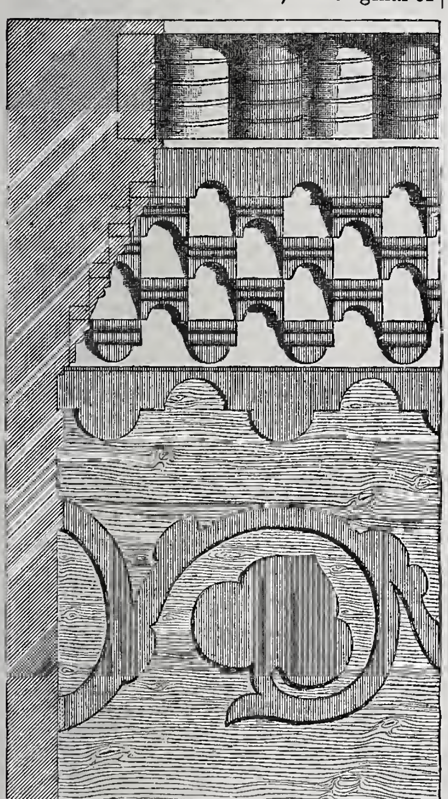
In Swiss architecture there are exhibited examples of both constructive and decorative art developed under conditions most favorable to their natural and legitimate growth. In the construction of these houses are shown forms and devices which builders are led to employ who carefully study the



Swiss Architecture.—Fig. 6.—Example of Outside Wall Decoration from House in the Canton of Berne.

nature of the material in which their work is done, and in the decoration used there is exhibited what may be considered by some persons rude ornamentation, but which nevertheless has a grace and beauty about it commending it to all intelligent observers, worked in the same material and with the same degree of care to use the best forms which characterized the main construction.

In Fig. 1 of the accompanying illustrations is shown a Swiss house, the original of



Swiss Architecture.—Fig. 7.—Detail of Example shown in Preceding Figure.

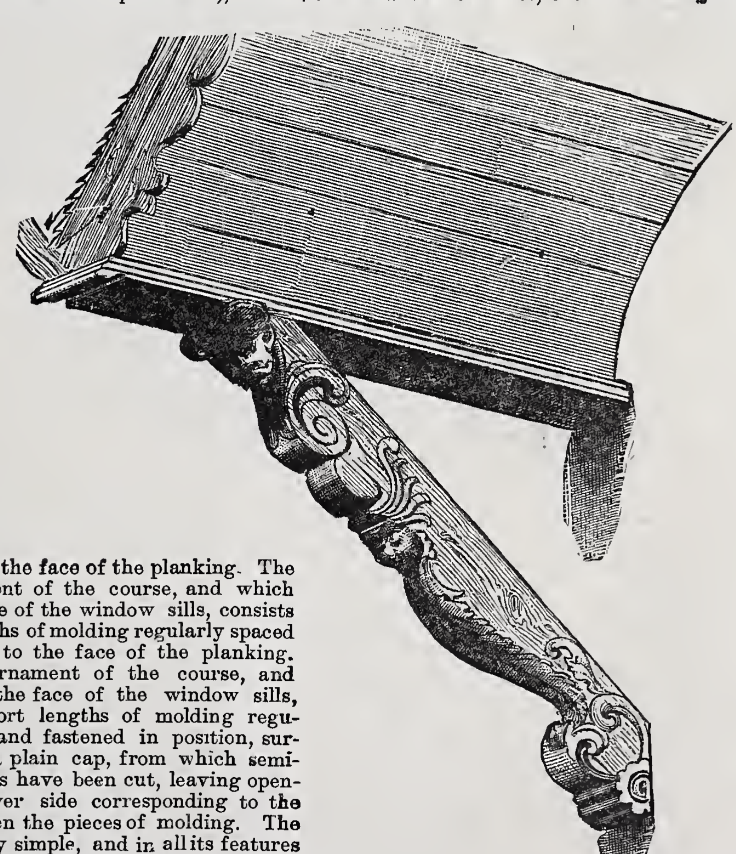
which is to be found in the Canton of Berne, and which exhibits in a marked degree some of the features we have been describing. The lower story is of stone, and above is the house proper, which is of timber construction. The walls are of heavy plank, notched together at the corners, and allowed to project through upon either side far enough to make the jointing secure. These projections, as they approach the roof, are made to form not only important members in the support of the roof, but also ornamental brackets, which add very much to the general appearance of the structure. The ornamentation everywhere is such as can be made easily and cheaply in wood. The roof is constructed with a wide projection upon all sides, which not only affords protection to the houso from avalanches of snow, for which it was primarily designed, but also protects the walls from the weather. Partitions in houses of this character are constructed of plank, and are carried through the outer walls, being notched into

Swiss Architecture.—Fig. 8.—Example of Bracket Supporting Ends of Purlins.—From House in Canton of Berne.

them in the same general manner as the connections between the outer walls at the corners.

Galleries and balconies are of very common occurrence in Swiss houses, and quite frequently are very prominent features, growing out of a variety of causes. Houses are often built overhanging their bases, a method of construction which obtains the greatest amount of floor room with the least possible ground space. In such structures galleries around the houses supply the same general purpose as our porches, and in some cases the galleries themselves constitute the overhanging portion of the house. Balconies are a pleasing feature in the arrangement of the houses, affording, as they do, places from which may be obtained the finest views of the surrounding scenery. In the house shown in Fig. 1 a gallery extends across one side of the building at the line of the principal floor, and a balcony is shown in the end on a line with the second floor. The wide projection of the roof shelters both of them. A design of a balcony of similar construction is also shown in Fig. 4.

When we come to examine the ornamentation of the building shown in Fig. 1, the design finishing the space between the sills of the windows in the principal story and the basement claims attention. Through the middle part of the course runs what, for lack of a more fitting term, we will call a line scroll sawed work (although it is not at all likely that the Swiss builders worked out this pattern in the same manner that modern mechanics would produce it), which



Swiss Architecture.—Fig. 9.—Example of Eave Bracket from Canton of Aargau.

is fastened to the face of the planking. The upper ornament of the course, and which forms the face of the window sills, consists of short lengths of molding regularly spaced and fastened to the face of the planking. The upper ornament of the course, and which forms the face of the window sills, consists of short lengths of molding regularly spaced and fastened in position, surmounted by a plain cap, from which semicircular pieces have been cut, leaving openings in its lower side corresponding to the spaces between the pieces of molding. The parts are very simple, and in all its features the design is one well adapted to construction in wood. The ornamentation between the two stories and upon other parts of the building is made in the same general way. Details of the curves occurring immediately below the balcony are shown in Figs. 2 and 3. Short lengths of molding joined together by a serrated cap, after the general manner shown and described, was a favorite kind of ornament with the early Swiss builders, and some very beautiful effects were produced by use of such simple means. In Fig. 6, which shows the appearance of the work, and Fig. 7, which shows the profile and details of construction, is a characteristic example of this sort of decoration, the original of which is also to be found in the Canton of Berne. A broad band of ornament is produced by simply placing short lengths of molding in such a manner as to form diagonal and vertical lines, the whole being finished with an appropriate cap. The effect of this upon the walls of a house is extremely rich, and yet, by the character of the parts and the work involved, the cost must have been very small.

The early Swiss builders made use of very little perforated work in their external decoration. Then scroll work was almost always applied to a backing, which held it in shape, and prevented its destruction by shrinkage and warping. It would be difficult to find in their best work anything at all resembling the forms and construction of ornaments which our builders are so lavish in applying to houses built in the so-called Swiss style in this country. This perforated woodwork, or scroll work, as it is now commonly called, was seldom allowed to stand alone. A solid backing was always considered necessary to its proper protection and preservation. It would seem, then, that modern builders have neither precedent nor the nature of the material to justify the manner of using scroll sawed work, now so common. Here, at least, is one lesson to be derived from a consideration of Swiss architecture that is of a nature to be put to instant use.

In Figs. 6 and 7, to which we have already referred in describing the character of ornament employed in the upper part of the design shown, is exhibited a very pretty scroll, applied in relief upon a wall surface. Similar construction is also indicated in Figs. 2 and 3. Such patterns as these were favorite ornaments with the old Swiss builders, and they were used very freely, as is evident upon examination of many of their houses. Sometimes the pattern was used as a trefoil, as in Fig. 6, and sometimes one lobe of the leaf was pointed, as in Fig. 3. Still another method of ornamenting, which was quite frequently used, is also shown in Figs. 6 and 7. The upper member of the belt course consists of a horizontal row of short half cylinders, placed alternately in and out, the surfaces of which are beaded. A modified form of this ornament is seen in the elevation on the first page, in one of the upper courses. Fig. 5 shows still another form of ornament, constructed upon the same general principles we have been describing. It combines some of the characteristics of several of the other examples, and is quite simple and inexpensive. It is a fact which ought not to be lost sight of, that all the ornaments which were favorites with the old Swiss builders were of a character calculated to take the smallest possible damage from the weather, and were the least liable to injury in the shrinkage and warping to which all exposed timber is liable, while they were also of forms which afforded the smallest possible lodgment to dust and dirt.

We have already alluded to perforated work. By examination of Fig. 1 it will be seen that the only place in which the Swiss builders allowed themselves to indulge in this style of ornamentation was in their balconies, but here they managed it skillfully and with the most careful regard to the nature of the material. In the balcony shown in Fig. 4 is one of their most intricate patterns of pierced work, but even it shows the most rigid adherence to principles. The work, as may be seen upon examination, is all done from the edge of the board inward, and with the exception of a single member of each pattern, the design is one which can be done with a hand-saw and draw-shave. The design is a rich one, and puts to shame some of the bits of scroll sawing used by the decorators of modern cottages. In all the patterns of perforated work used by the Swiss builders, their practice was to work from the edge of the board inward, never cutting away so much of the board as to leave insufficient grain from end to end to keep its strength unimpaired. This rule is one which ought to be universally observed. Wherever an exception to it is seen it will be found that the design, however choice in its lines, considered independent of the material in which it is worked, has lost much in effect. It fails to please the eye and to satisfy the mind, although the observer may fail to analyze the reasons sufficiently to perceive the real cause of its unsatisfactory character.

Upon the brace or bracket supporting the lower roof purlines, shown in Fig. 1, is a characteristic example of Swiss ornamentation in a different position from any of the parts we have already described. It shows well how they combined decoration and utility—how they made a part beautiful while strictly adhering to the best features of construction. If all the ornamentation be taken away from this bracket, there will still remain enough straight timber with the grain running from end to end to insure all the strength necessary in its use as a brace. This principle of construction, as may be seen by examination of similar parts in all of the work, was never sacrificed, but was always most carefully observed. No better example, perhaps, of its application could be found than in the design shown in Fig. 9, which is an example of Swiss ornamentation that in a measure foreshadowed the forms so common in the architecture of the renaissance. The bracket is highly decorated by carving, yet the artist, with rare appreciation of the necessities of construction, has left, unimpaired by cutting, material of abundant strength for supporting the load it was intended to carry. His timber in the start was large enough to leave sufficient straight grain running from end to end after the carved design had been put upon it Accordingly, we find in this brace both beauty and usefulness. It appeals to the senses with double force. How much better it is in every way than some of the modern methods of doing the same thing—supporting the load to be carried by some hidden means, and tacking up to catch the eye an ornament of such form and materal as has hardly sufficient strength of parts to support itself.

In Fig. 8 is shown another form of bracket, in which the ornamentation employed is made by a chisel and gouge, in the way of chamfers. The decoration is altogether appropriate and very effective. The finish employed at the ends of the horizontal pieces affords still another example of Swiss art which commends itself to approval.

In the examples we have chosen as illustrations, and in the remarks we have made concerning them, we have but touched upon the subjects of truthful construction and legitimate ornamentation in woodwork, which are the most important lessons to be learned from the old builders, whether we investigate the architecture of Switzerland, or that of Norway, or of other wooded countries. The old Swiss builders, among others, seem to have so thoroughly mastered the principles of construction and ornamentation in wood as to make them competent teachers of the builders of the present time. Upon the slightest comparison of the forms of woodwork and the methods of construction our builders are now employing with those of these old masters, we see to what great disadvantages in beauty, utility and durability they are working, and we are afforded some idea of what is to be gained from an intelligent study of the nature of the material which they are using. We are far from advising the duplication of Swiss houses in America. We do not advocate copying anything. Servile imitation is always to be abhorred. But the old Swiss builders have set an example of thoughtful attention to natural principles which it will be well for us to emulate. Swiss buildings—that is, buildings built of materials and in the exact form employed in Switzerland—are not adapted to our needs. We have not the timber to spare. Modern machinery makes more desirable shapes and plans possible. But we ought not to lose sight of the fundamental principles of construction and decoration, while employing the improvements which modern invention has made available. We should keep the dust from our marvelous machinery—band saw, jig saw, mortising machine and planer—out of our eyes, so that we may be able to perceive the nature of the material we employ in our construction, even while it is running through them.

Ownership of Gas Fixtures.—It has been decided that when a new building is rented as a residence, gas-fixtures are not an essential part of the realty; and the owner is not required to furnish them. The tenant must supply them, if the landlord does not, and in this case may remove them when he leaves. In latter years, the owner of the house generally puts in the gas-fixtures, because their absence is frequently a bar to the letting of the premises, and he can get more than the interest on their cost in the price of the lease, but he is not required to do it unless it is in his agreement.

Building Stones—Their Properties and Uses.

BY JAMES LEAL GREENLEAF.

From the time that the earth first took definite form to the present day the forces of nature have been engaged in tearing down and remodeling the then existing state of the world. At times masses of matter, melted by the heat, still present in the interior of the globe, have flowed out and overspread the surface. The changing seasons have disintegrated the rock, the rains have worn and washed it away, and the ocean has been beating and grinding the earth to powder till we know not if such a thing as the primeval rock exists.

All these, and many other causes, some of them belonging to the domain of the animal kingdom, have been the means by which our granites, sandstones, limestones, &c., have been formed, and such, then, are the processes by which was made that material which man has been pleased to call his building stone.

It is the aim of the following paper:

I. To discuss the essential qualities of a building stone, and the conditions which affect those qualities.

II. To give a classification and description of the building stones in ordinary use.

Considerations of economy and safety combine to make durability one of the most essential requisites in a building material. Many varieties of stone possess this quality to a high degree. They present firm and unyielding opposition to the hand of time, and hence have become admirable material in the hands of the engineer and architect. The immense and continuous strains put upon buildings, bridges and the like, not merely by the loads to which they are subjected, but also by their own weight, make it necessary for us to select material for their erection which shall meet any requirements, as regards strength, that may be made of them within extensive limits. Yet, with the possession of all that is desirable in these respects, a stone may not be available, owing to the expense of quarrying, transporting, or cutting it. Finally, must be consulted the æsthetic side of man's nature.

We have, then, as the primary requisites of building stone, first, durability; second, strength; third, cheapness; fourth, beauty.

Besides these there are many other conditions, some of them merely desirable, and others indispensable under certain circumstances, while not necessary in average work. For example: A rock may be of such a nature that it can only be obtained from the quarry in small, irregular pieces. It would evidently be of no use for columns, and in places where massive masonry required large and regular blocks of stone, while it might be used to advantage in irregularly coursed masonry, or, perhaps, as a rip-rap for the protection of piers and structures of a like nature, from the action of the water. Again, an item not to be left out of consideration in selecting a building stone, is the case with which it can be cut and prepared for the use for which it was intended—in other words, the hardness. The greater the resistance offered to the chisel, the greater will be the time and work necessary to shape it, and, consequently, the larger the cost, which, as before stated, should never be lost sight of by the engineer.

Hence, as a general thing, for stone work requiring much cutting, carving and elaborate finishing, the softer stones are employed; but in cases where immense strength is wanted, and a rough and unfinished surface harmonizes with the massive character of the structure, a harder and less yielding article is required.

But just here comes in the question of durability. Usually a soft stone is more easily injured by changes of temperature, &c., than one of harder nature, and for this reason an economy in the first cost by using easily worked stone may be more than balanced by expensive repairs, which, if a harder stone had been used, would not have been necessary. In some localities are stones which possess the most agreeable property of being soft and easily worked before they are deprived of their quarry water, and of hardening on exposure. Thus nature supplies us with an article which surmounts the difficulty just mentioned. In the Paris basin is found a limestone of such a character. Coquina, a fossil shell-stone of Florida, and the Topoka stone of Kansas, are similar.

Rock is supposed to be the type of all that is unchangeable and lasting, but the truth is that, unless a stone is suited to the conditions in which it is placed, there are few substances more liable to decay and utter failure in performing the duties required of them.

The conditions of durability are:

1. Good weathering qualities—that is, power to undergo unchanged variations of climate and atmosphere; and this embraces the consideration of hardness, density, ratio of absorption and chemical character.

2. Resistance to wearing by the action of other bodies, which is a condition required more especially in roads, sidewalks, &c.

3. Ability to withstand high temperature, to which fire-stone is subject.

If our land was what is known as a rainless country, and the temperature uniform throughout the year, the selection of building stone, as regards durability, would be a very simple affair, for almost any stone would remain unchanged through ages. In Egypt, whose climate is particularly favorable for the preservation of such material, we find many illustrations —as, for example, the pyramid of Cheops, built of nummulitic limestone, and retaining its clear cut outline although 4000 years old; also the obelisks, covered with hieroglyphics, which have maintained their distinctness through so many centuries. When the obelisk was removed to England, the climate so quickly acted on it, that more damage was done in a few months than ages of exposure to the clear Egyptian sky had effected, and it was found necessary to paint it with a preserving wash.

Our country, and others belonging to the temperate zone, are subject to rainfalls and variations of heat and cold which have a great influenee on building stone, and make its proper selection of very great importance. The heavy showers during the rainy season of the tropics do not cause as much injury as lighter, but more frequent, rains, which keep the stone in a continually moist condition. Of course, the injury done by moisture in softening and disintegrating the stone, and especially during cold weather by freezing, depends on its ratio of absorption, and for that reason it is necessary to determine this.

The ratio of absorption is the ratio of the weight of water absorbed by the stone to the weight of the dry stone. It is found by first weighing a piece of dry stone, then saturating it with water till bubbling ceases, and reweighing. The difference of the two weights equals the weight of the absorbed water, and this divided by the weight of the dry stone gives the ratio of absorption.

The ratio of absorption depends largely on the density—a dense stone not absorbing so much water as a lighter, more porous one, and, therefore, compactness is a matter of importance, especially in cold climates; for if the water in a stone is once allowed to freeze, it destroys the surface, and the stone very speedily crumbles away, or shales off, like some of the poorer varieties of brown stone, of which we have so many examples in this city. The action of frost is one of the most powerful agents in cold climates for the destruction of stone. The sides of cliffs are continually breaking away, owing to water getting into the crevices and freezing, and by its expansion splitting off large pieces of rock. The same action takes place, although on a less extensive scale, on the sides of stone buildings and walls exposed to moisture and variations of temperature. It is necessary to find the amount of this action on a stone before selecting it; but all artificial methods for determining the effect of frost are more or less imperfect, because they do not conform to the conditions met with in nature. Much the best way to satisfy one's self of the amount of resistance of a stone to the effects of freezing, and, in fact, of its general durability, is to find some spot where the outcrop of rock has been long exposed to the rain and frost and all the changes of the season. In such a case the conditions to which the stone will be submitted in the building will be much more nearly realized than is possible in experiments carried on in the laboratory. If the surfaces are compact and free from loose shale, and if the edges are sharp and solid, the probabilities are that the stone will be as lasting as could bo desired.

One difficulty to be guarded against is, that many rocks are variable even in the same quarry. Thus, a surface may indicate a remarkably compact, good stone, and that part of the rock will be such, while a few feet below, or to one side, the rock may be soft, absorb much moisture, and, when exposed, may rapidly crumble away. On this account, it is always best, in providing the material for important buildings, not to rely on the tabulated qualities of a stone, but to make independent and careful tests before deciding. One of the tests for the action of frost which has met with the most favor is that devised by M. Brard, and is the method, with some modifications, given to the students of the School of Mines in their analyses of building stones. The great objection to it lies in the fact that not merely mechanical, but chemical action as well, operates to disintegrate the stone, thus giving the specimen a worse eharacter than it really deserves.

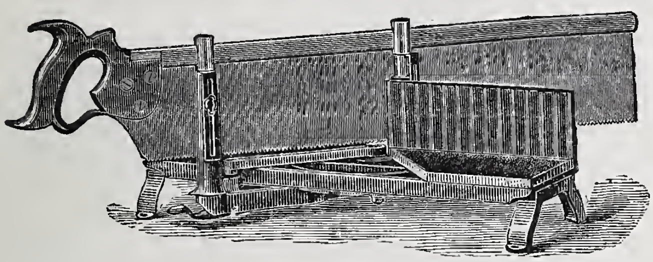
(To be continued.)

The New Langdon Miter Box.

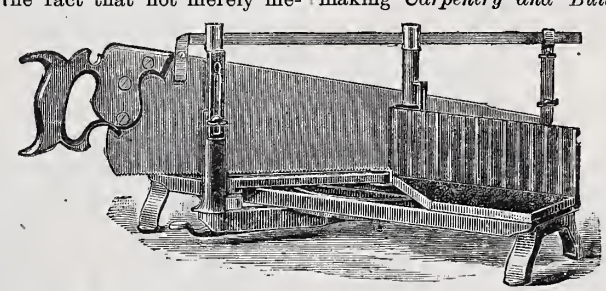
The Langdon miter box is a tool so well known to our readers that an extended description of it seems unnecessary. Since its first introduction, some ten years ago, it has found its way into numerous shops throughout the land. Still it has not entirely superseded the old wooden box, made by the workmen who used it. To make one of these old style wooden boxes in such a manner as to cut accurately, has always been considered one of the fine arts in the trade, and a severe test of a mechanic's skill and ability. With the introduction of metal boxes, this time-honored device is becoming each year less known, and ere long will have entirely disappeared before the advance of its more successful rival. A mechanic's skill at present is tested in the use of improved tools, rather than in the construction of such devices as formerly he was obliged to make in order to perform his work.

The metal miter boxes were not in the most perfected form at the date of their introduction to the trade. The Langdon box has undergone improvements from time to time, since its invention, all made with a view to meet the requirements developed by use. The last improvement which has been made upon this article, and to which we call special attention at this time, is the fitting of a frame to run in the guide in place of the top of the back saw. This device is clearly shown in the engraving. By its use any saw may be employed with the box, so that the workman may select the saw best suited to his work. He is no longer restricted to the use of the saw that specially belongs to the box, which, like all tools used in common by a number of mechanics, is seldom in first-rate order. What is everybody's business to keep up is very generally neglected by all, and the saw belonging to the miter box is no exception. By this improvement each mechanic may use his own favorite saw, be it either back, panel or framing saw, an arrangement of which the better class of workmen will gladly avail themselves.

The Langdon miter box is manufactured by the Langdon Miter Box Company, 74 Chambers street, New York City, and is for sale by the hardware trade generally.



The Langdon Miter Box.—Fig. 1.—Arranged for Back Saw.



The Langdon Miter Box.—Fig. 2.—Arranged for Panel Saw.

A Graceful Acknowledgment.

It may be remembered by some of our readers that the series of articles, entitled "Some Problems in Framing," which formed one of the prominent features of the paper during a part of last year, was called out by the letter of a correspondent. A portion of his letter was quoted in the first of the articles on page 132 of the volume for last year, in which his wants were stated. We proceeded to answer his questions in detail, the reply and the discussion which followed covering about every point concerning which any information could be required. A few days since we received another letter from the same correspondent in which he says:

"Your extended and elaborate articles and drawings, entitled 'Some Problems in Framing,' in answer to some queries of mine, prove tho amount of pains you take in making *Carpentry and Building* complete and useful. The paper has exceeded my most sanguine expectations. My queries were completely and satisfactorily answered, and in addition I can say I have derived more benefit from the paper than from any twenty-five dollars' worth of books I ever bought."

It is not our habit to publish the complimentary letters we receive (and we may remark, parenthetically, it is well it is not our custom, or of late all our space would be required for them alone), and our sole object in publishing this one is to show, by a practical example, to what lengths we are ready to go to serve our subscribers, thereby encouraging others to send us such questions in the matters of framing, construction, &c., as arise in their business and require answer. We are at all times willing to take up practical topics of this character, and to work them out to the extreme limit of the interest they may possess. What we are able to present is of itself, in some cases, even of less interest and importance to our readers than the discussion called out and which follows in the correspondence department. In any event, we assure our readers that any question sent to this paper will receive the careful attention its importance demands, and, in all probability, exhaustive discussion at the hands of practical men in the department devoted to correspondence.

We are much obliged to our California friend for his graceful acknowledgment. We hope to be allowed to serve him even further in the future. He certainly, from his treatment in the past, can have no hesitation about sending to *Carpentry and Building* to help him out whenever he is perplexed.

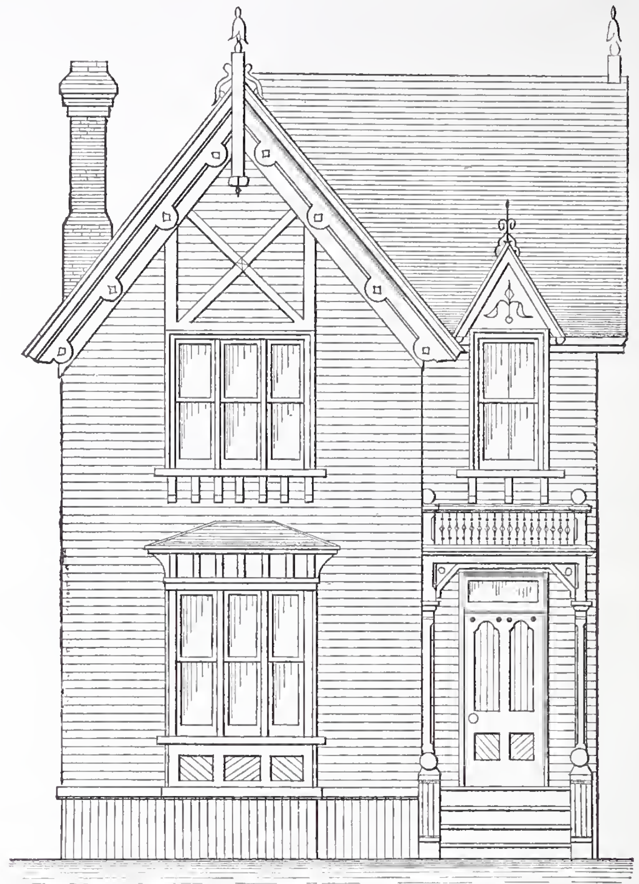
A Small Frame Dwelling.

Herewith are presented engravings of a set of drawings for a small dwelling, prepared by Mr. William Raeside, of Toronto, Ontario. Mr. Raeside is not a professional architect, but is a builder of acknowledged skill and experience. His drawings exhibit what may be accomplished by those who follow architecture as a matter of amusement and recreation, rather than as a special business. In his letter to the Editor accompanying the drawings, Mr. Raeside says that the entire set was prepared at odd hours after the day's work was done. We call attention to these facts, simply to impress upon our readers the desirability of improving their leisure hours in this manner, and as an example of what may be accomplished by patient work in the intervals of labor. Any builder prepared to make drawings and specifications in proper shape and of acceptable quality, must obtain thereby a better standing in the community than those who are unable to draw, and who are not intelligent concerning drawings made by others. We are always glad to see designs coming from practical builders. Between the professional architect upon the one hand, who, however proficient in draftsmanship and theory is seldom practical, and the builder, upon the other, who, however practical in handling tools and material, is seldom proficient in the matter of drawings, there is a wide gulf, which, in the interest of good buildings at moderate cost, ought to be bridged. A judicious combination in one man of the arts of the two, resulting in either an architect of practical experience in building, or a builder with a knowledge of those things which go to make the architect, is very desirable. These are points, suggested by the designs before us, which it will be well for our readers, especially the young men, to consider carefully.

Another point which may be noticed in passing. The drawings presented on this and the following pages give indications that as much care has been bestowed upon them by their author as though they represented a building costing ten times the money. As a general rule, small houses are not considered worth careful attention upon the part of builders and architects. The drawings prepared for them are frequently deficient in finish and lacking in detail. In this instance, however, each little part seems to have been carefully considered and worked out with commendable care. Full size sections of the trimmings, base boards, hand rails, &c., accompanied the set, which we have not engraved for lack of room to print them in the paper.

We would not have it supposed that the house here presented is not without its faults. Many of our readers will criticise it, and some of them, no doubt, will be able to suggest changes which in their estimation would result in marked improvements. All cheap houses must be open to criticisms of like character. What pleases one does not please another, and by the time all desirable features are incorporated in a building, the cost far exceeds the original limits. Mr. Raeside set out to design a house to cost $1000, and how well he has accomplished this—with what success he has distributed his cost throughout the several apartments—we leave our readers to determine.

The character of the foundations employed will suit some sections of the country, while in others no one would think of building in this manner. The absence of a cellar will be considered a very serious objection by many. The lack of a means of heating the middle room on the first floor is, at first sight, objectionable also, although with a stove in the front room and one in the kitchen, in all but the severest weather, this apartment should be quite comfortable without a fire of its own. A consideration of this matter will no doubt suggest to some the idea of moving the kitchen chimney to a point where it can be made to serve both rooms. This might be done to advantage, and the stack, rising as it should to the hight of the ridge of the roof, might be made a feature in the design, to a possible im-



Small Frame Dwelling.—Fig. 1.—Front Elevation.—Scale, ⅛ Inch to the Foot.

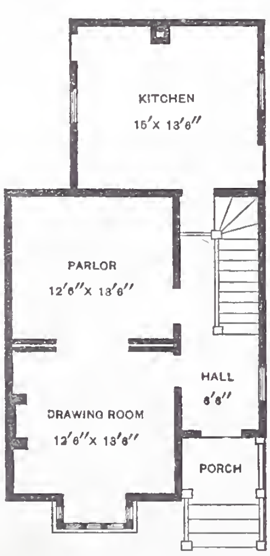


Fig. 2.—First Floor Plan.

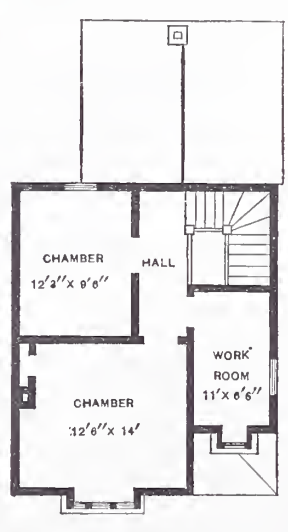


Fig. 3.—Second Floor Plan.

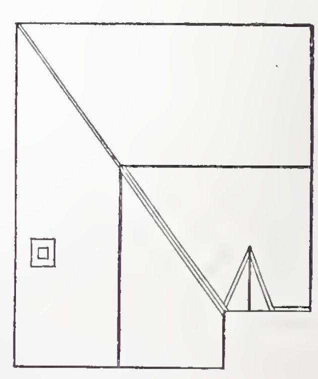


Fig. 4.—Roof Plan.

Small Frame Dwelling.—Floor and Roof Plans.—Scale, 1-16 Inch to the Foot.

provement in the appearance of the side elevation.

There are other points that might be mentioned in this connection, but we leave their consideration to our readers. It is not our purpose to praise too highly, nor to criticise too severely, any design published in our

to be executed according to details and finished in a workmanlike manner.

Porch and Front Steps.—The porch at front door to be executed as per detail, and front steps to be made in accordance with drawings; carriages of steps to be 6 x 4 inches and properly fixed to mud sill.

Doors.—Doors on ground floor to be 1¾ inches thich, 4 panels, and doors on chamber floor 1⅜ inches thick, also 4 panels, and made as per detail; all other doors to be common stock made; all doors to be properly hung with 3½ x 3 inch butts, as judgment may direct; door frames to be made

Small Frame Dwelling.—Fig. 5.—Side Elevation.—Scale, ⅛ Inch to the Foot.

columns. We desire rather to present examples of current work as we find them, pointing out the lessons to be derived from their study, leaving all else to our readers.

Specification

Of labor and material accompanying drawings, prepared by William Raeside, of Toronto.

Posts.—Provide and excavate for 24 cedar posts not less than 10 inches diameter, and let into ground 4 feet, well rammed.

Sills and Joists.—The sills and joists for ground floor must be well seasoned, all joists to be properly sized and well fixed to sills and plates. Where practicable, all trimmings to be 4 inches thick, joists to be on ground floor 10 x 2 inches, and on chamber floor 9 x 2 inches, and placed 16-inch centers.

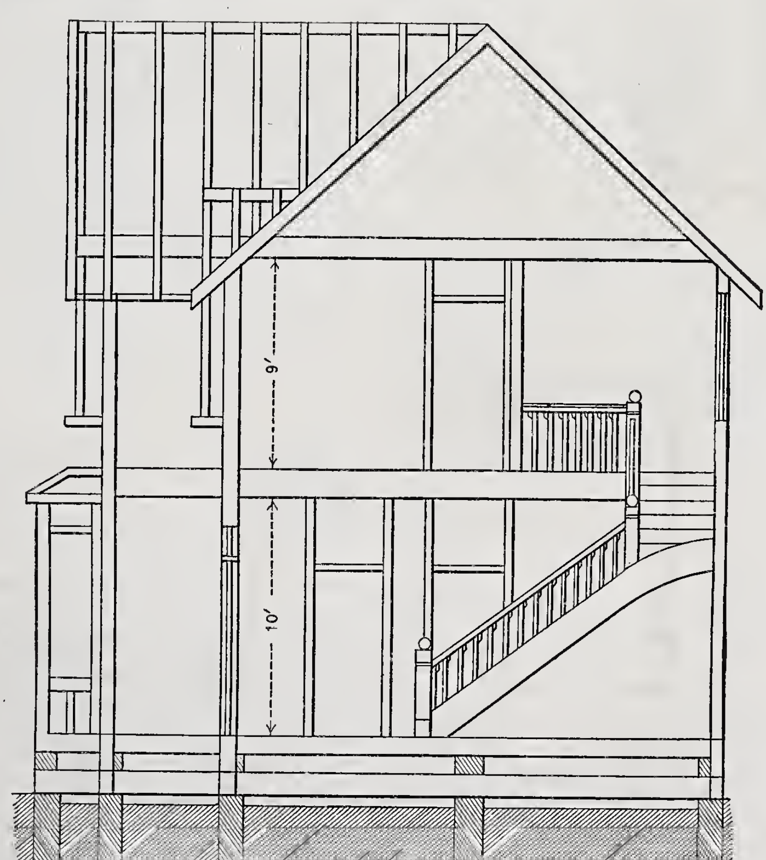
Flooring.—Rooms and Hall on ground floor to be laid with 1¼-inch best seasoned stuff, not more than 6 inches in width and blind nailed. Rooms on chamber floor to be laid with 1 inch best seasoned stuff, not more than 7-inch widths and blind nailed.

Partitions and Frame.—The wood partitions and frame of building, 4 x 4 inches; corner studs, 4 x 2 inches; studs, 4 x 4 inches; door studs, 4 x 4 inches; heads and braces all to be placed 16-inch centers and properly braced where necessary.

Roof.—The Rafters for main building to be 6 x 2 inches, placed 2-foot centers, and rafters in kitchen extension to be 4 x 2 inches, placed 2-foot centers, covered in both cases with well-seasoned stock lumber; butts properly made. All roofs to be shingled with No. 1 shingles 4 inches to weather, and bedded in mortar.

Walls.—All external upright walls to be covered with the best quality siding, properly nailed to studding.

Windows.—The windows throughout the building to have boxed frames, double hung, with best iron axle pulleys and metal weights, six-strand sash cord and brass fastener, the frames for bay, oriel and dormer windows



Small Frame Dwelling.—Fig. 6.—Longitudinal Section, Showing Foundations and Framing.—Scale, ⅛ Inch to the Foot.

Front Door.—The entrance door to have strong double rabeted frame and oak sill 2 inches thick; door to be made strictly in accordance with detail, and properly hung with strong 4-inch iron butts.

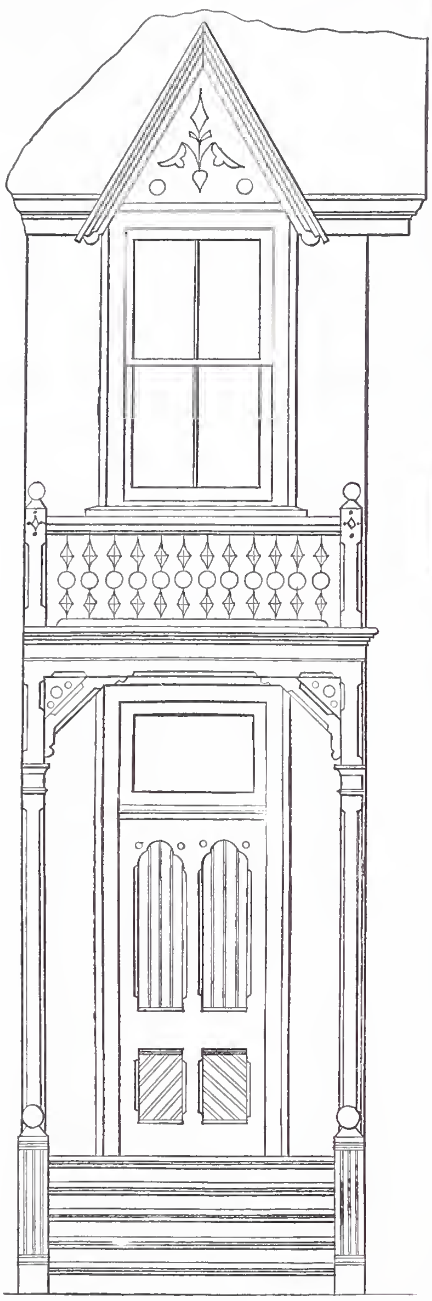
of 1¼ inch stuff with ½ inch stop, nailed on to form rebate.

Sash.—All sash and fan-lights to be 1¾ inches thick and glazed with best sheet glass.

Base, &c.—Base, architraves and general finishings to be got out same as detail, and hand cleaned and fixed in a first-rate manner.

Sheeting.—Kitchen to be dado-sheeted 3 feet high and finished with capping.

Stairs.—Stairs to be executed according to drawing; to be built in a proper manner, with 1⅛-inch treads, ⅞-inch risers, tongued together, and blocked carriages to be 6x2 inches, rough bracketed. Newel to be 7 x 7 inches, oak turned and chamfered, as per drawing; balusters, 1½ x 1½ inches,



Small Frame Dwelling.—Fig. 7.—Detail of Porch, Front Door, &c.—Scale, ¼ Inch to the Foot.

pine chamfered, as shown; rail, 3½ x 3½ inches, oak molded, as per detail, and all done in a workmanlike manner.

Generally provide and fix locks, fasteners, &c., to the satisfaction of those concerned. Provide and fix eaves troughs, flashings down pipes, and covering for deck of bay window—all to be of the best quality tin. The whole of the lumber of every kind to be of the very best quality, according to the work for which it is intended; that for framing and carpenter's work generally to be perfectly sound and free from sap shakes, wains, large, loose or dead knots, and holding the full size specified. The lumber for the joiner's work throughout to be thoroughly seasoned and perfectly clear. The carpenter and joiner's work throughout to be done in the most skillful and workmanlike manner, and all framing to be executed in the most approved manner.

Bricklayer.—Bricklayer to find all necessary scaffolding, and to provide and lay according to plans; all his material to be sound, well-burned brick; all flues to be well pargeted to the very top; chimney to be topped with nice clear-colored bricks and tuck pointed; open fire-place to have a piece of iron 2½ x ⅝ inches, chamfered and turned up at ends; hearth to be arched as may be directed.

Plasterer.—All plaster work to be two coats, the putty coat to be hard white; flush laths to be thoroughly well seasoned and properly fixed with a good key.

Painter.—Painter's work to be three coats; tints to be decided by those concerned. Material to be composed of the best white lead and oils.

Strength of American Timber.

Prof. Thurston is engaged upon experiments for determining the exact value of American constructive materials. Although the investigation has not yet been carried far enough to be complete, he presented the results already obtained in a paper read before the fall meeting of the American Association for the advancement of science, in which was given the following table, which will doubtless interest many of our readers:

TENSILE TESTS.

Wood.	Length—Inches.	Diameter—Inches.	Tensile strength.	Total elongation.	Weight per cubic foot in pounds.
White pine....	4	0.527	6877.5	0.725	29.376
Yellow pine...	4	0.532	2070.2	1.650	46.656
Locust........	4	0.522	28925.2	1.850	57.024
Black walnut..	4	0.535	9786.4	0.850	38.016
White ash.....	4	0.544	15490 5	1.475	34.560
White oak.....	4	0.481	13207.8	1.300	41.472
Live oak......	4	0.497	10309.2	1.150	67.392

TESTS BY COMPRESSION.

Wood.	Length—Inches.	Diameter—Inch.	Compressive strength.	Compression per cent. of length.
White pine..........	2.25	1.117	9592.6	3.498
Yellow pine..........	2.25	1.102	11952.3	2.906
Locust..............	2.25	1.073	14818.9	3.300
Black walnut	2.25	1.112	7001.7	1.254
White ash	2.25	1.104	8148.3	2.310
White oak...........	2.25	1.117	7143.5	3.300
Live oak............	2.25	1.117	10409.2	3.366

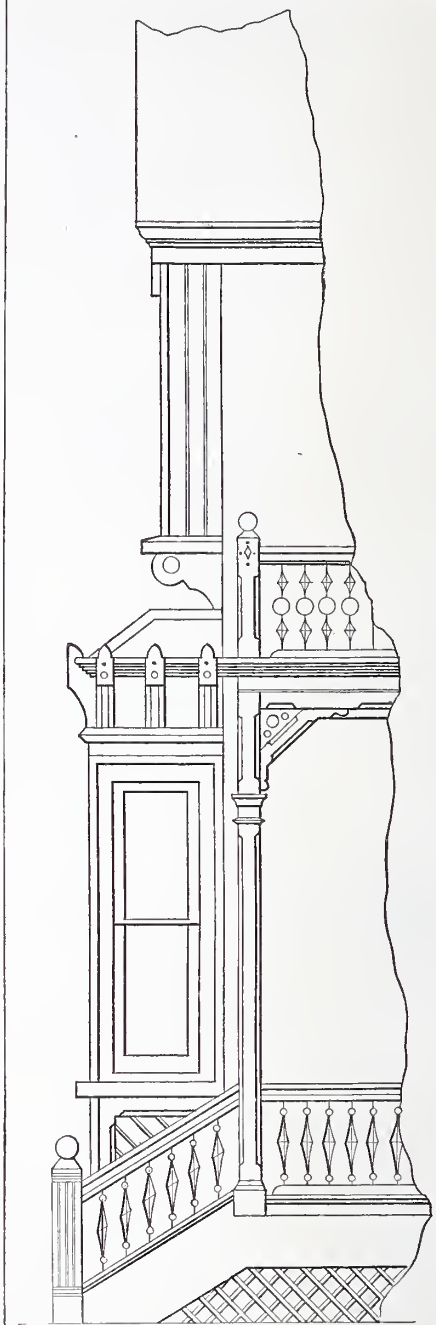
TESTS BY TRANSVERSE STRESS.

Wood.	Length—Inches.	Breadth—Inches	Depth—Inches.	Load.	Deflection.
White pine.............	54	3	3	5280	1.28
Yellow pine............	54	3	3	16740	1.96
Locust.................	54	3	3	13680	2.70
Black walnut	54	3	3	7440	0.72
White ash..............	54	3	3	9720	2.50
White oak..............	54	3	3	9840	1.76
Live oak...............	54	3	3	11280	1.38

Essential Features of Roofs.

Roofs of dwellings, stores and buildings of all kinds have for their first object the protection of the structures upon which they are placed. In Southern climates this protection is chiefly against rain and sun. In Egypt, where rain is almost unknown, the roof is essentially for a defense against the sun. In northern countries the roof must protect against wind and snow, as well as the sun and rain. In nearly one-half of the United States, all of Canada and all of the northern part of Europe, the defense against snow is exceedingly important, and the roof that cannot keep it out and properly dispose of it, not only when fine and dry and driven before the wind, but when falling quietly and heavily saturated with moisture, is not worthy to be considered a sound or valuable roof.

In the greater portion of the United States a roof, to meet all the requirements of the climate, must partake of the characteristics of the roofs of all countries and climates. As far south as the latitude of New York city we have arctic winters and tropical summers, with intermediate seasons of rain and wind, which try a roof to the utmost. In building a roof in this country we must first seek protection against the sun, and make it a non-conductor of heat. We should not however, build, as did some of the



Small Frame Dwelling.—Fig. 8.—Side View of Porch, Bay Window, &c.—Scale, ¼ Inch to the Foot.

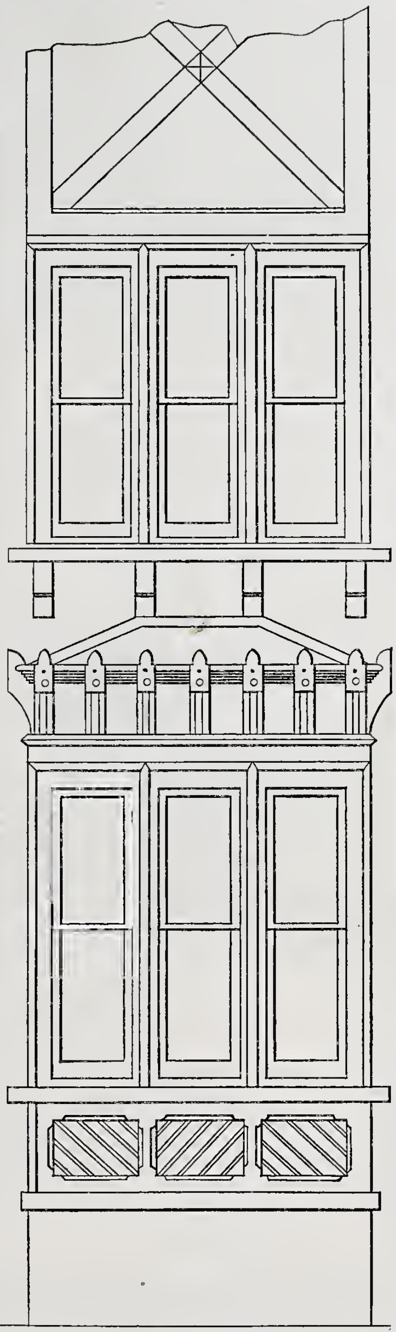
ancients, to make the roof afford us shade by means of its projection. Shade must be obtained by temporary roofs or awnings which can be removed upon the approach of winter, when all the sunlight is needed. The next essential in a roof is its ability to shed water, and incidentally we should look for a roof which would not in any way injure the water falling upon it, because in many sections of the country it is very desirable to save the rain water and utilize it for domestic purposes. Further, the furious March winds, as well as those of the autumn, require not only to be resisted, but to be kept out. To do this the roof must be tight in the joints. It must be understood that while a roof may keep out rain and water perfectly, wind carrying dry snow may find its way through very easily. Indeed, we are inclined to think that it is more difficult to lay a joint tightly enough to keep out snow driven by the wind, than it is to keep out water. We have seen powdered snow driven through openings where water could not pass under any circumstances.

Having our roof tight against water and wind, we must provide against the weight of snow. The architects of the Middle Ages who built in snow countries solved this problem very wisely. They reasoned that the weight of snow which was likely to fall upon their roofs was greater than they would sustain, and so they wished to get rid of it at once. This they did by giving their roofs a sharp inclination. The snow falling upon these sharp roofs found no lodgment, but slid off before it had time to collect in any quantity. They did not have the continual labor of shoveling the snow from their roofs to the damage of the covering material, to the danger of those employed in the work and to the drain of pockets in the way of expense. They never used flat roofs, but always those with sufficient pitch to throw off the snow. This steepness of pitch gave them several advantages in their selections of material for roof covering. It was upon these steep roofs that slates were first laid. Lead, copper, tile and shingles were all used upon them. The sharp pitch made the covering comparatively easy. It should be understood that if a steep roof is to be used, the pitch ought to be great enough to make the snow slide off at once and in small quantities. A roof that accumulates a large quantity of snow before allowing it to slide off is a man trap. We have frequently seen roofs send half a ton of snow like an avalanche down into the street, to the great danger of man and beast, simply because the pitch was not steep enough. A flat roof would have been vastly better on this account.

A roof should be durable. We think it would be difficult to give any reason why the top of a stone or brick house should need any more repairs than the outside walls. In other words, the typical or perfect roof should be built in such a manner that it will last as long as the house which it is intended to protect. This may be done, as many of the readers of *Carpentry and Building* can testify. One gentleman wrote to us a short time ago, giving an account of a roof with which he was familiar which was something like 140 years old, and which was, until within a few years, sound and tight. Such roofs cost money, and we do not expect people to put them upon buildings which are not likely to last more than 25 years. It is well, however, for people to know that good roofs can be built which shall last as long as the buildings, and require as little repair and attention. In any event, the rule ought to be established that roofs should be as durable as the buildings upon which they are placed.

Slate and Its Uses.

Dr. Phin, some years ago, in an article on the subject of slate and its uses, spoke of it with especial regard to its value as a roofing material. While it is, perhaps, a bad thing that our forests have been destroyed so wantonly, this destruction has in one way been an advantage, since it has in a great measure driven the shingle out of use and helped to make slate popular. As a roofing material, slate has long been used in Europe to the exclusion of almost all others. It is true that thatch and tiles have been freely employed there, but they are gradually disappearing before their mineral competitor. In this country, owing to the abundance of timber, our roofs have been made mostly of shingles; and where these have been thrown aside, their places have been taken by sheet metal—generally tin—a most expensive and inappropriate material, as it requires to be carefully protected by paint; and, moreover, the extent to which all metals expand and contract by heat, renders them unsuited for roofing, as this contraction and expansion causes them to buckle and finally to crack. Of late years, however, a more extensive use has been made of slate, and we begin to see along our country roads neat villas and cottages which show that we have not only the material at our command, but that among us we have mechanics who can make good use of it. How far this state of things may be due to the introduction into this country of the mansard roof, it would be difficult to say. Certain it is that the mansard becomes all but an impossibility in the absence of slate, while, with the excellent varieties of this material that are found in this country, it would almost seem that the mansard should be peculiarly suited to our wants, tastes and facilities. Among the many advantages that may be mentioned as



Small Frame Dwelling.—Fig. 9.—Front View of Bay and Chamber Windows.—Scale, ¼ Inch to the Foot.

being peculiar to slate roofs are durability, imperviousness to storms, and their power of resisting the attacks of fire. Shingles rot and metals corrode, but slate seems to defy the action of the elements. As an agent capable of resisting fallen cinders, slate is incomparably superior to shingles; and, so long as cold water is kept from it, it is certainly more efficient than either wood or metal in resisting flame and radiated heat. It unfortunately happens, however, that in this country we have fire departments endowed with more muscle than brains, and whose knowledge of the properties and capabilities of slate is as yet very limited. Furnished, as they are, with the most powerful and efficient fire-engines in the world—steam and hand—they would deem it inexcusable if they did not drench the hot slates with cold water, just as they are in the habit of drenching shingles, to prevent them from taking fire. They do not seem to know that cold water driven against hot slates will almost reduce them to powder, and they seem to forget that slates will not burn; in such cases they consequently never follow the true method, which is to throw the water where it will be converted into steam as much as possible, and thus cut off the access of oxygen to the flames. The only circumstances under which it is admissible to throw water on a slate roof on the occasion of a fire, is when the engines reach the spot before the neighboring roofs have had time to get very hot. Then, by wetting them thoroughly and keeping them wet by occasional dashes, the slates are kept cool by the evaporation of moisture from their surfaces, as well as by the contact of cold water, and thus all danger of firing the wooden sheathing to which they are attached is avoided.

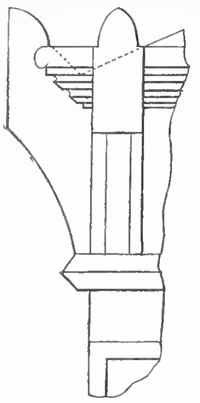
But roofing is not the only purpose to which slate may be applied with advantage. Unlike wood, metal or marble, slate is not acted upon by moisture, a corrosive atmosphere or acid liquids; in other words, it neither rots, rusts nor dissolves. The silicate of alumina, of which good slate is chiefly composed, is one of the most indestructible and incorrodible of materials. Hence, as a material for the construction of tanks, whether for water or other liquids, it is unsurpassed. It has also been used in the construction of shelving for dairies, and, as it does not absorb any vapors, like tiles, nor rot like wood, nor rust like metals, it is rapidly taking the place of these materials. The same properties render it peculiarly appropriate as a material for the tops of tables and benches in the laboratory and dissecting room. On such a table acids may be spilled with impunity, and there is no danger that it will absorb noxious fluids from an anatomical subject. Its employment in the construction of billiard tables, as well as in many minor departments of manufacture, is well understood; but perhaps the most unique and recent adaptation that has been made of it is that of tiles for areas, halls, passages, &c. As it may be had of a great variety of colors and beauty of surface, it may be applied to the formation of mosaic work in halls and public rooms with the best effect, while for areas and small back yards the more common varieties may be made to form an impervious and durable floor, that will exclude not only any noxious fluids that may be accidentally spilled on it, but that will resist and carry off the washings of our city atmosphere, which render city rain so very impure. In the country these things are not matters of so much importance; but in cities, where the soil is never purified by vegetation, but becomes sodden with the continued defiling influences attendant upon a dense population, the safest plan is to keep all such influences out and all possible emanations in. This may be done cheaply and effectually simply by covering the entire surface with slate tiles laid in hydraulic cement. Bricks and ordinary unglazed tiles will not effect the desired end; but slate tiles, from their impervious character and the exceedingly close joints which they may be made to form, do it most perfectly.

Such are a few of the uses of this most important material. As it becomes better known, the range of its usefulness will extend, and the enormous quantities of slate of superlative character with which this country is supplied will be more generally utilized.

NEW PUBLICATIONS.

Common Sense in Church Building. Illustrated by Seven Original Plates. By E. C. Gardner, Author of "Homes, and How to Make Them," "Illustrated Homes" and "Home Interiors." Bicknell & Comstock, New York.

This little work of not quite 200 pages is written in an entertaining style, and will interest even those who do not agree with the author upon all his points. It is calculated to entertain the general reader as well as the student. The chapters are arranged in part after the manner of a correspondence between those who are concerned in a church to be built and an architect. Some parts of the work are interspersed with scriptural quotations, their application, however, being to a material church edifice rather than, as is usual, to the spiritual kingdom. Mention of some of the subjects discussed may convey to our readers an idea of the scope of the work. The subjects are named in a manner altogether as quaint as the plan of treating them. "Light *versus* Darkness," "Heresy in the Side Pews," "Shape of Audience Rooms," "A June



Small Frame Dwelling.—Fig. 10.—Detail of Bay Window Cornice.—Scale, ¾ Inch to the Foot.

Journey" and "A Sunday Morning Call" are some of the more suggestive titles. The work is very carefully gotten up, is well printed and neatly bound, and does credit to the publishers.

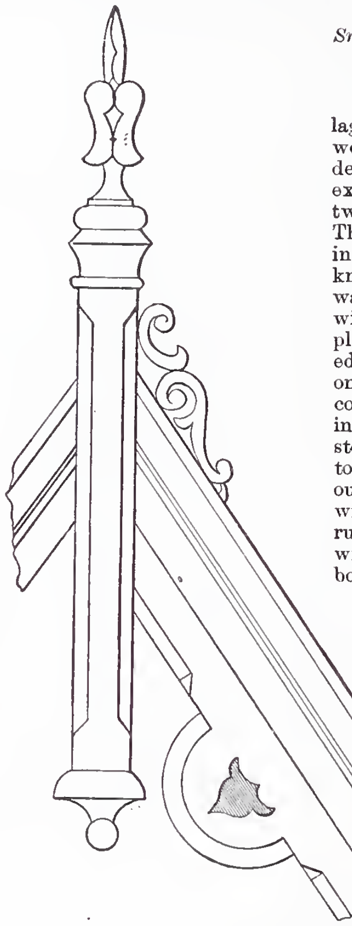
How Can I Learn Architecture? Hints to Enquirers and Directions in Draftsmanship. By F. T. Camp, Architect, New York. Published by the Author. Price, paper, 25¢; cloth, 50¢.

This little work has been prepared with the view of answering in a practical manner the question so often asked by wide-awake young carpenters and builders, How can I best qualify myself for practicing the profession of architecture? The author at the outset discriminates between the evident intent of the question and a literal interpretation of its words. Practical men—that is, men engaged in the practical operations connected with building—have no time to go through an exhaustive and comprehensive study of architecture and kindred sciences with which the architect is required to be familiar, even if they have the desire to inform themselves upon the theory of their art. Hence, the question is really much broader than the intent of the one who propounds it. What is really meant is, How can I learn to make plans, sections, elevations and details? And this question the author sets himself to answer. First he describes a draftsman's outfit. Next comes a chapter on the technics of planning, illustrated by some 40 cuts and diagrams, showing how the different features of a house, such as doors, windows, chimneys, &c., and the different materials of which parts are composed, as wood, stone, brick, &c., are represented upon plans. Then follows some general remarks upon planning, wherein attention is called to the principles which govern the division of a house into apartments. "General Remarks upon Exteriors," "Drawing the Plan," "Using the Instruments," "Designing the Elevations" and "Tracing and Inking," are the titles of following chapters. A closing chapter, entitled "The Architect," discusses who ought and who ought not to be architects. A "List of Books for a Student of Architecture" is appended. The book contains a very considerable amount of information in very small compass, and is one which should be in the hands of every intelligent builder.

Practical Treatise on Lightning Protection. By Henry W. Spang. Illustrated. Claxton, Remsen & Heffelfinger, Philadelphia.

We are indebted to the author for a copy of the above work, the most complete treatise upon the subject which it has been our privilege to examine. The author states in his preface that metallic conductors, commonly called lightning-rods, have been employed for over a century, but the many instances where buildings with them have been destroyed or damaged and their inmates killed by lightning, have caused a prevalent doubt in the public mind as to their utility. The fact is, serious errors have been made in the construction and application to buildings of nearly all the lightning conductors heretofore erected. The author attempts to explain these errors in the work before us, and to point out correct methods for protecting buildings.

The book is somewhat comprehensive in its scope. Following the introduction is a chapter upon electricity and its properties, then experiments with artificial lightning, then a consideration of the electricity of the atmosphere and earth, a dissertation on the formation of clouds and storms, and so leading on, step by step, to a consideration of the different means employed for lightning protection. From the last-named chapter we quote: "Among the means which have been employed in seeking protection from lightning, it may be mentioned that the Romans had an idea that seal-skins were a defense against the celestial weapon, and tents were made of them for that purpose. The ringing of church bells and the firing of cannons were resorted to in the belief that the noise thereof would prevent strokes of lightning. Refuge in caves in the earth was taken dur-



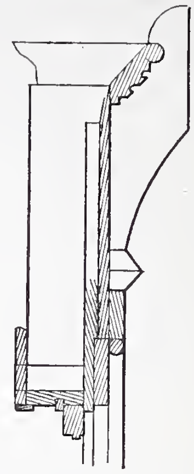
Small Frame Dwelling.—Fig. 11.—Detail of Gable Cornice and Finial.—Scale, ½ Inch to the Foot.

ing thunder storms. Hammocks suspended by silken cords, and feather beds have been sought as asylums. Cages of glass have been made for the very timid, and beds or stools insulated with glass supports have been used by persons under the impression that glass was an absolute non-conductor of lightning. For persons outdoors during the thunder storm, a probable lightning-conductor has been suggested, consisting of an umbrella having a metal stem to the lower part, by which a metallic chain is attached which is allowed to drag on the ground, but making a very poor connection therewith." Following this chapter the author discusses the proper function of the lightning-conductor, defines reliable lightning-conductors, and considers the best form and joints for these lightning-conductors. And so on, taking up each phase of the subject, discussing it exhaustively. Mr. Spang is warmly endorsed by some of the most eminent electricians and scientists in the country. His book throughout is quite interesting, and is deserving of attention upon the part of the building public.

Bricklaying in France.

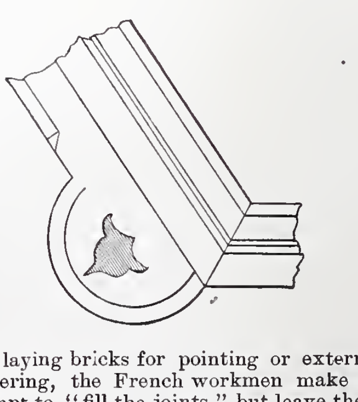
From the Artisan Report upon the Paris Exhibition of 1878, made to the Society of Arts, we extract the following:

Both in Paris and in the towns and vil



Small Frame Dwelling.—Fig. 12.—Vertical Section through Bay Window Cornice.—Scale, ¾ Inch to the Foot.

lages outside, bricklaying seems to be the work of only two schools of bricklayers of definitely fixed methods. This sameness of execution and sameness of design in these two typical methods is very remarkable. The execution consists, without exception, in laying the bricks in mortar in a manner known as "left for pointing," and in afterward stopping in the joints, and laying on with a ⅜-inch jointer a white joint in either plaster or putty. This is the method adopted for the best description of work. The only other mode of finishing the face work consists in laying the bricks as in the first instance and then stopping in with white stopping. The whole is afterward colored to the required shades, and the joint brought out white by ploughing into the stopping with a jointer run along a "straight-edge" rule to the depth of about ¼ inch. The width of the joints is about ⅜ inch, alike both for bed and cross-joints.

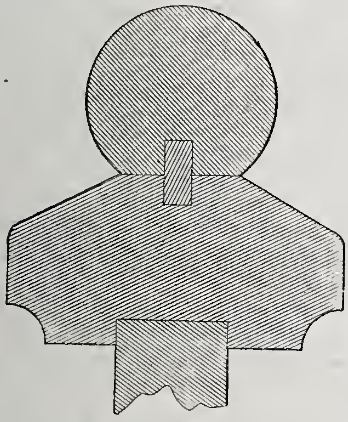


In laying bricks for pointing or external plastering, the French workmen make no attempt to "fill the joints," but leave them gaping and open to a depth of about three-quarters of an inch, so that no "raking out" is required. Such performance would not be sanctioned by an English clerk of works, or suit the taste of English bricklayers, although it must be confessed a better key for either stopping or plastering is thus obtained than by the "raking out" process. Whether the French have borrowed or adopted "tuck pointing" from the English, I cannot say. They call it

"English jointing," or *Joint Anglais*. In my opinion a good lesson might be learned from them if their mode of mixing and the materials which they employ could be accurately ascertained. The joints have a glazed appearance, and are very hard; and I have not noticed a single instance in Paris of the crumbling away, or falling off of the joints, so frequently seen in England

This may in some measure be due to the difference in the action of the two atmospheres, or to the less frequent sudden changes from soaking rains to freezing which occur in Paris. Whether this be the case or not, I am convinced that the more capillary absorption is avoided by the employment of materials of a more dense and less porous nature in the construction of joints, the less will be the subsequent disruption of our work by the expansion of the water lodged in the pores upon the occurrence of freezing. From what I can make out by the examination of both old and new work, the durability of the French pointing is due in a great measure to the employment of a more dense, and consequently less absorbent material than we use, and to the giving a better key to the stopping, by the method of leaving the joints open, as has been described.

The only artistic effect produced in brickwork in Paris is the almost universally adopted checkered, lozenge-shaped, and square patterns, which are supposed to be done in various colored bricks, viz., light, dark, red and blue; but which is not unfrequently the work of the pointer, or of the painter, rather then the laying in regular bond of a design in brickwork by the bricklayer. Such artistic work and careful execution as is instanced in the red brick mansions of the "Queen Anne" style, and other buildings in brickwork in England, where the geometrical knowledge, the artistic taste, and the neat workmanship of the English bricklayer is exemplified with such pleasing effect, is not easily to be found in Paris.



Small Frame Dwelling.—Fig. 13.—Hand Railing of Stairs.—Scale, ⅓ Full Size.

The extent to which ornamentation in bricks and artistic brickwork is adopted by French architects may be fairly judged, since it may be assumed that France as a whole is represented at the Exhibition. If any steps had been recently taken to improve the French style of brick buildings, this would certainly have been shown there in some way. I have also examined drawings in the architectural and civil engineering departments, and although these indicate a tendency to more general use of bricks in the provinces, in prison, school and dwelling-house architecture, yet nothing appears in this material in the way of moldings, cornices, gaps, gauged arches, niches, scrolls or carving, as is seen in almost every town in England to a greater or less extent. In fact, ornamentation in domestic architecture does not seem to run very high in France, so far as I could judge from what I saw of Paris and the few places outside its walls which I visited. The French appear to delight in decorating their public places and edifices to any extent, but do not apply the same rule to their houses, and are therefore very unlike the English, who take pride in the appearance of their homes. This is the cause of the variety of styles, and of the competition of street architecture in England.

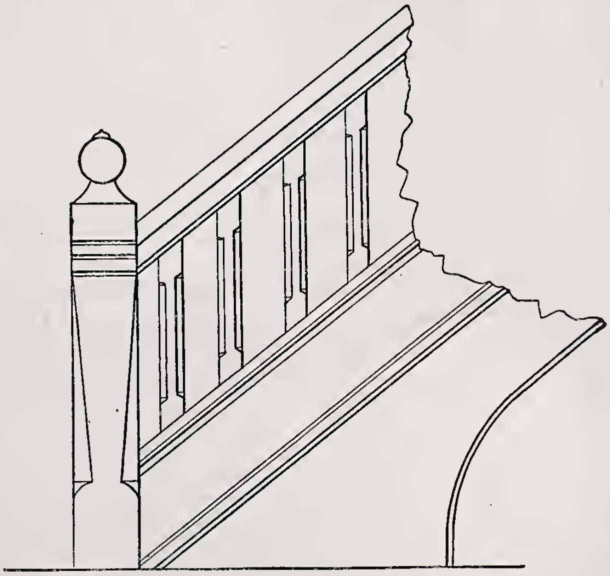
House Joiners vs. Cabinet Makers.

The present demand for hard-wood finish for the interior of dwellings in what might be called cabinet-work style, is tending to displace the ordinary house joiners, and to put in their places men who heretofore have been simply cabinet makers. The style of finish in vogue necessitates the employment of workmen of the greatest skill. Ordinary carpenters, or even joiners of moderate skill, stand very poor chances of turning out satisfactory work where every joint must be invisible, and where neither paint nor putty is allowable. This demand for house finishing has taken many men from the regular cabinet-making shops into those shops which also engage in house work. At present the pay is better upon house finishing than upon regular shop work, while the additional advantage of being more certain of steady employment in those shops which conduct both branches of the business than in those which carry on but one, takes many men away from the latter.

It should not be supposed, however, that the transfer of mechanics in this way from the line of trade in which they have worked all their lives to another in which they have little or no experience, is attended with no embarrassments. The cabinet maker is seldom as well informed in the matter of construction as the house joiner, and, consequently, he works in this respect at considerable disadvantage. He secures the work, therefore, not so much upon his special merits as a joiner, as upon the lack of qualifications in other directions upon the part of the man he displaces. House joiners, as a rule, know very little of the art of finishing and polishing the work when constructed, and as the demand is at present, finishing is all-important. The cabinet maker, it would seem, secures work principally by reason of his knowledge in this respect. If the house joiners, therefore, will make a study of this matter of finishing, and also strive to acquire that special skill in the matter of joints which marks the good cabinet maker, they will have but little difficulty in regaining this part of their business or in holding their own against the encroachments of this branch of the trade.

A lesson is to be derived from this condition of things. At the present day no man is safe in his trade in knowing only one thing. He may be a house joiner of exceptional ability, and, having met with success in his trade for a term of years, feel secure. But a change occurs, and for the reason that he is not proficient in the polishing of woods and in other arts specially belonging to cabinet making, he is displaced by men who are his inferiors in all other respects. On the other hand, if during the time he has been working at his trade as a house joiner, he has also been learning something about polishing and finishing woods, he is ready for a new order of things, and holds his place in his trade, and very possibly, too, at an increase of wages. Other mechanics, as well as house joiners, should take this lesson to heart at this time. There is no telling what will be the next demand of fashion, or what new issue will be sprung upon the building trades. In any event, the man who has his eyes open and who carefully studies collateral trades, is more ready for any change whatever than the man who goes blindly along, heeding not the signs of the times, and who wakes up only when he finds some one else earning the dollar which should be his.

Small Frame Dwelling.—Fig. 15.—Vertical Section through Eave Cornice, and Side View of Window above Front Door.—Scale, ½ Inch to the Foot.



Small Frame Dwelling.—Fig. 14.—Detail of Newel Post, Balusters, &c.—Scale, ½ Inch to the Foot.

Amount of Building in New York City in 1879.—The report of the Building Department shows that more money was spent in New York last year for new buildings than had been spent in any year since 1871. As a result of better times and of rapid transit, this is a striking exhibit. It would be still more striking if the value of money was included in the comparison, for in that case it would doubtless be seen that 1879 was the greatest building year New York has ever seen, and that the $22,000,000 spent last year produced more buildings than the larger amounts spent for the same purpose in the "flush years" after the war. One item of comparison, that of "first-class dwellings," shows that $10,000,000 were spent upon it last year, against $16,000,000

CORRESPONDENCE.

H. W. C.'s Stair Building Criticised.

From B. P., *Jacksonville, Fla.*—In the December *Carpentry and Building*, H. W. C., Detroit, invites criticism on his stair-building letter. He has not failed to give plenty of scope. His directions about placing the stairs so that most of the building may be seen before coming to the stairs, sound curious and need more light; and so he says, "the window must be placed in the middle of them." Staircases with a window in the middle of them are English, perhaps? If so, I am not competent to criticise the arrangement, never having seen it on this continent. He has housed out the wrong side of the wall string marked A. He had better take his hatchet and chop that piece of stuff into kindling wood, and get it under his glue pot, quick, before the foreman sees it.

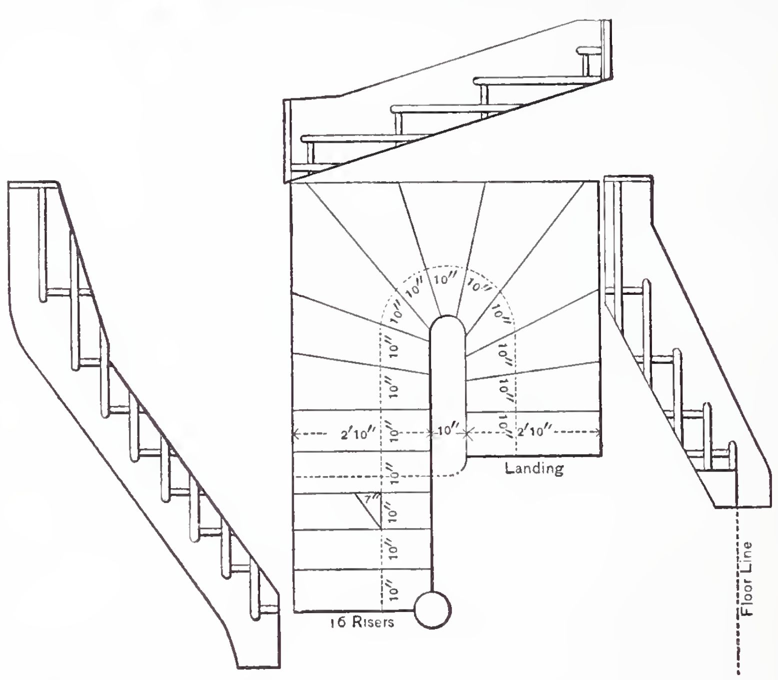
He recommends a templet to be used with the pitch-board. To hold a templet 5 or 6 inches wide, close up to the edge of string, and hold the pitch-board close up to the templet and close down to the string while using the marking knife, would be troublesome. Usually a gauge line is run down the string on which the pitch-board is laid, with the rake on the line, and a careful stair builder will use a rod or some method of marking the angle of each step on the gauge line, so that the same exact spacing will be used on each string, to insure their agreement; and this is just where a learner is liable to be not sufficiently careful, as it is easy, in using the pitch-board, to make a variation of 1-64th of an inch, which may become 1-32d of an inch next step, and be continued, and probably increased, the end of the string—then it is found, when the risers are set, that they don't square with the string.

H. W. C. gives a 9-inch tread with 6-inch riser. A very chopping kind of step. It is a well-settled and common-sense principle that the shorter the riser the wider the tread should be. Seventeen inches (never less than 16 or more than 18 inches) may be taken as the measurement of tread and rise together. Find the run and fix nearly the width of tread you can use; then an 11-inch tread will give a 6-inch rise, and a 10-inch tread a 7-inch rise, and so on, there remaining generally a fraction to be added or deducted, as the length of run or hight of story may require. In 12 flights the writer has built during the past season, the rise varied from 6 15-16 inches to 7 9-16 inches, and the tread from 10 inches to 11⅛ inches.

H. W. C. says lay down a plan of winders the full size the pitch-board would give the flyers. A singular direction, unless he means on a cen r line or on the traveled line. In such articles as this of H. W. C., the intention is supposed to be to convey instruction to learners, and nothing should he said and nothing appear on the drawing calculated to mislead the student. Perhaps the drawing was not engraved exactly as drawn—there is no scale to which it will work exactly.

H. W. C. has a singular idea of easing a wall string. None of his lines intersect on a level at the angles, or intersect at all, in fact. One of the purposes of the easing is to get a level line on which to make the proper miter for the molding at the angles. H. W. C. makes the edge of string drop down close to the nosing of one step and keeps 5 or 6 inches off at another, and if the square is put on either end of the string it will be seen that the curve either rises above or falls below. That will never do, brother chip; when the foreman comes round he will send you over to Windsor to help finish that barn and set another man on these stairs. And what is the bottom edge of wall string eased for? Is it proposed to plaster on such lines? If so the plasterer will be liable to get excited and say bad words. But perhaps this is English? In America the line of the front string governs the shaping of the plaster finish of soffits of stairs. So much time was occupied in easing the wall string there was none left for easing the front string to the floor—where an easing is usually required.

H. W. C. always glues his wall string up 14 inches wide. The learner will do well before he glues up to find what width he can run his winders in; 16 inches may be called for, or 12 inches may be sufficient in some cases. H. W. C. says there is no particular "rake" for the line on which he starts the lay-out of his wall string; the learner will find there is a "most partikler" rake. If he pitches his step too high he will work out at one edge before he gets to the bottom, and if he pitches too low he will work out at the other edge. If 6 inches margin is required above the nosing line, mark 6 inches from the edge, lay the pitch-board with the rake on that line, or on the edge of string either, precisely as for making the steps; cut off the string by the pitch-board; now add together the widths of all the winders or parts of winder that come in this piece of string, and divide by the total number of winders or parts; if 5 winders come in and the total is 60 inches, the average is 12 inches. Set your square against the end of string just cut off, and square over at the point where you have 12 inches to the 6-inch margin line you marked, then if the pitchboard shows you have room enough for your rise without running out at the bottom, the stuff is right width and you can lay out the steps quite sure you will come out the right distance from the edge at the finish.



Stairs Laid Out with only Four Winders in Cylinder, showing Strings Ready for Housing.—Accompanying Letter from B. P.

H. W. C. says in setting out strings the pitch-board is the face of the easer and top of the thread; if it is so on the wall string, it can't be the same on the cut string, certainly. He says 10 inches wide for the cut string—a 10-inch cut string looks rather poverty stricken. And then he gives directions for veneering the cylinder. With such a common staircase—no turn-out at the starting, 10-inch string nor easing to the floor—a veneered cylinder would be like a pair of lavender kids on H. W. C.'s hands going to work.

Drawings ought to show as nearly as possible the manner in which the work is done. H. W. C.'s risers look as if they rested on the steps. The last one is actually set on an inch or two. The joist appears to show both end and side, while the landing tread, which should meet the floor on the center of the timber, appears about twice the width of the regular treads. And is there no cylinder here? and if there is, how will it be placed? H. W. C. sets up so many stumbling blocks for the learner that it almost suggests——well, I will stop here.

How Shall that Gate be Kept Closed?

From A. H., *Harrisonburg, Va.*—In the November number of *Carpentry and Building* there appeared a communication from T. G. D., of Quebec, entitled "A Puzzling Question." I think possibly I am able to offer a satisfactory solution, but before attempting to do so, I want a little more information as to your correspondent's requirements. Is the gate to keep out cattle, &c., or men and boys? If it is wanted to keep out stock I am prepared to furnish a plan through *Carpentry and Building* which will just fill the bill. If that is not what is wanted, however, there is no use to go to the trouble of making the drawings. Hence my inquiry.

From T. A. F. E., *New York.*—T. G. D., who lives in Quebec in a terrace of five houses, comes to the readers of *Carpentry and Building* in a quandary. He has a back gate used by the other occupants of this terrace, and which some of them refuse to keep closed during the bewitching hours of night. Perhaps I may misunderstand the intent of his questions and read them too literally, but it seems to me he could solve his difficulties in one of several ways. I note a few.

First he wants to know how to arrange it that when the gate is open the key may not be withdrawn. Let him, primarily, assure himself that the gate is really open. Then let him send for some stalwart blacksmith—one with a biceps of not less than 30 inches, if possible—requesting the brawny smith, per messenger, or by telephone, to bring a 40-pound sledge hammer with him. Then let the blacksmith roll up his sleeves, swing the sledge around his head, and smash the handle off the key close to the lock. This will prevent the key being taken out. Or let him tie to the gate, close to the lock, a bull-dog with a naughty eye and a bad record. This also will make it difficult to get the key out.

But, asks the correspondent finally, how shall I keep the gate closed without quarreling with my neighbors? My suggestion would be by going into the house and retiring to bed as soon as he has the gate securely fastened.

Failing in all these ways, it seems to me an effectual method would be to brick up the gate every night and have the bricks taken down in the morning. A salient feature of this plan would be that he would have the wife and family of the bricklayer to rise up and call him blessed. If, however, none of my suggestions are satisfactory to T. G. D., I advise him to leave Canada, with its terraces and open gates, entirely, and come over into the great and glorious republic of the United States, where a man would be likely to keep the gate closed from his window—with a shot-gun.

Estimating the Cost of Stair Building.

From B. P., *Jacksonville, Fla.*—How do builders estimate the cost of stair building? The material may be figured out easily, but the labor appears to most builders an unknown quantity. Referring to my "mem." book, it appears that the twelve flights which I erected during the past season required, in all, 261 days' labor, including my own time. I made the working drawings, set out all the work and worked as much as possible. Two flights were straight, two straight with turnout at the starting, four started winding one-quarter, two winding one-quarter to the landing and two winding one-quarter, with regular treads above and below the cylinder. All but two were bracketed, riser mitered to fillet, string rebated and beaded. Cylinders in all but one case glued up with staves and doubled. Wall string molded in every case and the easings worked by hand. Two were 12-feet story; the rest 15 to 16 feet. Rail in two cases, 2½ x 4½ inches; one case, 3 x 5 inches; two cases, 4 x 5 inches; the rest, 3 x 5½ inches. Newels were supplied ready to set.

Joining Wing Roof to Main Roof.

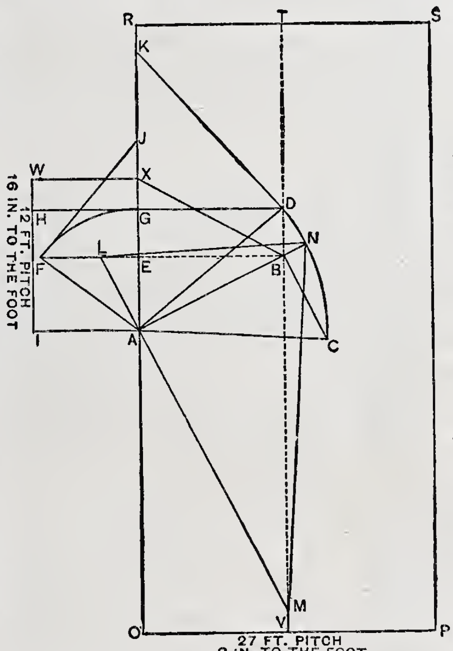
From A. H. F., *West Meriden, Conn.*—Having read in the January issue of the *Carpentry and Building* of a method of joining the roof of a wing to that of the main building, as given by A. J. H., with a request to be set right if found wrong, I am induced to send the inclosed, merely calling the attention of A. J. H. to the principle of obtaining the bevel for the cut across the top of the valley rafters, as that given by him makes too sharp a bevel, the error becoming more apparent as the roof is increased in steepness. The plan supposes a wing 12 feet in width, with roof rising 8 feet, to be joined to the side of the main building, the roof to which has a span of 24 feet, with a rise of 8 feet. In the first place, I wish to show the bevels for the rafters and roof-boards when valley-rafters are unnecessary, as well as when the job is a small addition.

First, draw the seat lines over which the valleys are to be placed. From their point of intersection, as at B, erect a perpendicular to one of them, as B C, which make equal to the hight of the roof at that point. Connect C and A, thus finding the length of the valley, and by its inclination with A B, its pitch. From the point where the seats of the valleys intersect, erect B D of indefinite length and perpendicular to the seat of the ridge B F. With radius A C, the length of the valley, and from A as a center, describe arc C D, cutting B D at D. Connect D A. Let A E be the seat of a common rafter. At E erect the perpendicular E F, which make equal to the rise of a common rafter. Connect F A. Then will A F be the length of a common rafter. The angle F A E gives the level bevel across the foot, and the angle E F A the plumb bevel at the head of both the common and jack rafters.

When valley rafters are employed, instead of using the level bevel F A E at the foot of jacks, use plumb bevel E F A. With A as a center and length of rafter A F as radius, describe arc F G, cutting extension of seat A E at G. Connect D G and extend to H. Then will H D represent the ridge, D A the valley, A I the plate, and I H the rafter at gable. The whole, inclosing one side of the roof, can be spaced off for the rafters, thus giving lengths and top bevel of the jacks. H D A gives the bevel across the side of the roof boards where they meet the valley. To find the bevel across the edges of the roof boards where they abut against the boarding on the main roof, we draw from F, and perpendicular to rafter A F, the line F J, meeting the extension of seat line A E at J. Take the length J F and lay it on an extension of A E from G to K. Connect K D. Then G D K will be bevel across the edges of the roof boards. We have obtained this bevel by supposing the edge of the board to lie in the plane of a roof whose pitch forms a right angle with the roof in question, as is the case in a roof of one-half pitch, where, by the way, as the two sides are of equal inclination, and form with each other the same angle that the side of the roof boards do with their edges, the bevel on the edges of the roof boards is the same as that across the side.

To obtain a clear idea of the relation of these lines to each other, we will try to put them in their proper place as they might appear in the roof itself. Looking at the triangle A B C, we find B C to be a plumb line; therefore we imagine it rotated on its base A B until B C stands perpendicular to the plane of the paper, which would bring the valley C A to its proper position. E F in the triangle E F A being a plumb line, we rotate the triangle on its base A E until the rafter A F comes to its proper place. Having now the valley and a common rafter in place, we next raise the roof H D A I by rotating on the edge of plate A I. When at its proper pitch we find G resting on F, and D on C, while the triangle D G K, attached by its base G D to the ridge D H, has changed its position, K resting on J, and the line K G becoming identical with line J F. The line D K would then be the valley for a roof having the inclination J F, which is square from the pitch A F, the two pitches having the same relation to each other that the edges of the roof boards on pitch A F have to their side.

When we employ valley rafters we obtain the lengths of our valleys, as before stated, where A C gives us our length. A C B shows the plumb or down bevel at the head, and B A C the level bevel along the foot. To obtain the bevels across the top of the valley rafter: From A draw perpendicular to A B line A M to its intersection with the seat of ridge B M; also from A draw perpendicular to A B line A L to its intersection with the seat of ridge B F. Extend the seat A B of the valley rafter to N, making it equal to the length of rafter A C. Connect L N and N M. Then will A N M be the bevel for the top of that portion of the rafter resting against ridge over B M, and A N L be the bevel for the top of that portion of the rafter resting against ridge over B F.



Joining Wing Roof to Main Roof.—Accompanying Letter from A. H. F.

The reason for obtaining the line L M is that it is the intersection of the plane in which the top of the valley rafter, when in position, is found, with the plane in which the top of the plates is included. The lengths and bevels are considered as applied to a center line along the upper surface of the rafter, which is shortened by deducting one-half the thickness of the ridge pole. An additional deduction in the case of jacks should be made of one-half the thickness of the valley rafter, in all cases measuring back square from the surface of contact. When sawing the joints for the valley on the roof boards and jacks, labor and stock may be saved by making this joint midway, instead of at the end of the piece, as the surplus will have the joint ready fitted for the valley to the opposite side of the roof. Take the precaution, where a stick is thus cut into two jacks, to let the camber favor the longer one.

A Cheap Set of Plans.

From A. M., *Cortland, N. Y.*—I inclose subscription for *Carpentry and Building* for another year. I am very much pleased with it. I used one of the plans published in one of the earlier numbers of last year, in the construction of two houses which I have just finished. I am glad to be able to say that they are considered the nicest-looking cottages for the cost (less than $1000) in our town. I found the plans to work out well and to make a very convenient cottage. I feel under obligations to you for so good a plan at so small a cost.

Black Lines in Certain Designs.

From W. C. D., *Ashland, Oregon.*—I would like to have the following answered through *Carpentry and Building*. Do the black lines on face of bracket in the design published on page 90, May number of last year; also on face of window finish, page 57, and in the panel between window and end of porch, in the fourth-prize design, represent painted lines, or are the figures cut through?

Answer.—The black lines referred to by our correspondent represent cut work rather than painted work. In the places where they are used cut work would be much more appropriate than painted work, although a close imitation of cut work could be produced by the painter's art. In engraving designs where only black lines can be used to produce effects, it is sometimes hard to indicate how certain parts are to be constructed. The lines to which our correspondent alludes might represent painted patterns, but the nature of the work demands cut work instead of paint.

Day's Work at Shingling.

From C. L., *Litchfield, Mich.*—I have been very much interested in the discussion of how much constitutes a day's work at shingling. It seems to me we have got some very fast shinglers among the readers of *Carpentry and Building*, particularly C. N. P., of Allegheny, and the man that he speaks of, who carried 5000 shingles up an 18-foot ladder and laid them in one day. I do not say that he could not carry that many shingles up the ladder in that time, but I would like an explanation of how he laid them. Let me propound one or two questions. How can 5000 shingles be crowded upon 580 feet of roof? It takes 655 shingles 5½ inches to the course to cover one square. Hence, it would require 3799 shingles to cover 580 feet of roof. Where did this fast workman put the other 1201 shingles? I think all of us could be fast shinglers if we figured in this way.

It seems to me R. L., of Buffalo, hits the nail on the head in the matter of shingling, and his directions are worth careful attention. For my part I don't want any of the fast shinglers to work for me. If a man will carry on to the roof and lay 2000 shingles in a day, doing it well, putting two nails in each shingle, I am satisfied.

From J. E. W., *Royalton, Wis.*—In all the talk on shingling in your columns, I do not see anything about using a straight-edge instead of a line to lay the shingles by. R. L. may laugh at me, and say such things may do out in Wisconsin, among the farmers, but I am free to confess that I use a straight-edge, and think I can lay 3000 in that way where I could only lay 2000 by a line. My plan is to procure enough straight-edge boards to reach the length of the roof, and gauge them to the width that my shingles are to be laid to the weather, thus obviating the necessity of measuring, chalking the line, &c., for each course. I place my straight-edge in position and fasten it by tacking it to the roof with a nail partly driven in at each end, leaving the nail out enough so that it may be taken hold of with the claws of the hammer when necessary to raise it for the next course. I take my armful of shingles and place the whole course before I nail any, and then nail the whole course. In this way I can put on more shingles than any man I ever saw who used a line.

I agree with S., of Indiana, that a No. 1½ Maydole hammer is far ahead of any hatchet for shingling, and also that one blow is as good as forty on a shingle nail. R. S., of Buffalo, finds fault with driving a nail at one blow, as he says it shoots the nail head half way through the shingle. If a man is doing much shingling, he knows how hard to strike a nail to drive it just far enough.

From L. W. T., *Upper Alton, Ill.*—The record of S., of Indiana, is 109 feet in two hours, or 5 squares and 40 feet in 10 hours. That Maydole hammer (claw)! It would take considerable clawing around to accomplish the feat. That hawk-bill knife (the novelty of a shingler's kit) would be splendid to "hook" things in fast—no trimming or guessing allowed. If he had only used a hedge-hook and a pair of sheep-shears, he could have laid 11 squares "just as easy." You May dole that out to your patrons, David, but the old suckers will be incredulous.

Next comes C. N. P., Port Allegheny, Pa., at the rate of 6 squares per day—10 hours. Who says he is not bragging? Well, who said he was? He shingles from right to left for various reasons. How would it do to adopt the craw-fish plan of locomotion? Adopt the Maydole kit, with the old sucker addition, and beat the best time.

Then comes sweepstakes, G. E. W., Royalton, Wis., at the rate of 7 squares in 10 hours, and offers to do it again. For the sake of all that is dear to you, G. E. W., d-o-n-'t! It will wipe out the building business before we are rich enough to retire. If you don't stop, I will strip for the fight and put on about 15,000—squares a day. There, now!

From J. V. *Canandaigua, N. Y.*—With several years' experience, and with a great many different hands, the average day's work with me has not been over 2000 shingles. I agree with R. L. as to driving nails, but not at all as to the number of nails with cut or sawed shingles. I would not myself, nor would I allow my men, to put more than one nail in a shingle except in last course, unless it were necessary to make it lie down to line over. I believe the shingles are less liable to check or rot, and though not making quite so smooth a roof, will make one which will last very much longer.

Rule for Laying Out the Rail in a Cylinder for Stairs.

From B. P., *Jacksonville, Fla.*—In November *Carpentry and Building* L. M. D., Hastings, Minn., asks for "a simple rule for laying out the rail in a cylinder for stairs." If L. M. D. were to look into the matter he would find that the "simple rule" he needs would cover a good deal of ground, and require a good deal of time and close study to master. When I was an apprentice lad, long years ago, a simple formula was given me, with the information that in a few years a good hand-rail could be got out that way every time. L. M. D. can have the benefit of it, with the assurance that it is of universal application and may be relied on. Here it is:

	Parts.
Brains	25
Study	25
Practice	50
Total	100

Every builder should have one man competent to lay out and execute stair-work; then he should select a smart youth and let him work with his stair hand and learn the business properly.

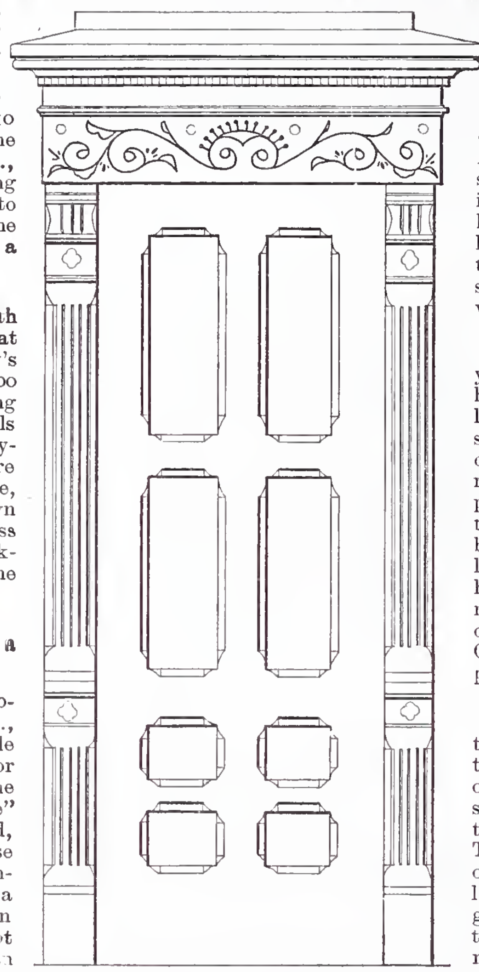
Preservation of Ropes.

From B. F. L., *Tiffin, Ohio.*—Will you please inform me, through *Carpentry and Building*, what is the best thing to put on ropes to make them last well? A friend of mine advises me to use linseed oil. Shall I follow his suggestion?

Answer.—Sperm oil is, we believe, what is used during the process of manufacture. If our correspondent's ropes are to be used out of doors, a coating of tar is probably the best that can be employed. A tarred rope is not quite as strong as one that is not tarred, but it is far more durable. Tar contains an acid which injures manila fiber so that its strength is considerably impaired, but it keeps the wet out of the center of the rope, which more than makes up for the injury it sustains. In ships, all the standing or permanent rigging is of tarred rope. If the rope is not tarred, any kind of grease will probably improve the wear of the rope by keeping it safe and pliable. We hardly dare to recommend linseed oil, however, because it hardens with time, which might have a tendency to injure the rope. Sperm oil, fish oil, and even tallow would seem to be better for the purpose. In making splices in ropes it is always considered a good plan to grease the ends with tallow. Fresh tallow only must be used; that containing salt attracts moisture, and accordingly would be likely to keep the rope wet.

Design of Door and Door Trimming.

From W. T., *Newark, N. J.*—The inclosed elevation and detail of door and trimming represent a design which I have encountered in my daily work, and which I have thought would be of some interest to readers of *Carpentry and Building* to inspect.



Design of Door and Door Trimming.—Contributed by W. T.—Scale, ½ Inch to the Ft.

The small panels into which the door is divided, the design of the hood and the general features of the composition, remind one strongly of the patterns which were in vogue 50 years ago, and examples of which are to be seen in some of the houses built in our grandfathers' time which are still in existence.

I am told that, with the revival of old styles generally, designs of this particular character are considered in and about New York quite the proper thing. The tracings I inclose are from drawings of an architect of considerable note, whose name I will not mention lest he should think an injustice was done him in presenting a detached fragment of his work, apart from those portions which supplement it and show it off to best advantage. There are some features about the door and trimming with which I am well pleased. I like the finish of the stiles and rails against the panels, and I like the lines in the trimming in the shape of grooves. But I am quite free to say I have seen caps which I like better than this one. It seems to me, also, that something better than the scroll design shown in black lines could have been used above the door.

I would like to see designs of doors and trimmings and other features of interior finish from readers of "our paper," published in *Carpentry and Building* as a regular thing. It seems to me a comparison of the designs which we are required to execute in the course of our business, together with a discussion of their merits, cannot fail to result in good to all who engage in the work as well as be an indirect advantage, to the general reader.

Gum on Oil Stones.

From S. D. R., *Albia, Iowa.*—I offer the following in answer to the question of W. G. S., published in the December number of *Carpentry and Building*. The experience of your correspondent is not an exceptional one. If the oil-stone is good, free from seams or hard spots, take coarse, sharp sand and put it upon a board or marble slab, using water with it, and grind down the face of the stone. If it is not a good stone throw it away and get instead a first-class Washita of uniform color and grain. Put it in a box having a lid, and when not in use keep covered to prevent the accumulation of dust. Use kerosene and sweet oil, equal parts, upon it. After sharpening tools, clean the face of the stone with a cloth. Never leave the iron or steel cuttings to settle in the pores of the stone. By following these directions, I believe W. G. S. will have no further trouble. I have been using kerosene oil for the last ten years without the slightest change in the temper of my stone. I always find it ready for use when wanted.

From W. A. J., *Wallingford, Conn.*—If your correspondent W. G. S. will take a half sheet of coarse emery cloth or paper, lay it on a smooth piece of board, emery side up, and turn the oil stones face side down upon it and rub it briskly for a few moments on the emery, all gum will disappear without the aid of turpentine or anything else. It will also keep the stones from becoming concaved, as they always will unless they are faced off now and then. I have faced off a stone in this way in ten minutes that would take two hours' grinding or scouring as I used to see it done. Coarse sandpaper will answer the same purpose, but it is not half so good.

From J. E. W., *Royalton, Wis.*—In answer to W. G. S., of Chattanooga, I would say that I have tried turpentine with sweet oil on oil stones with not very satisfactory results. In fact, I never found sweet oil to be the thing in whatever way you may mix it. The best oil I have ever used was sperm oil of the best quality I could get. Good No. 1 lard oil mixed with a little kerosene is very good. I have used kerosene a good deal in the past 10 years, and my experience does not uphold the popular notion that it hardens the stone.

From L. W. T., *Upper Alton, Ill.*—If W. G. S., of Chattanooga, will take one gill of coal oil and one table spoonful of melted lard, mixing while warm, for use upon his oil stone, he will not be troubled with gum. I have used the above preparation for about 16 years, and have never found it to injure the temper of the stone.

Division of Labor in Building Operations.

From H. J., *Quincy, Ill.*—In your November number I noticed a communication from L. M. D., of Hastings, Minn., who wished to learn how to lay out hand railings for the cylinders of stairs that he is building. As he does not give even the shape of his stairs, I think he has very little knowledge of hand railing, and would advise him to employ a stair builder to put up his rail, or, at least, have a stair builder make the parts over cylinders. He will not only get a better job, but get it cheaper. If there is no stair builder in his locality, he can send a sketch of the stairs as built to some stair factory.

If carpenters and builders would make it a rule to let out their stairs to a stair builder, same as they contract for their brickwork and plastering, and if they would buy their sash-doors, blinds and moldings from the factory, in the place of making them by hand, and would keep a separate class of men to do rough work, such as laying joists, floors, shingling, &c., and employ joiners to do their inside work, such as hanging doors and finishing the building, they would profit by it, and there would not be such a vast difference in their estimates on work.

We are at present paying such men as do shingling $1.50 per day; they will lay 2500 shingles a day on a large straight roof. Shop men we pay $2 per day, and I am satisfied they would not average 2000 shingles per day. We have a man that will hang 20 doors in 10 hours, and do it better and easier than others equally as good on average work who can only hang 10 doors in the same time. Every successful builder knows this to be true, and has an advantage over his competitors who may only have three or four men to complete an entire building. One man can buy his lumber as cheap as another in the same locality; consequently, he can only save in the labor and management on the job. As a general rule, builders in the West are poor in purse. A few who had saved money before machinery was introduced, have lost it again by persevering in making their own doors, sash, blinds, moldings and stairs. I think builders should look into this matter, and save a little for old age. I would like to hear from others on this subject.

Brace Rule.

From W. K. I., *Rockland, Ind.*—L. R. C., in the October number, asks for a brace rule, and several have given methods for cutting braces. I am a young mechanic, but will give the method I follow for what it is worth: Add together the rise and run, take one-half, multiply by 17 and divide by 12. *Ex.*—To find the length of a brace for a run of 4 x 3 feet between shoulders:

$$4+3=7\div2=3\tfrac{1}{2}\times17=59\tfrac{1}{2}\div12=4\text{ ft. }11\tfrac{1}{2}\text{ in.}$$

This is mathematically correct. I cut rafters by the same rule, applying the framing square to the timber in the same manner as in other methods for obtaining the bevels. This method does away with lengthy operations in square root—the square root of 1 foot by 1 foot run being 17 inches—and will give the length of brace or rafter for any rise and run; also, the rule reversed will give the "run" of brace or "pitch" of roof, the length of timber given.

Problem of Areas.

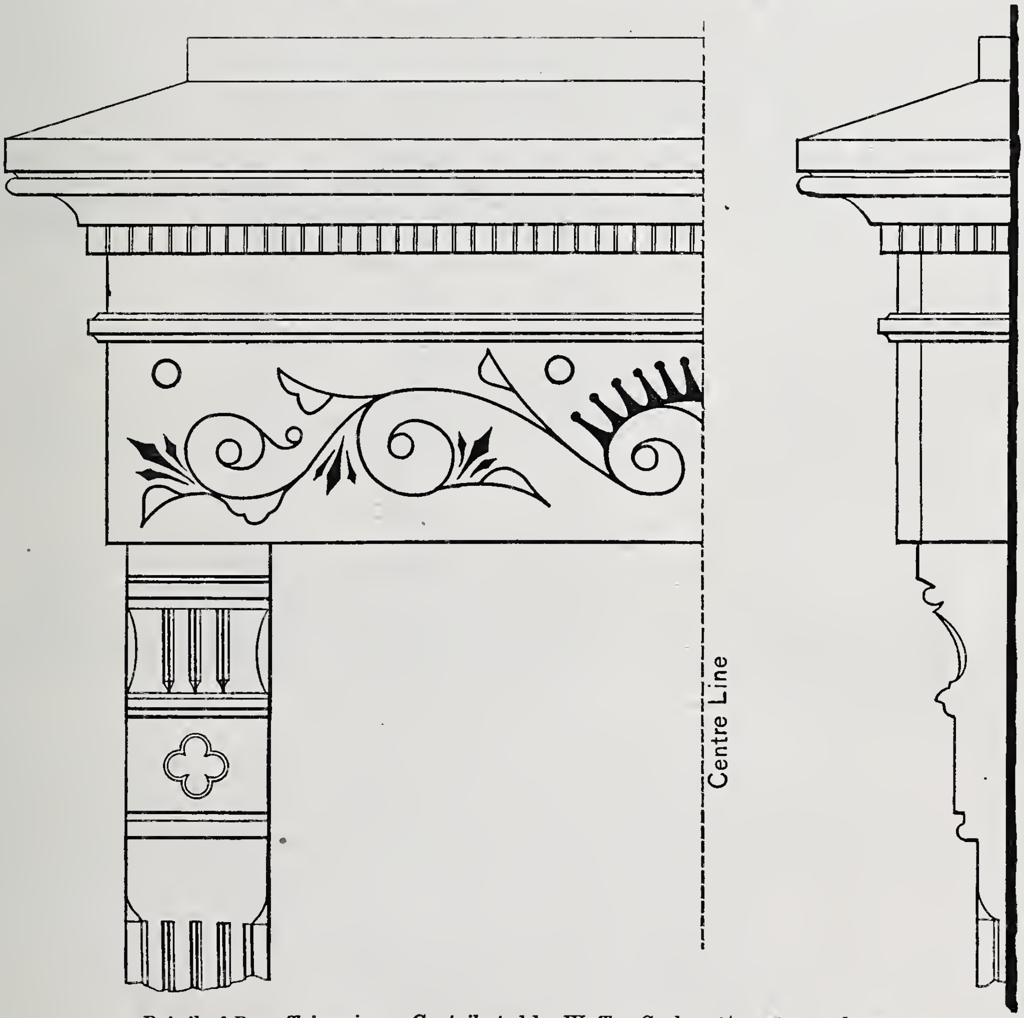
From J. S., *Fremont, Ohio.*—I am puzzled over the problem of areas published on page 119 of the volume for last year, and would be obliged for further explanation. In remarks in connection with the problem, it is stated that the spindle-shaped strip shown in Fig. 2 makes the additional square, but it seems to me there are 65 squares without this strip. Yet if the squares be arranged again in their original shape, as shown in Fig. 1, there are but 64. I frankly acknowledge my inability to comprehend the problem.

Answer.—Our correspondent's mistake occurs in supposing that the second figure (Fig. 2, page 119) contains 65 squares besides the diagonal piece—which is described as spindle shaped. All the spaces through which this strip passes, it will be seen by inspection of the diagram, are elongated. They contain just as much more than the squares as the amount shown between the diagonal lines passing through them. The whole figure would seem to contain 65 squares when calculated by multiplying the number in the end (5) and bottom (13) together, but since we know from the first figure that there are in reality only 64, we readily argue that the apparent increase of one square is contained in this space. This is arriving at the conclusion in a manner somewhat different from that followed in the original presentation of the question, but it may serve to enable our correspondent to comprehend the principle involved. The result is susceptible of proof by calculation. If the area of the several squares and parts of squares in Fig. 2 be obtained, their sum will be found to equal the 64 squares in Fig. 1. And further, if the area of the spindle-shaped piece contained between the joint lines be calculated, it will be found to be equal to one square. Hence the second figure contains 65 squares, but it does not consist entirely of the pieces cut out of the first figure. The first figure contributes 64 of the squares, while the extra square is furnished by the space between the pieces as they are placed to form the second figure.

Indefiniteness in Receipts.

From O'BAZ, *Mt. Vernon, N. Y.*—Not uncommonly I find receipts from some of your many correspondents, as well as in "universal" receipt books," &c., so carelessly prepared as to seriously curtail their value, inasmuch as to determine the writer's meaning it would be necessary to resort to, perhaps, expensive experiments.

The oversight I more particularly refer to consists in the absence in giving proportionate "parts" of different ingredients, of any clew to the peculiar measures of the same, as of weight, volume, &c. Instance: Who will tell what I mean by "equal parts of hydrogen gas and mercury," or "7 parts popcorn to 3 of molasses"? I hope the hint will be taken largely, and, withal, kindly.



Detail of Door Trimming.—Contributed by W. T.—Scale, 1½ Inches to the Foot.

Blackboards.

From G. L B., *Cohoes, N. Y.*—You will oblige me if you will give me a recipe for making blackboards on school-house walls. The walls are plastered—I think they call it the browning coat—and have been blackened before, but they wear off, and have to be blackened over again. You will confer a great favor if you can give me the benefit of your knowledge.

Answer.—The best material for a blackboard that we have ever used was a large slab of Vermont slate set in the wall. This never wears out so as to need repairing. It is, however, somewhat costly, and we suppose that it is out of the question for our friend to think of using it. Next to this is probably a good black paint with a sharp tooth. Such a paint may be made by mixing flour emery with shellac varnish, and then adding as much ivory black as is needed to give the proper color. If too thick, more alcohol should be added. Silicate paint for blackboards can be obtained of almost any dealers in school supplies, and any stationer can order it. This comes in small tin cans, and is quite similar to that which we have described. It is to be diluted with alcohol when it gets too thick.

The constant action of the chalk upon the surface of the board wears it away, and hence paints of all kinds must be expected to wear off. As they are not costly, however, it is not an expensive matter to repaint the board whenever it becomes too smooth. If done on Saturday, the board will be ready for use on Monday morning, although a little care may be needed for the first two days of use.

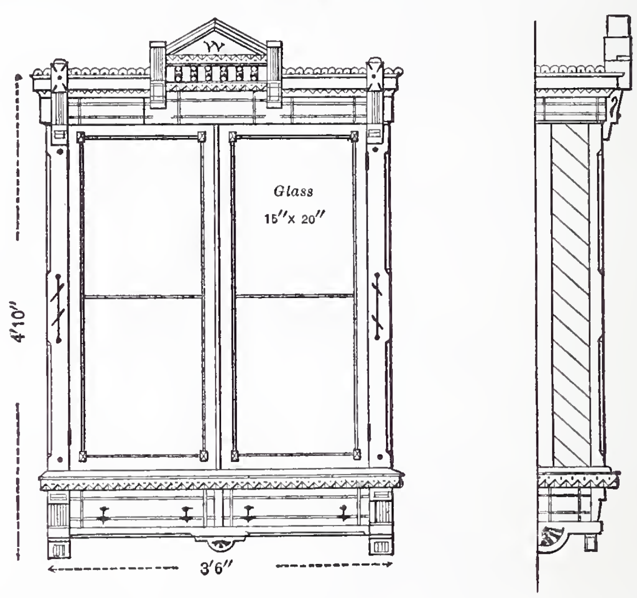
Patent on Method of Shingling Hips of Roofs.

From M. P. E., *Middlesex, N. Y.*—One of the subjects of discussion in the correspondents' department that has attracted my attention was the manner of shingling the hips of roofs. In the October number, among other plans, was one from C. M. M., Malden, Ill., which consisted of dropping the first shingle to the bottom of the preceding course, letting the outside edge come to a line with the course to be laid on the opposite side, making a double course on the hip. By this arrangement a lap comes first on one side and then on the other, the same as in the old way, only leaving a long corner from the last course laid to the one below. The idea is that by this construction the corner will not curl up and check off, as in the usual construction. Having occasion to shingle some hips, it occurred to me to try this plan, and I write to give an account of the results. In a few weeks the owner of the premises was requested, by a traveling man, to pay a royalty for it, as it was Holcomb's patent. He threatens to prosecute in the United States courts, unless his demands are paid. Now, I desire to ask, do you or your readers know anything about a patent on this device? If so, when was it issued, and what is the proper way to investigate the matter? We don't propose to give our money in that direction.

Answer.—It is a matter of surprise to us that any one claims a patent upon this device. We cannot say positively, but we are under the impression that it has been in common use in certain sections of the country for a long time, much longer than the life of a patent. We never before heard of it being patented, and, without further information than is at hand at present, we would think it possible that the claim made for royalty was altogether fictitious. It is barely possible, however, that a patent is in existence. To determine this, a search would be necessary through the records of the Patent Office. An exhaustive search can only be made in person or by an agent at Washington. By going to any library in which full sets of the Patent Office reports may be found, satisfactory information might be obtained by simply looking through the indexes. Before any royalty can be collected, it will be necessary for the parties to show the patent, or a certified copy of the same. By this means our correspondent ought to be able to obtain such data as will enable him to determine the nature of the demand. If any of our readers are able to furnish any information upon this point, we trust they will write us at once. We publish this letter, which comes to hand just as this number goes to press, without first taking the time to look it up ourselves, in order that our readers may be on their guard. As soon as we can investigate the subject, full particulars will be published in these columns. The plan to which our correspondent alludes is published on page 198 of volume for last year.

Design for Wall Bookcase.

From H. W., *New York City.*—I send you herewith a design for a wall bookcase, an article of furniture which should come into more general use than at present. It is a thing which is very useful in small rooms, although it is not necessarily out of place in those that are larger. This design has the merit of being easily executed, and is therefore cheap. It should be screwed to the wall by means of large screws. If care is taken to secure a hold in the timber, two of them will be sufficient.



Design for Wall Bookcase on Brackets.—Contributed by H. W.—Scale, ½ Inch to the Foot.

REFERRED TO OUR READERS.

We have several times called our readers' attention to the importance and usefulness of the department of correspondence. We are in the habit of publishing, from time to time, such questions as are likely to draw out answers from our subscribers, and such as it would seem are likely to prove desirable topics for discussion. We appreciate the value of answers straight from the work-bench, and are sensible of the fact that almost every problem admits of more than one solution. We therefore cordially invite all our readers to co-operate in keeping up the interest in this department of the paper. Send along practical questions for answer, and at the same time answer, wholly or in part, some of the questions which have preceded you. Do not wait for some one else to write. Very likely that very "some one else" is waiting you, and therefore those who really need the information are deprived of it. The apprentice boys and young workmen should not hesitate to write. Their information is fresh, and ought to be easily put in shape. It will not be hard for them to get ahead of their bosses in many cases. Some of the best letters we have received so far have been from those who have described themselves as beginners in the trade. We hope all will co-operate to render this department of intercommunication even more valuable in the future than it has been in the past. We publish a number of queries below, which we hope our readers will consider at once and send early answers. To insure publication in the next issue, answers should reach us by about the 10th of the month. Where cuts are to be made, even a few days earlier would be desirable.

Ventilating School Rooms.

From L. S. C., *East Machias, Me.*—I notice that the December issue of *Carpentry and Building* shows me in the ridiculous light of asking "if a register from a furnace should be placed near the ceiling of the room?" I have no copy of the communication sent, and it was so long ago that I have forgotten the wording used; but my intention was to inquire about ventilating registers and pipes, and, unless greatly mistaken, there was no reference at all to heating pipes. The school room in the case which prompted the inquiry is heated by two cylinder stoves near the main entrance doors, and the plan we adopted was a 24-inch circular register in the center of the ceiling, but, contrary to my opinion, not directly connected with the hood on the outside, but opening into the large space of the attic, and the bad air escapes through the hood as best it may. An equally objectionable feature, to my mind, is the unnecessary waste of heat.

Please correct the error spoken of and use so much of this as, in your judgment, will lead to more light on the principles involved, by discussion or otherwise. The school room is intended to accommodate from 50 to 60 scholars. My inquiry was whether ventilating pipes and registers should be proportioned to the number of scholars or the area of the room, or both.

Note.—Our correspondents' wants are now so carefully set forth that our readers can have no doubt as to his needs. We trust that his letter will call out the amount of practical discussion, together with the records of experience, that the importance of the subject demands.

Keying an Arch.

From S. B., *London, Ont.*—I desire to suggest a practical question for discussion to the readers of *Carpentry and Building*. What is the best method, or correct method, of keying in a pointed arch with brick, such as a Gothic arch, a Tudor arch, or those represented in *Carpentry and Building*, pages 28 and 29 of last year's volume? Communications upon this subject should be illustrated, showing the point or points to which the bricks should radiate. In explanation of my question, I would say that there is a diversity of opinion among bricklayers as to which is the correct way of accomplishing this matter. A discussion upon the part of the readers of "our paper" will probably bring the best method to light.

Test for Linseed Oil.

From S. W. J., *Shelbyville, Ill.*—Will some reader of *Carpentry and Building* forward for publication a practical and reliable test by which the purity of linseed oil may be known?

Plan of Baptistery.

From C. W. C., *Burkeville, Va.*—We are about building a church near this place, in the country, and in view of this fact I will be glad if some of the readers of *Carpentry and Building* will furnish me a plan for a baptistery. I would like to have dimensions, with full directions for construction, together with plan for fitting and completing it. We desire it to be upon the most economical and durable plan. Probably some of your readers who have had experience in similar constructions will be able to accommodate us in this matter.

Full Sized Patterns of Cabinet Ware.

From E. D. B., *Carlysle, Iowa.*—Can you tell me where I can get full sizes of patterns for parlor suits, upholstered chairs, &c.?

Answer.—We have no knowledge of anything of this kind being published. If there be anything of the kind, doubtless some of our readers know of it. They will confer a favor by informing us accordingly.

A Combined Band Saw, Jig Saw and Circular Saw Wanted.

From W. F. R., *Malden, Conn.*—I have a suggestion to make, through the columns of *Carpentry and Building*, to the manufacturers of woodworking machinery. A combined band saw, jig saw and circular saw upon one bed, with a turning-lathe attachment, the bed to be 3 or 3½ feet in length, and the whole run with a good heavy balance wheel by hand, gotten up cheaply and substantially, would be a very good machine for carpenters. The only difficulty that I anticipate in the construction of such a machine is in the item of cost. If it could be produced and sold at a moderate price, I am sure it would take well. One hundred dollars, it seems to me, would be a reasonable price for such a machine. I am sure it would pay me well at that price. I hope some enterprising manufacturer of machinery will put this suggestion to use.

Day's Work Hanging and Trimming Doors.

From G. N. C., ——.—I am very much interested in the department of questions and answers in *Carpentry and Building*, and would like to ask of my fellow mechanics through it what is an average day's work at fitting, hanging and trimming doors of a size, say, 3 feet 6 inches by 6 feet 6 inches to 3 feet by 7 feet? By trimming, I mean fitting and putting in mortice, locks, knobs, &c.

Note.—The question suggested by our correspondent above is one well worthy the attention of builders generally, and may be made a fruitful subject of discussion. From letters already received, some of which have appeared in *Carpentry and Building*, we know that there exists a wide difference in the ideas of mechanics upon this subject. By the records of the results of practical experience, in this matter as in others, much good can be accomplished. Please send along letters upon this subject.

Braces in Truss Roofs.

From E. H. C., *East Rochester, N. H.*—With your permission, I should like to say a little concerning the truss, or braces in truss, that I asked the question about in Vol. I, No. 11, page 219, and the answers given on page 237 of same volume.

I don't like the manner in which L. V. A., of Paterson, N. J., answers, or tries to answer, my question. I think the correspondents' department is a very interesting part of the paper, and of much benefit to the practical mechanic, and that all questions referred to the readers should be answered without reflecting on the questioner's ability. "No one man knows it all." Let us make this department of "our paper" a place for friendly consultation and mutual benefit.

I presume if I had given the size of timbers used in truss, also the peculiar place it occupied and the weight it was to sustain, L. V. A. would have made a different answer from what he did. I will give all the particulars this time, and should be pleased to hear from L. V. A. again.

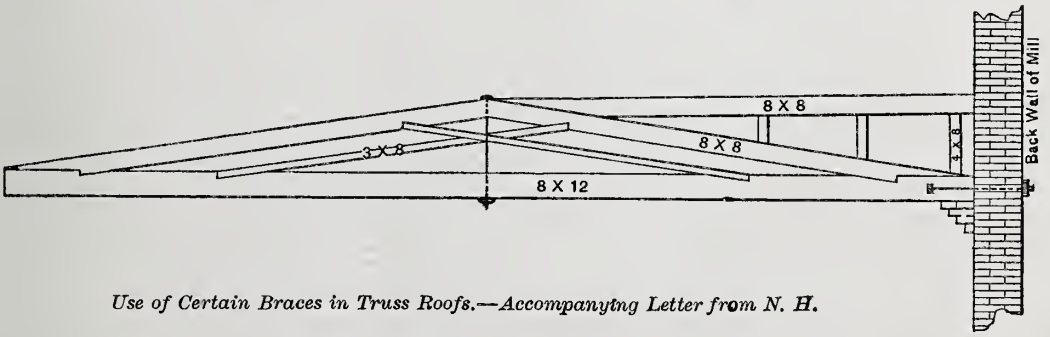
J. J. M., of Newark, N. J., answers the question in a skillful and gentlemanly manner. I shall be pleased to hear from him again also. I inclose another sketch of truss as used, giving size of timber, &c., and refer to the question on page 219, Vol. I, and will add this: How much more load would this truss sustain if it had been used as illustrated on page 1 of Vol. I, Fig. 1?

I will give my reason for asking these questions: During the past summer I was asked to get out a set of plans for an extension to the first story of a four-story brick mill. The span of trusses was to be 40 feet and the rise 3 feet. Trusses were to be placed 8 feet on centers without jack rafters. Roof covered with 3-inch spruce plank and tinned. Under side of plank to be sheathed, with space between. This roof was to be capable of sustaining all shafting that might be used to run machinery in room; also heavy snow slides from slate roof about 40 feet above.

Considering the enormous load this roof would have to carry, I made a plan of truss like the one given on page 1, Vol. I, of *Carpentry and Building*, considering such a truss to be just the thing to sustain a heavy load.

The agent of the company that it was for liked the plan of truss much, and had me commence to put my plans into execution; but before I got ready to put the roof on I was prostrated with a fever, and as they were in a great hurry to have the job completed, they got help from another source and completed it before I got out, but not according to my plan for truss. They thought the latticework would not amount to anything, and did not put it on, and said the braces were of no use after they put them in. I say the braces are of much account, and would have been of much more value if they had put on the latticework. So, to show them that they are not so smart but what there are a few things they don't know yet, I ask these questions, through the columns of *Carpentry and Building*, for the purpose of getting the opinion of a few strangers, "for a prophet hath no honor in his own country;" also for the purpose of trying to keep up the interest of the correspondents' department.

Now, I should be pleased to have the opinion of as many as can make it convenient to communicate anything in regard to these questions that would be of practical interest to builders; also to convince a few persons in this village that "one man don't know it all," for it was by one man's not minding his own business and letting others alone, that my plans were not carried out. If I am wrong I will give it up, but if I am right I want to have it "confirmed by many witnesses," through the columns of "our paper."



Use of Certain Braces in Truss Roofs.—Accompanying Letter from N. H.

Some Questions of Taste and Judgment in House Finishing.

From A. B. C., *Little Falls, N. Y.*—It is within the power of the practical readers of *Carpentry and Building* to furnish me some very desirable information through its columns—information that will be useful to me, and I think to others also. I desire to ask one or two questions upon architectural points: 1. Is it proper to place an O G band molding under the window stool on the outside? Is it proper to place O G band molding on the inside, under the stool-cap? What should be the finish at these places? 2. At what distance from the top and bottom should the butts be placed on doors in hanging them? What is the proper hight from the floor for the knob upon the door? What determines the size of the newel post in the hall? At what distance from the top and bottom of blinds should the trimmings be placed?

Note.—We are disposed to think that many of our readers will give this correspondent the broad answer to each of his questions—"According to taste." Architecture and building is not controlled by set and arbitrary rules. Certain fundamental principles in design, strength, &c., are recognized, and applications of them are made from time to time, according to the taste and judgment of the operator. If our correspondent had changed his questions, and requested a statement of what is good taste or good practice in each of the cases which he enumerates, he would be more likely to receive numerous answers. As it is we refer the questions to our readers, suggesting that there is much room for discussion upon the points raised which may be profitably pursued. We shall be pleased to have as many letters upon these topics as our readers may see fit to send us.

Buildings for Hot Climates.

From F. A. S., *Phœnix, A. T.*—I have carefully inspected the designs for residences, already published in *Carpentry and Building*, but a question arises, Why don't you give something suitable for warm countries? I would be very glad to see published plans for comfortable residences suited to hot climates. I have purchased several books on architecture, but in all of them I fail to find a word about Southern homes. Will not some of the practical builders in the Southern part of the country aid brother mechanics by contributing to *Carpentry and Building* the results of their experience?

Cupola for Stable.

From S. F. F., *Waverly, Va.*—Will some of the readers of *Carpentry and Building* be so kind as to forward for publication a plan of the cupola, suitable for a stable 42 by 100 feet in size, having 20-foot posts?

Construction of Cesspool.

From G. M. N., *Boston.*—Permit me to request of the readers of *Carpentry and Building* information concerning the best method of constructing a cesspool or receiving cistern, into which to discharge the contents of house drainage, including contents of water-closet. The soil into which I propose to sink it is very hard and compact, so I must, I presume, construct it in such a way as to retain both the fluids and solids as well. What shall be the process of cleaning it out, and how shall I ventilate it, as it is to be only about 40 feet from the house?

Swiss Style in Architecture.

From J. A. P., *Eureka, Mich.*—I am about to build a cottage, and desire it designed in the Swiss style. There are no architects in this vicinity acquainted with that feature of architecture. Will some reader of *Carpentry and Building* furnish me with plan, elevation and details suitable for the above?

Design for Gothic Church.

From T. S., *Mid-Lothian, Va.*—I would like very much if some of the contributors to *Carpentry and Building* would furnish a design, with details, for a frame gothic church suitable for a country village. It should be about 60 feet long, 34 feet wide, and 16 feet from floor to eaves; hight of roof about two-thirds of width of the building. In connection therewith, I should like to know the best form of roof truss to use and the size of timbers best to employ.

Balloon Framing.

From J. D. H., *Bel Green, Franklin Co., Ala.*—I wish to ask a favor of the practical readers of *Carpentry and Building*. I notice a great deal said about the balloon style of framing. I desire to see some representation of the proper method of erecting buildings in that style.

Note.—In many of the popular works upon architecture and building issued the past 20 years, the balloon style of framing buildings is explained, and no doubt some of these are in the hands of our correspondent. We understand, therefore, from the wording of his question that what he is after is something more than that contained in the books. We take it that he wants descriptions and illustrations of balloon framing as practiced by the best builders in the country, in order to get at the best forms of construction determined by experience. We trust our readers will look up this matter and send in communications upon the subject. The practice of balloon framing differs very considerably between the several sections of the country. No doubt some methods of carrying out the principles are better than others. Let us have a fair showing, in order that the best may be determined.

Framing a Curb or Gambrel Roof.

From D. A. B., *Franklin, N. Y.*—I desire to ask of some of the experienced builders among the readers of *Carpentry and Building* the proper portions to observe in designing and framing a gambrel roof. In a building where the width is 45 feet, having purlins near the center, should the break in the roof be at that point? Would it not be too far from the plate? What rule shall I follow in establishing the pitch of the roof? This information will be thankfully received if some of the readers of your paper will take the trouble to present it.

Rubber and Glue Molds.

From G. E. F., *Buffalo, N. Y.*—Will some of the readers of *Carpentry and Building* furnish me information concerning making a mold of rubber from which to take plaster casts? I desire full instruction for doing this kind of work. I would also like to know something about making glue molds, and the kind of wash used to harden the surface, &c. If some one will favor me with directions he will put me under obligations.

Change of Color in Paint.

From R. M., *Glastonbury, Conn.*—Will some painter of experience answer through the columns of *Carpentry and Building* why paint upon a wood building sometimes seems to mildew, and turns to a dull, disagreeable color? I think it can be partially accounted for by dampness in the walls and covering. Am I right?

Prices of Building Materials in New York, January 20, 1880.

Blinds.—OUTSIDE.

Per lineal, up to 2.10 wide....$	....	@ 0.24
Per lineal, up to 3.1 wide.....	....	@ 0.28
Per lineal, up to 3.4 wide......	....	@ 0.31
Per lineal, paint'd and trim'd	0.45	@ 0.55
INSIDE.		
Per lineal, 4 folds, Pine.......	....	@ .56
Per lineal, 4 folds, ash or chstnut........	....	@ .90
Per lin'l, 4 folds, cherry or butternut........	....	@ 1.07
Per lineal, 4 folds, bl'k wal't.	....	@ 1.30

Bricks.—(Afloat.)

Pale..........	℘ M.	$5.50	@ 5.75
Jersey........		7 50	@ 8.00
Long Island.........	"	8.00	@ 8.25
Up-River.........	"	7.50	@ 8.00
Havers'aw Bay, 2ds.	"	8.25	@ 8.50
Havers'aw Bay, 1sts.	"	8.50	@ 9.00
FRONTS.			
Croton—Brown.........	℘ M.	....	@ $10.00
Croton—Dark..........	"	....	@ 11.00
Croton—Red...........	"	....	@ 11.00
Philadelphia..........	"	18.00	@ 20.00
Trenton..............	"	17.00	@ 19.00
Baltimore........	"	34.00	@ 38.00

Yard prices 50c. ℘ M higher, or, with delivery added, $1.50 per M for Hard and $2.50 per M for front Brick.

FIRE BRICK. (yard prices).

Red Welsh........	$35.00	@ ....
Scotch........	30.00	@ ....
English........	30.00	@ ...
Silica........	45.00	@ 55.00
Stourbridge........	55.00	@ ....
American........	27.00	@ 30.00

Afloat. 500 ℘ M le s

Cement.—(Cargo rate, nomiual.)

Rosendale, ℘ bbl..........	$1.00	@ 1.10
Portland Saylor's American, ℘ bbl........	2.55	@ 2.65
Portland (imported) ℘ bbl..	2.80	@ 2.90
Roman........ " ..	2.75	@ 2.85
Keene's coarse..... " ..	6.00	@ 6.25
Keene's fine........ " ..	9.75	@ 10.00

Add 25 cts. to above rates for yard prices.

Doors.

RAISED PANELS, TWO SIDES.

2.0 x 6.0.........	1¼ in.	$0 84	....
2.6 x 6.6.........	1¼ in.	1.18	....
2.6 x 6 8.........	1¼ in.	1.24	....
2.8 x 6.8.........	1¼ in.	1.30	....

MOULDED.

Size.	1¼ in.	1½ in.	1¾ in.
2.0 x 6 0.........	$1 54	....	....
2.6 x 6 6.........	1 90	2 41	....
2.6 x 6 8.........	1.96	2.43	....
2.6 x 6.10.........	1.98	2.51	....
2.6 x 7.0.........	2.02	2 61	....
2 8 x 6 8.........	2 02	2.61	3 21
2.8 x 7 0.........	2.11	2.71	3.36
2.10 x 6.10.........	2.23	2 82	3.55
3.0 x 7.0.........	2.33	3 06	3.75

2nd quality 15 cts. less.

Drain and Sewer Pipe.

Discount 50 to 60 per cent. according to quality and size of order.

Pipe, per foot.		Bends & Elbows, Each.	Branches—Sing.	Branches—D'bl.	& V.	Traps, Each.
2 in..	$ .13	$ .40	$ .48	$ ...	Longer than 1 ft., charged as pipe.	$1.00
3 " ..	.16	.50	.61	...		1.25
4 " ..	.20	.65	.75	1.30		1.75
5 " ..	.25	.85	.90	1.55		2.50
6 " ..	.30	1.15	1.05	1.80		3.50
7 " ..	.35	1.50	1.20	2.05		5.00
8 " ..	.45	2.00	1.45	2.45		6.00
9 " ..	.55	2.50	1.70	2.85		7.00
10 " ..	.70	3.00	2.00	3.30		8.00
12 " ..	.80	3.75	2.52	4.24		10.00
15 " ..	1.25	5.00				
18 " ..	1.60	7.50				

House Branches pr. lin. ft.		Sewer Branches pr. lin. ft.,	
15x6	$1.75	15 in.	$2.25
18x6	2.50	18 "	3.00

Glass.—(American.)

Prices current per box of 50 feet.

SINGLE.

Sizes.	1st.	2d.	3d.	4th.
6x 8—10x15....	$7.50	$6.75	$6 25	$5.75
11x14—16x24....	8.50	7.75	7.25	6.50
18x22—20x30....	10.75	9 75	8.75	7.75
15x36—24x30....	12.25	10.75	9 00	8.50
26x28—24x36....	13.00	11 50	9 75	9.00
26x36—26x44....	14.50	13 25	10.75	9.50
26x46—30x50....	15.00	14 00	11 25	10.50
30x52—30x54....	16.00	14 50	12.00	...
30x56—34x56....	17.25	15.50	13 50	....
34x58—34x60....	18.25	17.25	15.00	....
36x60—40x60....	20.75	18.75	17.25	....

DOUBLE.

Sizes.	1st.	2d.	3d.	4th.
6x 8—10x15....	$12.00	$11.00	$10.00	$9.25
11x14—16x24....	13.75	12.50	11.75	10.50
18x22—20x30....	17.25	15.75	14 00	....
15x36—24x30....	19.75	17.25	14.50	....
26x28—24x36....	21.00	18.50	15 75	....
26x36—26x44....	23.25	21.25	17.25	....
26x46—30x50....	24.00	22.50	18 00	....
30x52—30x54....	25 75	23 25	19.25	....
x56—34x56....	27.75	25.00	21.75	....
34x58—34x60....	29.25	27 75	24 00	....
36x60—40x60....	33.25	30.00	27.75	....

Sizes above—$10 per box extra for every five inches.

An additional 10 per cent. will be charged for all glass more than 40 inches wide. All sizes above 52 inches in length, and not making more than 81 inches, will be charged in the 84 united inches' bracket. Discounts: 50 @ 50 & 10%

French

WINDOW, PICTURE AND CAR GLASS.

Prices current per box of 50 feet.

SINGLE.

Sizes.	1st.	2d.	3d.	4th.
6x 8—10x15....	$8 00	$6 75	$6.25	$5.75
11x14—16x24....	8 75	8 00	7 50	7.00
18x22—20x30....	11 25	10 50	9 75	8.75
15x36—24x30....	12 75	11 50	10 00	.
26x28—24x36....	13 50	12 25	11.25	.
26x36—26x44....	14 75	13 75	11 75	..
26x46—30x50....	16 25	15 00	13 00	....
30x52—30x54....	17 25	16 00	13 50	...
30x56—34x56....	18 75	16 75	15 00	...
34x58—34x60....	19 50	18 00	16 00	....
36x60—40x60....	21 00	19 50	18.00	..

DOUBLE

Sizes.	1st.	2d.	3d.	4th.
6x 8—10x15....	$12 00	$11 00	$10.00	$9.25
11x14—16x24....	14 75	13 75	12 75	11.75
18x22—20x30....	19 00	17 75	16 00	....
15x36—24x30....	21 50	19 25	16 50	....
26x28—24x36....	23 00	20 75	18 25	....
26x36—26x44....	25 00	23 00	19.25	....
26x46—30x50....	27 00	25 00	21 25	....
30x52—30x54....	28 50	26 00	22.25	....
30x56—34x56....	30.00	27.75	24.75	....
34x58x34x60....	31.75	30 00	27.00	....
36x60—40x60....	35.50	32.50	30.25	....

Sizes above—$10 per box extra for every five inches.

An additional 10 per cent. will be charged for all glass more than 40 inches wide. All sizes above 52 inches in length, and not making more than 81 united inches, will be charged in the 84 united inches' bracket.

Discounts: Single, 50; Double, 60 & 5%.

GREENHOUSE, SKYLIGHT AND FLOOR GLASS.

Per square foot, net cash.

⅛ Fluted plate........	18 @ 20
3-16 Fluted plate........	20 @ 24
¼ Fluted plate........	24 @ 26
¼ Rough plate........	24 @ 26
⅜ Rough plate........	@ 35
½ Rough plate........	@ 45
¾ Rough plate........	@ 60
1 Rough plate........	@ 70

Hair.

Cattle........ ℘ bushel..$	....	@ 0.12
Goat........ "	....	@ 0.15

Lath.

Cargo rate........ ℘ M $ 2.00 @ 2.10

Lime.

Glen's Falls, or Keenan's common, cargo rate ℘ bbl........	.95	@ 1. 5
Glen's Falls, or Keenan's finishing Jointa........	1.00	@ 1.10
Rockland, common, last sales	.85	@ .90
" ....to arrive	1.00	@ 1.05
Rockland, finishing, last sales	1.00	@ 1.05
" ....to arrive	1.10	@ 1.15

Add 25c. to above figures for yard rates.

Lumber.—(Yard prices.)

Market firm with upward tendency.

Pine, very choice and ex.. dry, ℘ M. ft. thick........	$60.00	@ $65 00
Pine, clear........	50.00	@ 6 .00
Pine, selects........	40.00	@ 50.00
Pine, selected, box........	18.00	@ 20.00
Pine, common box........	16.00	@ 18.00
Pine, common box, ⅝........	13.00	@ 15.00
Pine, 1¼x10, 13 ft., matched, each........	.40	@ .43
Pine, 1¼x10, 13 ft.. culls....	.25	@ .28
Pine, 1x10, 13 ft., good matched, each........	.28	@ .30
Pine, 1x10, 13 ft., common, matched, each........	.20	@ .22
Pine, 1x4½, clear, match'd, each........	.22	@ .25
Pine, 1x4½, merchantable, matched, each........	.16	@ .18
Pine, 1¼x4½, cl'r, match'd, each........	.33	@ .35
Pine, 1¼x4½, merchantable, matched, each........	.28	@ .30
Spruce, 1x9, 13 ft., rough...	.18	@ .20
Spruce, 1x9, 13 ft. matched, each........	.20	@ .22
Spruce, 1¼x9, 13 ft., rough.	.20	@ .22
Spruce, 1¼x9, 13 ft., matched, each........	.23	@ .25
Spruce, 2x9, 13 ft., rough..	.35	@ —
Spruce, 2x9, 13 ft., match'd, each........	.40	@ .42
Spruce, 2x4, 13 ft........	.12½	@ .13
Spruce timber, flat, ℘ M ft	18.00	@ 20.00
Spruce timber, square, ℘ M ft........	20.00	@ 25.00
Hemlock, 1x10, 13 ft., each.	—	@ .16
Hemlock, 2½x4, 13 ft.,each.	.14	@ .15
Hemlock, 3x4, 13 ft., each..		@ .16
Hemlock, 4x6, 13 ft., each..	.40	@ .43
Ash, good, ℘ M ft........	40.00	@ 45.00
Oak........	45 00	@ 55 00
Oak, quartered	70.00	@ 90.00
Maple, cull........	20.00	@ 25.00
Maple, good........	30.00	@ 45 00
Chestnut........	45 00	@ 60.00
Bl'k walnut, good to choice	85.00	@ 100.00
Black Walnut, 2d........	55.00	@ 65.00
Black walnut, ⅝........	70.00	@ 80.00
Black walnut, selected and seasoned........	100.00	@ 120.00
Bl'k walnut counters, ℘ ft.	.12½	@ .20
Cherry, wide, ℘ M ft........	85 00	@ 100.00
Cherry, ordinary........	60.00	@ 80.00
Whitewood, or Poplar 1 to 1½ inch........	35.00	@ 4.500
Whitewood, or Poplar ⅝ in.	30.00	@ 35.00
Whitewood, or Poplar ⅝ panels........	35.00	@ 40.00
Shingles, extra sawed pine, 18 in., ...	5.00	@ 6.00
Shingles, clear sawed pine, 18 in., 2 md........	4.00	@ 5.00
Shingles, cypress, 7x24.....	14.00	@ 18.00
Shingles, cypress, 6x20.....	12.00	@ 14.00
Shingles, Cedar, 6x24, No. 1	—	@ 22.00
Shingles, Cedar, 6x24, A's..	—	@ 16.00
Shingles, Cedar, 6x20, No. 1	—	@ 12.50
Shingles, Cedar, 6x20, A's..	—	@ 10.00
Yellow pine dressed flooring, wide, ℘ M ft........	28.00	@ 30.00
Narrow ditto........	30.00	@ 35.00
Yellow pine girders........	30.00	@ 45.00
Locust posts, 8 ft., ℘ in.....	.18	@ .20
Locust posts, 10 ft.,........	.24	@ .25
Locust posts, 12 ft........	.25	@ .30
Chestnut posts, ℘ ft...	.3	@ .3½
Mahogany, ¼ in. ℘ ft.......	.5	@ .7
Mahogany, ⅜ in. ℘ ft.......	.8	@ .10
Mahogany, ½ in. ℘ ft.......	.10	@ .12
Mahogany, ⅝ in. ℘ ft.......	.12	@ .14
Mahogany, ¾ in. ℘ ft.......	.14	@ .16
Mahogany 1 in. ℘ ft.......	.16	@ .18
Rosewood, ⅛ in. ℘ ft.......	.11	@ .15
Rosewood, ¼ in. ℘ ft.......	.16	@ .20
Rosewood, ⅜ in. ℘ ft.......	.24	@ .28
Rosewood, ⅝ in. ℘ ft.......	.40	@ .45
Rosewood, 1 in. ℘ ft.......	.60	@ .75
Satin wood, ½ in. ℘ ft......	.25	@ .35
Satin wood, 1 in. ℘ ft......	.35	@ .50
Cedar (Cuban and Mexican) ℘ ft........	.10	@ .14
Cedar (Florida)........		@
Less than 1 inch........	.16	@ .24
1 inch and over........	.25	@ .30

Moldings.

50c. to 60c. per inch per 100 feet, according to quality.

Paper.

Rope, waterproof building, ℘ ℔.	.16	@ .17
Rosin Sized Sheating, ℘ ℔.	.4	@ .5
Dry Sheating ℘ ℔........	.3	@ 3½
Tarred Felt. ℘ ℔........	....	@ .2¼

Plaster.

Calcined City........Mill rate..$0.95 @ 1.00

Sash.

GLAZED.

Dimensions of windows.	12 Lights. 1¼pl.	12 Lights. 1¼c.	12 Lights. 1½c.	8 L's. 1½c.	4 Lights. 1¼c.	4 Lights. 1½c.
2.1x3.6.....	$1.08	1.15	....	....	....	....
2.4x3.10....	1.20	1.27	1.37	....	1.38	....
2.7x4.6.....	1.47	1.54	1.67	....	1.71	1.82
2.7x4.10....	1.56	1.64	1.79	....	1.85	1.99
2.7x5.2.....	1.69	1.77	1.91	2.21	2.19	2.34
2.7x5.6.....	....	1.88	2.06	2.30	2.35	2.53
2.7x5.10....	....	1.98	2.17	2.41	2.49	2.68
2.10x4.6....	1.61	1.69	1.83	....	1.86	2.00
2.10x5.2....	1.81	1.91	2.12	2.[illegible]3	2.[illegible]6	2.[illegible]7
2.10x5.6....	1.91	1.99	2.23	2.51	2.46	2.70
2.10x5.10...	2.17	2.25	2.51	2.59	2.61	2.87

c. means counted checked—plowed and bored for weights.

Hot bed sash, glazed........$2.35

HEAD LIGHT.

Two or three Lights, Glazed.

Size.	1¼	1½	Size.	1¼	1½
2.6x1.0 ..	56	68	2.10x1.10.	56	73
2.6x1.6...	68	79	2.10x1.6..	73	84
2.8x1.0...	56	68	3.0x1.0...	62	79
2.8x1.6...	68	84	3.0x1.6...	90	1.07

Slate.

By car load, delivered in New York.

Purple roofing slate, ℘ sq're.	$5.00	@ $5.50
Green slate........	5.00	@ 5.50
Red slate........	....	@ 9.50
Black slate, Pennsylvania...	....	@ 4.00
Tiles, 1¼ in. rubbed, ℘ sq. ft.	.20	@ .25

℘ sup. ft.

Steps and platforms, 1 in. thick........	28c
" " 1½ "	35c
" " 2 "	42c
Risers, 1 inch thick........	27c
Coping, 1½ "	27c
" 2 "	31c

Lineal ft.

Window sills, 4x7........	45c
" 3x7........	36c
Window caps, 4x10, plain........	65c
" 4x8, "	50c
" 3x10, "	47c
" 3x8, "	42c

Stair Material.

BALUSTERS.

Black Walnut.	1½ in.	1¾ in.	2 in.	2½ in
Fancy Turned.....	7c	9c	10c	16c
Neck Turned......	9c	10c	12c	19c
Fluted or Octagon	12c	14c	17c	25c

OCTAGON PANELED NEWELS.

Panels Veneered with French Walnut.

8-inch Newels, with Cap........	$6.12
9 " " "	6 88
10 " " "	7.60

SOLID NEWELS, WITH CAPS.

Black Walnut.	5 in.	6 in.	7 in.	8 in.
Fancy Turned....	$1.60	$1.90	$2.50	$3.40
Octagon........	2.10	2 40	3.00	3.90

STAIR RAIL.

Worked out and finished ready to put up. Easements and cylinders counted double. Price per foot (Newels and Balusters not included).

Black Walnut.	3 in.	3½ in.	4 in.	4½ in
Molded........	40c	45c	50c	53c
Toad Back........	45c	50c	63c	68c

STAIR RAIL, UNFINISHED.

Price per foot.

Black Walnut.	3 in.	3½ in.	4 in.	4½ in
Molded........	11c	13c	15c	17c
Toad Back	12c	14c	16c	18c

Stone.

Cargo rates, delivered at New York.

Amherst freestone, in rough, ℘ C ft........$	....	@ $0.85
Berlin freestone, in rough...	....	@ .85
Berea freestone, in rough....	....	@ .70
Brown stone, Portland, Ct...	1.25	@ 1.50
Brown stone, Belleville, N. J.	1.00	@ 1.50
Granite rough........	.50	@ 1.00
Dorchester, N. B., stone, rough........ ℘ foot.	....	@ 1.00

BLUE STONE

Rubbed hearth, 10 ft. or under........	20c
Rubbed hearth, 20 ft. or under........	30c
Rubbed hearth, 3 ft. or under........	45c
Rubbed hearth, 40 ft. or under........	55c
Rubbed sills, imported........	28c
Rubbed sills, domestic........	33c
Sills and lintels........	@ 17c
Sills and lintels, fine quarry cut sills........	@ 35c
Coping, 11 to 18 in. wide........	18c @ 30c
Coping, 20 to 28 in. wide........	35c @ 55c
Coping, 30 to 36 in. wide........	60c @ 75c
Steps, 8 in........	@ 55c
Steps, 7 in........	@ 40c
Steps, 6 in........	@ 25c
Steps, door. per in. wide........	@ 2c
Platforms, promiscuous, 4 in...	@ 32c

Vault Lights.—Nominal.

Platform, sq ft........	$3.00
Step and risers, sq. ft........	3.25
Floor light, sq. ft........	2.25
Roof light, sq. ft........	2.00
Platform, 2d quality, sq. ft........	2.60

COVERS.

Diameter.	Round.	Hexagon.
14 Inch........	$3.00	$0.00
16 "	3.75	4.00
18 "	5.50	6.00
20 "	8.00	8.50
24 "	14.00	15.0
26 "	16.00	17.0
30 "	23.50	25.0
36 "	31.00	33.0

Window Frames.

Up to 3.4 x 7.2, put together.. .... @ 20.4

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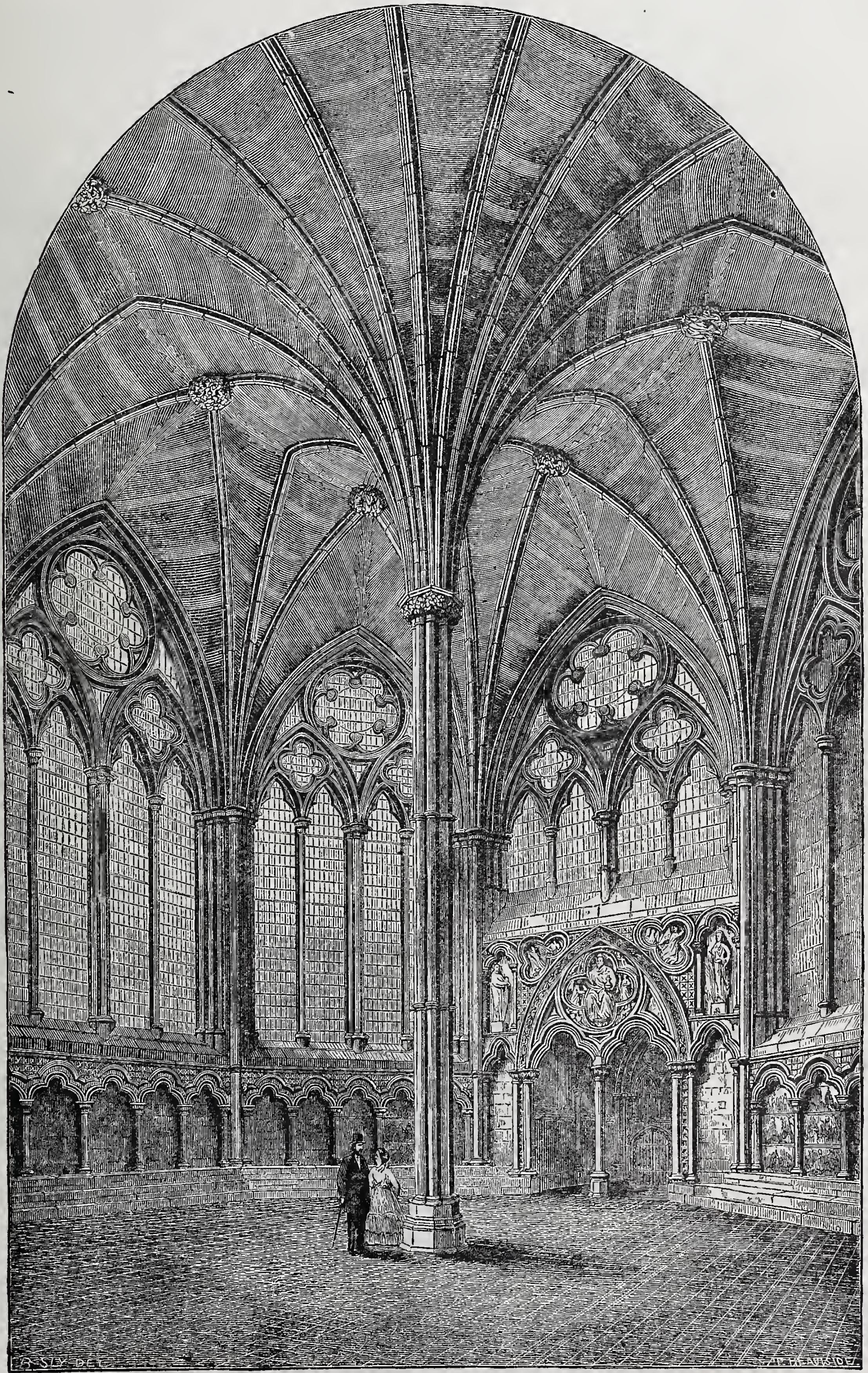


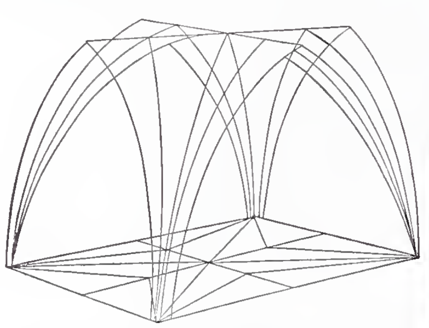
Vaults and Groins.—Fig. 1.—The Chapter House of Westminster.

MASONRY.

Vaults and Groins.

In the January number of *Carpentry and Building* we gave some attention to the subject of groins and vaults, more particularly from the carpenter's standpoint. We considered the principles employed in laying out the forms used in the construction of wooden vaults, and in the cradling employed in the erection of stone vaults. Much that was there said, both with reference to principles and in the matter of definitions of terms, is equally applicable to vaults of masonry, and therefore need not be repeated in introducing our present paper. At this time we shall devote ourselves to a very brief consideration of the history and progress of vault building in architectural construction, introducing, as we proceed, by way of illustration, a few examples taken from prominent buildings.

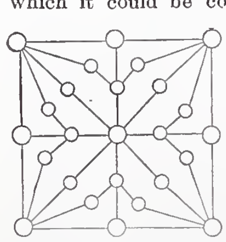
The simplest form of the vault is what is commonly called the "barrel" vault, and what is also sometimes termed a "wagon vault." The same construction is called by the French a "cradle vault." It is nothing else than a complete union, in the form of a semicircle, of two lines forming a semicircular arch. It can be easily understood by considering it as a halved cylinder. If there are two walls which are united together by a barrel vault, and if the corners of the walls are in turn united by two other walls, continued to the end of the vault, a semicircular filling up is the result. Such a



Vaults and Groins.—Fig. 2.—Illustration of Plain Ribbed Vaulting, the Vaults being of Equal Hight.

barrel vault exerts a pressure on the whole expanse of the two walls on which it rests.

Simple vaulting, then, may be described as merely the application of the common arch to the covering of an area of greater extent. This kind of construction may be scientifically defined as a vault which is formed by the surface of some regular solid around a single axis, and which springs from the opposite walls, presenting a uniform concave surface along its length. Such vaults were frequently employed by the Romans in the covering of their baths; but the Romans soon discovered how bare and void of effect they were and aspired to better things. The cylindrical vault reappears in the buildings of the mediæval architects, especially of the Normans, brought about, doubtless, by the ease with which it could be constructed.

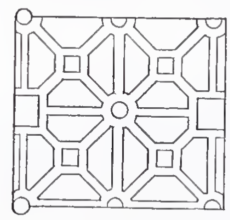


Vaults and Groins.—Fig. 3.—Plan of a Lierne Vault at Ricquise.

The cylindrical vaulting of the grand cathedral of Cologne is an extremely interesting specimen of the barrel vault.

To the mind of an architect possessed of an eye for effect, an easy method of improving the bald appearance of the cylindrical vault could hardly fail to occur. If ribs of permanent masonry were formed at intervals with panels between, a certain relief and play of light and shade would be obtained. This expedient was resorted to in many instances, and the vaults of the Norman Episcopal Palace at Norwich, England, afford a characteristic example. This less massive and more elegant form of construction has been denominated "rib and panel work."

It was reserved for the Gothic builders, however, to carry the vault to its highest development, but the steps which mark its



Vaults and Groins.—Fig. 4.—Plan of Vault of South Porch of Hereford Cathedral.

progress are gradual. The Norman architects began with the Roman or barrel vault. Ribs were next introduced, at first transversely and afterward diagonally, and then followed one after another the changes and improvements that culminated in that marvelous covering—

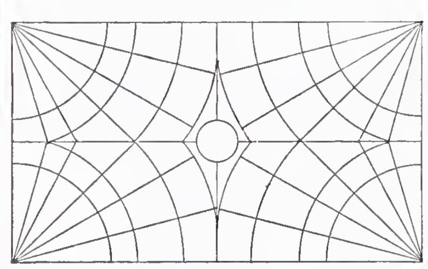
"Self-poised, and scooped into a thousand cells,
Where light and shade remain, where music dwells,"

which roofs so many of the famous churches and cathedrals of the old world.

Mediæval vault-building may be considered under three heads, viz.:

1. Vaults in which plain ribs only are used.
2. Vaults in which many liernes or cross ribs are employed in conjunction with the principal ribs and disposed in such a manner as to form panels, and
3. Face vaults, in which the principal ribs have a semicircular curvature and make equal angles with each other at their springing.

Of these three classes the first, or plain-ribbed vaulting, was in very general use at one time, especially upon the Continent of Europe. An illustration is shown in Fig. 2 of the accompanying engravings. Sometimes these vaults have ridge ribs, and sometimes they are without them. The later specimens usually have diagonal ribs on the groins, and both these and the transverse



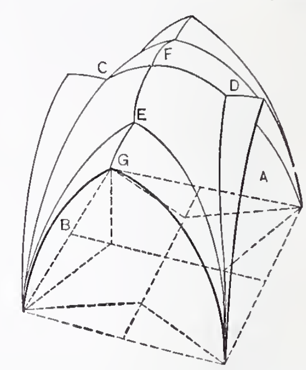
Vaults and Groins.—Fig. 5.—Plan of a Bay of the Groin'ng of King's College Chapel, Cambridge.

ribs are frequently ornamented with moldings, zigzags and other carvings.

In the second class, or lierne vaultings, the ribs become increased in number and the vaults are divided into panels and compartments, which are frequently filled with tracery. Ribs are also introduced crossing the vaults in directions opposite to their curves, so as to give an appearance of reticulation to the vaults, or as if a tracery of petrified network were spread over them. In the vaults of the first class, the ribs always marked a groin, and consequently the divergence of the vaulting surfaces. But many of the ribs of lierne vaults are merely superficial ornaments, controlled by the curvature of the vault, but not occasioned by it. A very considerable knowledge of projection is required in the construction of these vaults, as the pattern laid down on the plan, where the curved lines of the ribs are necessarily foreshortened, can afford but little aid in realizing the perspective effect of the finished vault Fig. 3 of our illustrations shows the plan of a lierne vault at Ricquise, near Abbeville, and Fig. 4 shows the plan of the vault of the south porch of Hereford Cathedral.

In the style known as face vaulting, the principal ribs have the same curvature and form equal angles with each other. The vaulting is generally covered with ribs and the tracing branching out equally all around them. The central portion of the vault between the pendentives is usually domical in form, and not infrequently has a pendant in the middle of each compartment. In Fig. 5 is a plan of a bay of the groining of King's College Chapel at Cambridge, an example of this kind.

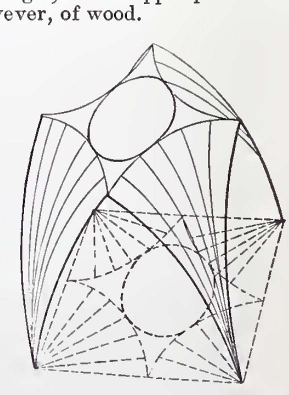
The simplest form of groin is that where the intersecting vaults are of similar hight, as shown in Fig. 2. Elementary as this first step in the art of vault coustruction seems to us, it is the product of considerable ingenuity, and was doubtless considered by the early architects as a *chef d'oeuvre.* In Fig. 6 is shown an example of groining in which the primitive arches are unequal in hight. The plan does not, however, essentially differ from that shown in Fig. 2, except that in consequence of the difference in the hight of the arches (A being higher than B), C D, E F must be joined by curved lines, determined on one side by the point



Vaults and Groins.—Fig. 6.—Example of Groining in which Intersecting Vaults are of Unequal Hight.

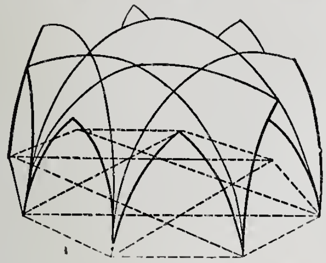
A, where G A intersects the longer arch. The plan in each of these examples, it will be seen, exhibits the general form of a star. In the illustration shown in Fig. 7 the plan also, in a measure, takes the form of a star; but the summit rib is done away with, and the construction differs from rib vaulting, as each successive course in building supports the next. This is characteristic of fan work.

The vaults we have so far considered are square in plan, but not unfrequently the plan is polygonal, when different expedients are employed, among them being the adoption of a central column to receive the ends of the ribs, a pendant to receive the arches, and boldly throwing the vault from wall to wall. Of this latter plan the vaulting to the kitchen to the Monastery of Durham (Fig. 8) is an example, a similar, but more elaborate vault being that of the Chapter House at York, Fig. 9. The upper part of the latter is, however, of wood.



Vaults and Groins.—Fig. 7.—Another Manner of Vaulting in which the Plan, as in Figs. 5 and 6, is of the Form of a Star.

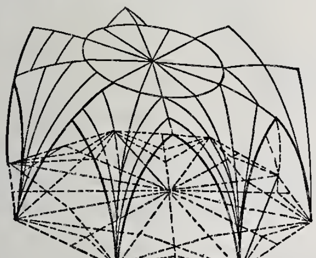
Considering how rapidly and how marvelously the art of vault construction progressed under the hands of the mediæval builders, it is a little remarkable that so few tentative examples, or those in what may be tained a state of development, should exist. Generally we seem to go from the grand and perfect examples of one style to another—dissimilar, but not less perfect—and we might almost be led to think that these old architects never erred and had no failures. Yet sometimes we come across a "missing link," which proves that, after all, these styles



Vaults and Groins.—Fig. 8.—*Vaulting of the Kitchen to the Monastery of Durham.*

were evolved, in great measure, from those preceding them, and used partly in combination with them.

Thus we have various remains, principally in France, which testify that long after the introduction of the pointed arch and vault, the semicircular form of the Norman still cropped up, and even struggled for supremacy. It seemed that the builders doubted the new and fair offspring of their hands, and cautiously retained the old elements in proximity. Thus, at the little church of Mouliherne, near Saumur, of which Fig. 10 presents a view of part of the vaulting, and Fig. 11 a plan of the same, the two systems are face to face. The four triangles (in plan) included between the points A B C are of the Anglo-Norman form—that is, cupola-like in the vaulting—while the other four triangles—A D F, D B E, B E G, E G C—are roofed after the French style, and the builder has had, consequently, to adapt his groins to the peculiar circumstances of the amalgamated types.



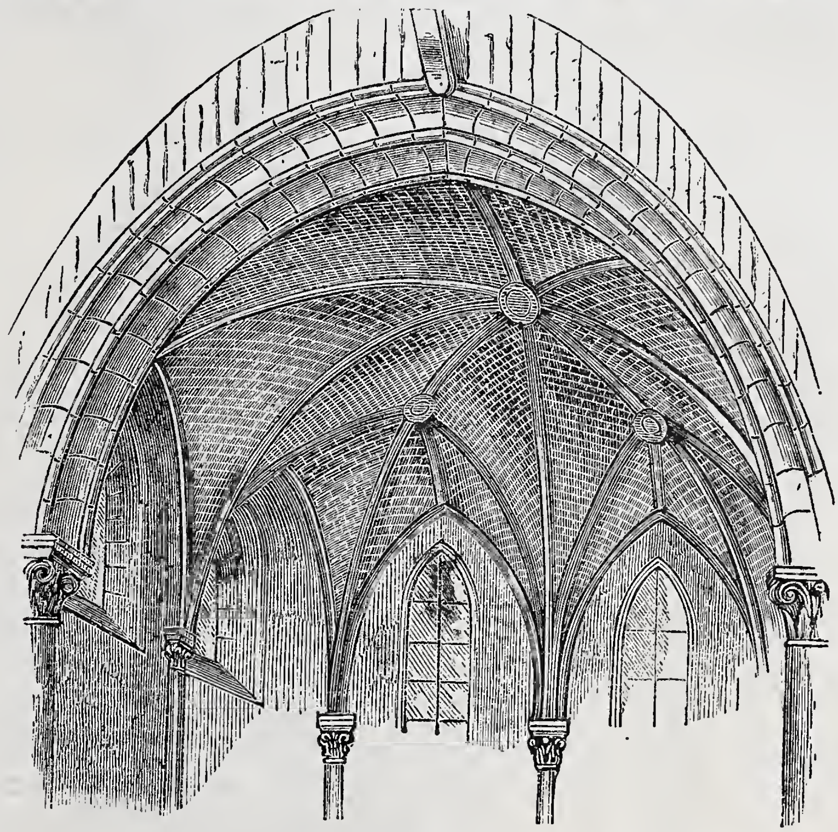
Vaults and Groins.—Fig. 9.—*Vaulting of the Chapter House at York.*

The Chapter House of Westminster, a view of which is afforded by Fig. 1 of the engravings, is an example of groining in which a central column is used to receive the ends of the ribs. The following description from the *London Builder* is appropriate in this connection :

"The Chapter House at Westminster is an octagonal building, to the south of that entrance to the Abbey known as the 'Poets' Corner.' In the center of this hall rises a lofty shaft of Purbeck marble, around which eight smaller shafts are clustered. From the bold and graceful capital of this central column groined arches spring on either side to the walls. The roof is built of white chalk, groined with ribs of fire stone."

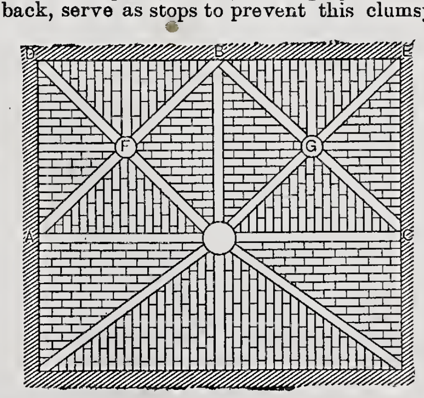
In contemplating the handiwork of those expert builders in stone who have left so many examples of their art in the church edifices of the Old World, we are lost in admiration. Their skill was marvelous. They imparted to stone an apparent flexibility equal to the most ductile metals. They made it forget its nature, and weaned it from its fondness for descending in the center.

French Bricklayers' Tools.—A correspondent of an English paper thus describes bricklaying tools in France: The tools of the French bricklayer differ only in the trowel and mortar trough. The latter is the same as used in some parts of Scotland and with mason's fixers, and is similar in shape to a washing tray. The French trowel would undoubtedly be an awkward tool for an English bricklayer to use, as it cannot be employed for cutting or trimming bricks, a process which is accomplished by another tool, the brick hammer. The spreading the mortar and cutting are both done in England by the trowel, which may be said to serve the purpose of hammer and trowel as well. The French tool seems to be made to suit the trough, rather than for laying



Vaults and Groins.—Fig. 10.—*Vaulting of the Church of Mouliherne, Saumur, France.—An Example of the Combination of Two Systems.*

bricks and "striking joints." There is a peculiarity about the French laborer's hod, which I saw in use on the ground only. Whether it can be carried up a ladder I cannot say. It consists of boards put together to form sides about 1 foot 10 inches by 1 foot 2 inches. These are set at right angles, like the bottom and one side of a box. The side which forms the bottom is then fixed upon two short poles, one to rest on each shoulder and be held by one hand. The side which stands up prevents the mortar, which is loaded on by an assistant, from slipping down about the bearer's neck and back. There are two brackets fixed to the under side of the poles, which, bearing against the back, serve as stops to prevent this clumsy



Vaults and Groins.—Fig. 11.—*Plan of the Vaulting of Fig.* 10.

implement from slipping forward. I say clumsy, because it cannot be used by less than two men, one to fill and the other to carry. It may be possible that more stuff could be carried by it than by the English hod. But the way in which I saw it loaded did not seem to indicate that it was customary to overload the bearer.

Wooden Roof and Bridge Trusses—Mechanical Principles.

There are many carpenters who are unacquainted, or, at best, have no very clear ideas of the mechanical principles involved in the common forms of roof and bridge trusses. It is manifest that all of those who, from the nature of their occupation, are frequently called upon to execute the designs of such work, should understand the nature of the strains in the several parts of the structure. They will then be enabled to give that particular attention to such portions of the work as are the more vital ; besides, it often happens that such men are called upon to make their own designs.

A very large volume might be written upon wooden roof and bridge trusses, but at the same time the fundamental mechanical principles of the subject are few and simple.

It is proposed in these articles, which are written only for such readers as described above :

1. To elucidate the more important of those mechanical principles in a familiar way, so that they may be readily understood and applied by any sensible man who can add, subtract, multiply and divide, and who can draw a diagram to a scale.

2. To furnish the necessary tables of the strengths and deflections of such materials as are used in such construction, and to describe the different strains that a piece of material may be subjected to, and in what manner the strengths of the materials under these strains vary with the dimensions of the materials.

3. To trace out the strains at work in roof and bridge trusses, and to estimate them by means of the principles explained and the use of the tables of the strengths of materials.

4. To furnish drawings of the proper kinds of joints for the different strains, such as for a thrust, a pull and a cross strain.

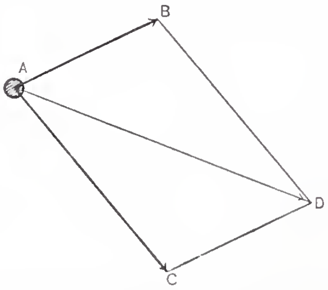
5. To give a limited number of drawings of the most approved common forms of roof and bridge trusses, with their dimensions.

Under these divisions of the subject, what will be given will be concise and as practical as the author can make it, that it may be useful to practical men. As this first article is exclusively devoted to mechanical principles, it may be thought to be unpractical, and hence unsuited to practical meu. Confused ideas are sometimes held as to what constitutes a practical man. In the industrial arts, a practical man is one who successfully applies principles to practice, and no carpenter can be truly said to be practical who does not intelligently apply the principles of carpentry to his work; but how can he intelligently and successfully do this if he be unacquainted with those principles?

This obvious fact should be always borne in mind, that the chief force which tends to destroy all trusses is weight, which, of course, has a vertical direction, and the different strains in the several parts of a truss are resultant from it. In the application of the parallelogram of forces, directly to be explained, the weight will be termed the resultant. This, in a strict sense, is a misnomer, but it is convenient to use the term in that way.

The mechanical law known as the parallelogram of forces, is of the utmost importance in tracing and determining the strains in the different parts of a truss. Whether those strains are examined by a rigid mathematical analysis, or whether by familiar methods, as is here undertaken, the frequent application of that law or principle is alike necessary. It may be defined as follows: If two forces act upon a body in a direction forming with each other an angle, then their resultant force is represented, both in directiou and amount, by the diagonal of a parallelogram whose two sides represent, both in direction and amount, those two forces.

Thus in Fig. 1, let A B and A C represent the directions and amounts of the two forces actiug upon a body at A; then their resultant force will be represented both in direction and amount by the diagonal A D. If the force A B should be 4 pounds and the force A C 6 pounds, then, in order to find the direction and amount of pounds of their resultant A D, lay off with any convenient scale each unit of measure representing a

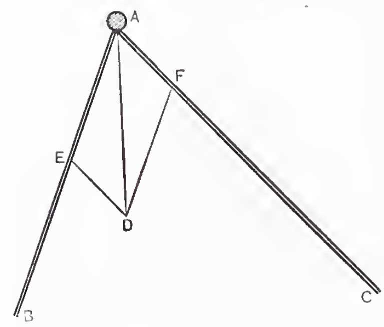


Roof and Bridge Trusses.—Fig. 1.—Illustration of the Parallelogram of Forces.

pound; on the line A B, 4 units representing 4 pounds, and, in the same manner, 6 units on the line A C, representing 6 pounds. Complete the parallelogram by drawing a line from B parallel with A C, and a line from C parallel with A B; at their intersection, D, draw a line to A; the direction of this line will be the direction of the resultant of the two forces. Then measure the line A D with the same scale, and the number of units and parts of units in it will be the number of pouuds and parts of pounds in the resultant of the two forces.

Let us now examine the application of this principle to a simple case in construction. Let a weight be supported at A, Fig. 2, upon two inclined posts, A B and A C. The tendency of the weight is of course vertical, and is prevented from descending by the two posts. Represent the weight by the vertical line A D. Draw D F parallel to A B, and D E parallel to A C; then will D F or A E represent the crushing strain on the post A B, and D E or A F the crushing strain on the post A C. Here we have the direction and length of the diagonal, and the direction of the two sides of the parallelogram, to fiud the lengths of the sides. It will be observed in this case that the diagonal is the cause of the strains, and hence it is primary, and that the strains in the posts are resultants from it. This is of very general occurrence in our present subject, and hence may be seen the application of the preliminary remarks at the beginning of mechanical principles. As obvious as all of this seems, beginners sometimes get a vague notion into their minds that, as the vertical diagonals are called resultants, somehow they are caused by the oblique strains.

In the preceding case we supposed the weights to be supported by posts. Let us now suppose the weight to be sustained by ties, as in Fig. 3. The strains in the ties will be seen to be pulls or tensile. The parallelogram of forces in this case is equally applicable. Thus, draw the vertical A D to

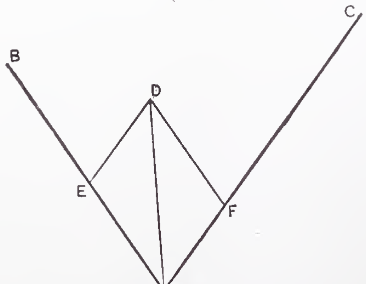


Roof and Bridge Trusses.—Fig. 2.—Application of the Principle to a Weight Supported by Two Inclined Posts.

represent the weight, and the lines A E and A F will represent the tensile strain on their respective ties.

In the two preceding cases it will be seen that if the posts or the ties are very much inclined—that is to say, if their ends are considerably spread out—the sides of the parallelogram will be greater than the diagonal. Hence, the nearer braces or ties approach the horizontal, the weaker they become. It may appear strange and incredible to those uuacquainted with the subject, that a given weight may produce greater strains in each of two posts or two ties than the weight itself amounts to, but it is, nevertheless, a fact. Let any one who may doubt it attach a weight to the middle of a strong cord; attach one end of the cord to a building, several feet from the ground, and then take hold of the other end of the cord and attempt to straighten it. He will find how many times greater the force required to bring the weight up to even nearly a level is than the weight itself.

Let us now determine the strains in an inclined beam loaded uniformly along its whole length (this is the case of a common rafter). Let A B, Fig. 4, be such a beam, abutting against the wall at A, and leaning against the vertical wall at B. There are only three forces acting upon the beam, and these three forces keep the beam at rest, or, as usually expressed, in a state of equilibrium. 1. There is the force of gravity acting on the beam, due to the weight of the beam and its load. 2. There is a horizontal force or reaction of the wall at the upper end of the beam at B; aud 3. There is an oblique force or reaction of the wall at the lower end, A. Now, to find these forces.

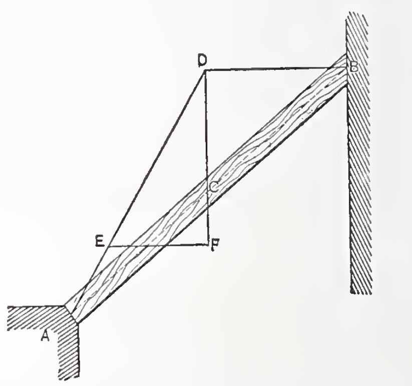


Roof and Bridge Trusses.—Fig. 3.—Application of the Principle to a Weight Sustained by Ties.

There is a law or principle in mechanics that when three forces, not parallel, act upon a body so as to keep it in equilibrium, they all tend to the same point in a vertical line, passing through the center of gravity of the body.

We here have a case of this kind. Let us now, by the means of this law, determine the three strains. Draw a vertical line through C, the center of A B, and which, in this case, is the center of gravity of A B and its load; produce the horizontal line from B so as to meet the vertical line at D. We now have the point at which two of these lines or forces meet; hence, according to the law, the third line or force must tend to this point. Then draw the line from A to D, and A D will be the direction of the oblique force. Now, from D lay off on the vertical line the distance D F equal to the weight of the beam A B and its load; from F draw the line F E parallel to the line D B; then will the line D E be the oblique force or thrust of the loaded beam at its foot, and only at its foot, as the strain gradually decreases to nothing at its top, and F E will be the horizontal strain or reaction of the wall at B. The oblique strain or thrust D E is a component of F E and D F; that is, the horizontal push of the beam and its load against the lower wall at A is equal te the horizontal push at B, and the vertical pressure of the beam on the lower wall is equal to the weight of the beam and its load—an obvious fact, as the pressure of the beam against the wall at B is only horizontal. If, instead of the wall at B, we place another beam inclined in an opposite direction, we have the case of a pair of common rafters.

It will readily be seen that if the span of the beam A B, or the horizontal distance between the two walls remains the same, but the pitch or inclination of the beam should



Roof and Bridge Trusses.—Fig. 4.—Determining the Strains upon an Inclined Bea[m] Loaded Uniformly along its Whole Length.

vary, that then the three lines DF, EF and DE will not hold the same relations to each other. If the pitch of the beam should become so great as to be nearly vertical, then the line DF would be nearly equal to DE, and the line EF would be very small; and if the pitch of the beam should become so little as to be nearly horizontal, then DE would become many times DF, and EF would become nearly equal to DE.

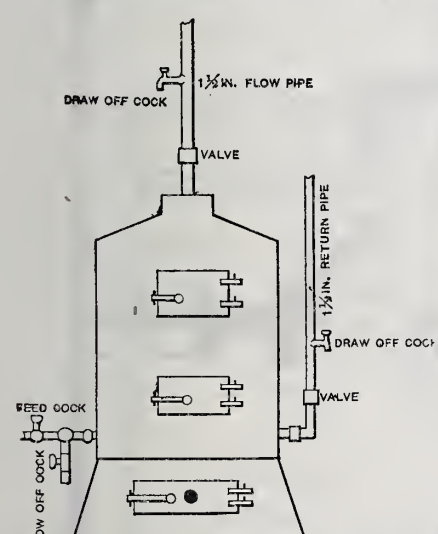
This might at first lead one to think that, for a given span, the greater the pitch of rafters the stronger the rafters would be; but it must be remembered that the length of rafters, and consequently the load, becomes greater as the pitch increases. The fact is that an angle of 33° 41′, which corresponds to a third pitch in a pair of rafters, is the most favorable for strength. At this pitch the crushing strain DE is about one-fourth greater than the weight of the rafter and its load. It, however, does not make much difference if the pitch is made not less than one-fourth or greater than one-half. At less than one-fourth pitch or greater than one-half the strength of the rafter decreases more rapidly. Besides the above crushing strain, there is a cross or tranverse strain in a rafter, but the consideration of this will come under the head of strengths of materials, to which another paper will be devoted.

Who was Terra Cotta?—The Providence *Press* tells of a lady in that city who, after attentively examining a bust in a window, eagerly inquired, "And who was this Terra Cotta, anyway?"

Heating Buildings by Hot Water.

The plan of heating buildings by hot water circulation is at the present time receiving considerable attention, both at the hands of engineers and private parties. A consideration of some of its more prominent features, together with a description of the apparatus employed, is therefore likely to be of interest to our readers at this time. First, we will refer briefly to the natural laws, upon which the successful operation of the system depends. The circulation of fluids and gases, in a great measure, is affected by the law of gravity. That all falling bodies gravitate with the same velocity, and therefore descend through a certain definite space in a given time, is an effect of which this great natural law is the cause. To this same source may be distinctly traced the phenomena attending the circulation of hot water through pipes. A circulation once established forces all the water in the apparatus to pass successively through the boiler, where it is primarily heated. It is upon the continuous and uniform movement of the water along the pipes that the efficiency of hot water apparatus immediately depends.

The force which produces circulation arises from the fact that the water in the descending pipe is heavier than that which is in the boiler. Or it may be stated differently: When heat is applied to the boiler, a dilatation of the water in it ensues. The heated particles ascend through the colder ones, while the latter descend by reason of their greater specific gravity, and in turn

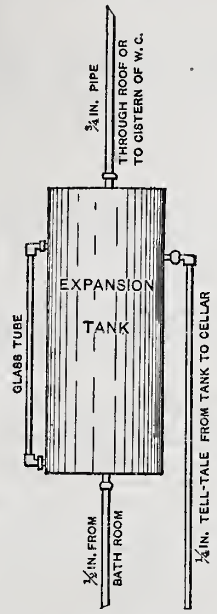


Hot Water Heating.—Fig. 1.—Diagram of Boiler, showing Valves, Draw-off Cocks, &c.

also become heated. Expansion follows, and this species of action and reaction proceeds until all the particles are equally heated. It follows that the colder the water is in the descending pipe, relatively with that in the boiler, the more rapid will be its motion through the circulating pipes, and hence the diffusion of heat through their pores and into the atmosphere surrounding them. A moment's consideration of the principles upon which the system is based will serve to show that the simplest apparatus, if arranged in conformity with these natural laws, may be made to do satisfactory service in heating buildings.

We desire to afford our readers an opportunity of considering the system apart from the patented and somewhat complicated devices sometimes employed in connection with hot-water heating, and to present them with a description unencumbered by scientific deductions and mathematical formula, so generally injected into accounts of this kind. We shall, therefore, carefully omit all theorizing, and confine ourselves to a description of the system and its workings in its simplest form.

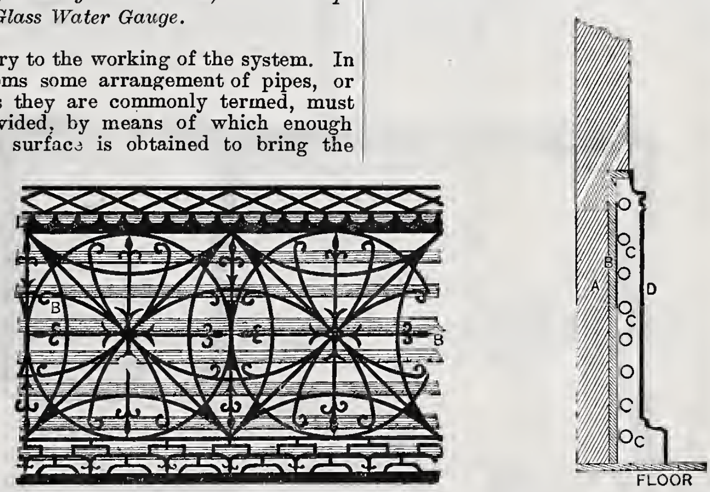
From the explanation of the principles involved and the laws upon which the operation of the apparatus is based, the working parts are self-suggestive. There must be a boiler or heater, from which one system of pipes leads to the various rooms to be warmed, and to which another system of pipes returns the water after it has given off its heat. Proper valves, cocks, &c., are



Hot Water Heating.—Fig. 2.—Expansion Tank, showing Connections, Tell-tale Pipe and Glass Water Gauge.

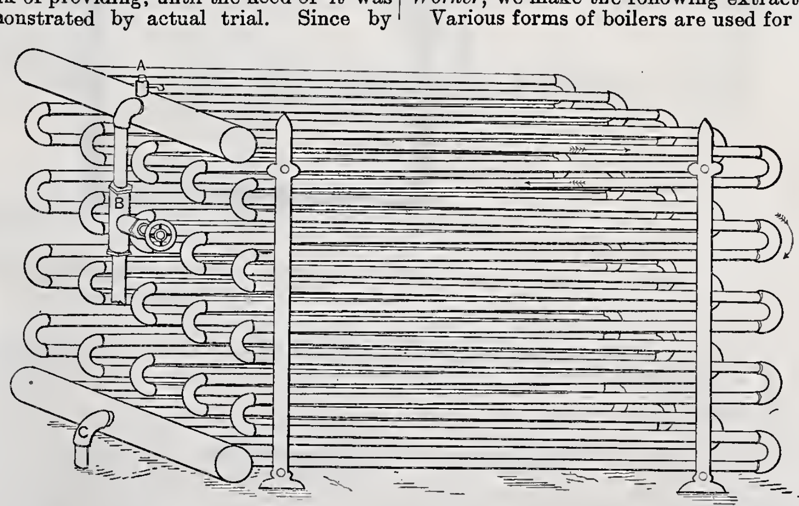
necessary to the working of the system. In the rooms some arrangement of pipes, or coils, as they are commonly termed, must be provided, by means of which enough heating surface is obtained to bring the temperature up to the required degree. There is one other essential feature, however, which the inexperienced would hardly think of providing, until the need of it was demonstrated by actual trial. Since by heating water expands, and therefore occupies more space when hot than when cold, a system of pipes filled with water and hermetically sealed, leading to and from the boiler, would not work. There must be some provision to take up the expansion that occurs, without strain upon the pipes, and without too great loss of heat. Since, also, by accident in managing the fire it is possible for the water to be brought up to the boiling point, some provision must be made in the apparatus to provide against injury; as, for example, bursting of pipes from the carelessness of servants. The device which is brought into service by these needs is known as an expansion tank. It consists, in its simplest form, of a sheet-iron cylinder, closed at both ends. From the top a small pipe leads out through the roof of the building, or into a soil pipe, thus affording a vent to the air or water forced out by the expansion due to the heat. A pipe from some portion of the hot-water system leads into the expansion tank through its bottom. In location the tank is placed above the highest coil. It therefore becomes the most convenient place from which to fill the pipes. Sometimes a glass gauge is provided of the general kind used upon steam boilers, by means of which the hight of the water in the tank can be told at a glance. A "tell-tale" pipe is also sometimes employed, running to the cellar, by which the state of the water in the expansion tank may be determined there.

A description of the practical working of a hot-water heating apparatus by a practical man will constitute a desirable conclusion to these remarks, which have so far been altogether general in their character. From an interesting paper entitled "Hot-water Heating as Practiced in Canada," written by Mr. J. W. Hughes, of Montreal, and which was recently published in *The Metal Worker*, we make the following extracts:



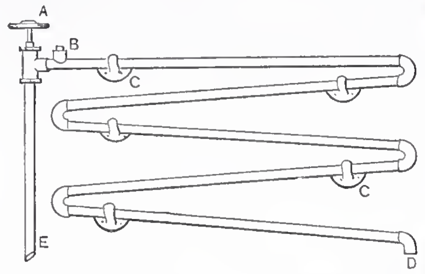
Hot Water Heating.—Fig. 3.—Base Screen, Fastened to Walls with Screws.—Pipes are Shown back of the Screen, and in End View. A, Wall. B, Paper and Iron Lining. C, Pipes. D, Face of Screen.

Various forms of boilers are used for hot-water heating. The essentials of a good boiler are a large area of boiler surface in proportion to grate surface, the breaking up and distributing of the water into thin spaces, so that it is not presented to the fire



Hot Water Heating.—Fig. 4.—Box or Cluster Coils. A, Air Cock. B, Valve. C, Return Pipe.—Arrows show the Direction of the Flow of the Water.

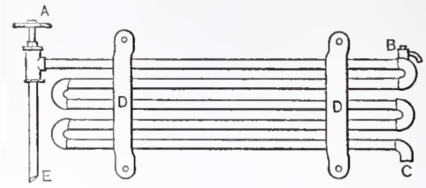
in large masses, and perfect and free circulation. The object is to have the water rapidly warmed, and as it ascends from the boiler to the various radiators or coils when heated, to insure its rapid replacement by the colder and more dense water coming back from the radiators in the return mains. Rapid and free circulation must always be provided for in all parts of the apparatus.



Hot Water Heating.—Fig. 5.—Wall Coil or Single Circulation, with Pitch Bends.—A, Valve. B, Air Vent. C, Hooks. D, Return Pipe. E, Flow Pipe.

Whatever form of boiler is adopted (I may here add that boiler is a misnomer, as the water does not boil, but only circulates), it should be proportioned to the work it has to do. It is well to allow a margin over the actual requirements of t e case, as the quantity of heat required to work the apparatus can always be regulated by the fire. A small boiler that requires forcing will not prove economical of fuel. The same remarks apply to the quantity of pipe used in the radiators in the various rooms, and for similar reasons.

Having selected a boiler, the next important requisite is to set it where it will work most effectively. A good draft is very important, and for this reason some care should be taken in providing a proper chimney flue, selecting the one that is most likely to give the best results. I find it better, where possible, to place the boiler as close as may be to the chimney, as the greater part of the heat being utilized by the boiler, there should not be any great quantity of heated gases to pass into the chimney. This is especially the case where hard coal is the fuel used, although there are



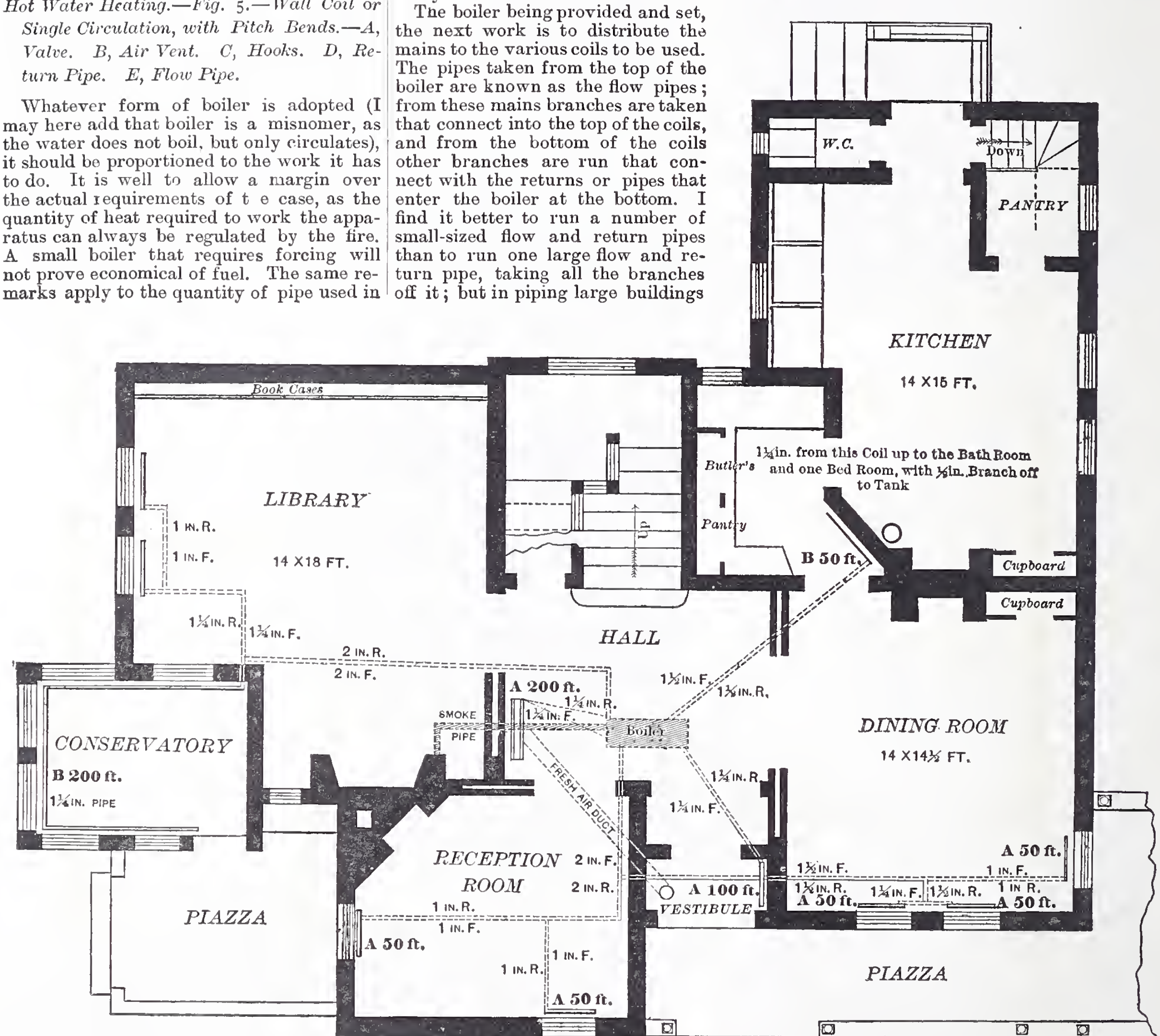
Hot Water Heating.—Fig. 6.—Close Wall Coil with Level Pipes.—A, Valve. B, Air Vent. C, Return Pipe. D, Ornamental Strap. E, Flow Pipe.

in this city numerous boilers, having from 10 to 30 feet of smoke-pipe leading from them to the chimney flue, which work satisfactorily.

The boiler being provided and set, the next work is to distribute the mains to the various coils to be used. The pipes taken from the top of the boiler are known as the flow pipes; from these mains branches are taken that connect into the top of the coils, and from the bottom of the coils other branches are run that connect with the returns or pipes that enter the boiler at the bottom. I find it better to run a number of small-sized flow and return pipes than to run one large flow and return pipe, taking all the branches off it; but in piping large buildings this sometimes is unavoidable. These pipes and the coils must all be so fitted that the air can be all taken from them by air cocks fitted at the highest points. This is very important, as where the air remains in the pipes it will be impossible to have a perfect circulation; in fact, a small quantity of air is sufficient to stop the circulation entirely, as it gathers in a high or low point and breaks the connection of the water. The engravings which are herewith presented will explain the position of air cocks and direction of all pipes. Pipes laid perfectly level will work well, and pipes that dip down and rise again will also work provided the dip or trap is not too deep, and that provision is made to insure such depressions being filled with water. In practice such depressions are to be avoided as much as possible.

There are various kinds of coils or radiators used: First, the box or cluster coils, which are clusters of pipe joined top and bottom, into headers or branch tees, as shown in Fig. 4; second, wall coils or single circulations. These are sometimes made with pitch bends, each pipe having an incline from the inlet or flow to the outlet or return, as in Fig. 7; but the most common form of wall coil used is made with close return bends, and the pipes are perfectly straight, and secured to the walls by shafts, the coils being set perfectly level. (See Fig. 8.) A third class of circulation coils, suitable for long runs, for heating large corridors, dormitories, wards, &c., are made of single rows of pipe, having the top and bottom rows of pipes connected to headers or branch tees, as shown in Fig. 5. Peet or other open way valves are best to use on hot-water coils. The air cocks are of the simple screw compression style.

One and one-quarter inch pipe is large enough for flow and return pipes for an ordinary size coil of the description shown in Fig. 7, say a coil containing from 200 to

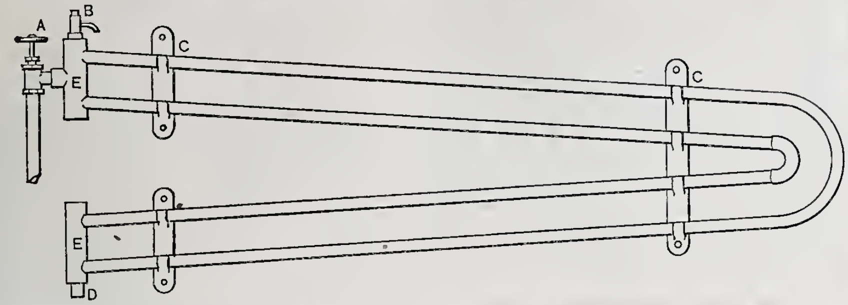


Hot Water Heating.—Fig. 7.—First Floor Plan of Suburban Residence, Showing Position of Fixtures, Runs of Pipes, &c. Scale, ⅛ Inch to the Foot.

A.—Box or Cluster Coils, fitted with Screens and Marble Tops.
B.—Unscreened Wall Coils, fitted above base and secured by Fancy Straps.
F.—Flow Pipes.
R.—Return Pipes.

The figures with the coils indicate the number of running feet of 1-inch pipe in them.
The figures with F and R on the plan indicate the sizes of pipe used for the flows and returns.

300 feet of 1-inch pipe. All the coils used for heating dwellings are made of 1-inch pipe as a rule, although three-quarter inch is sometimes used; sometimes, instead of fitting the air vents on the coils, a one-quarter inch pipe is taken off the top and run into basement, and the air-cocks fitted there. This prevents any muss or bother in drawing water from coils in the rooms. When coils



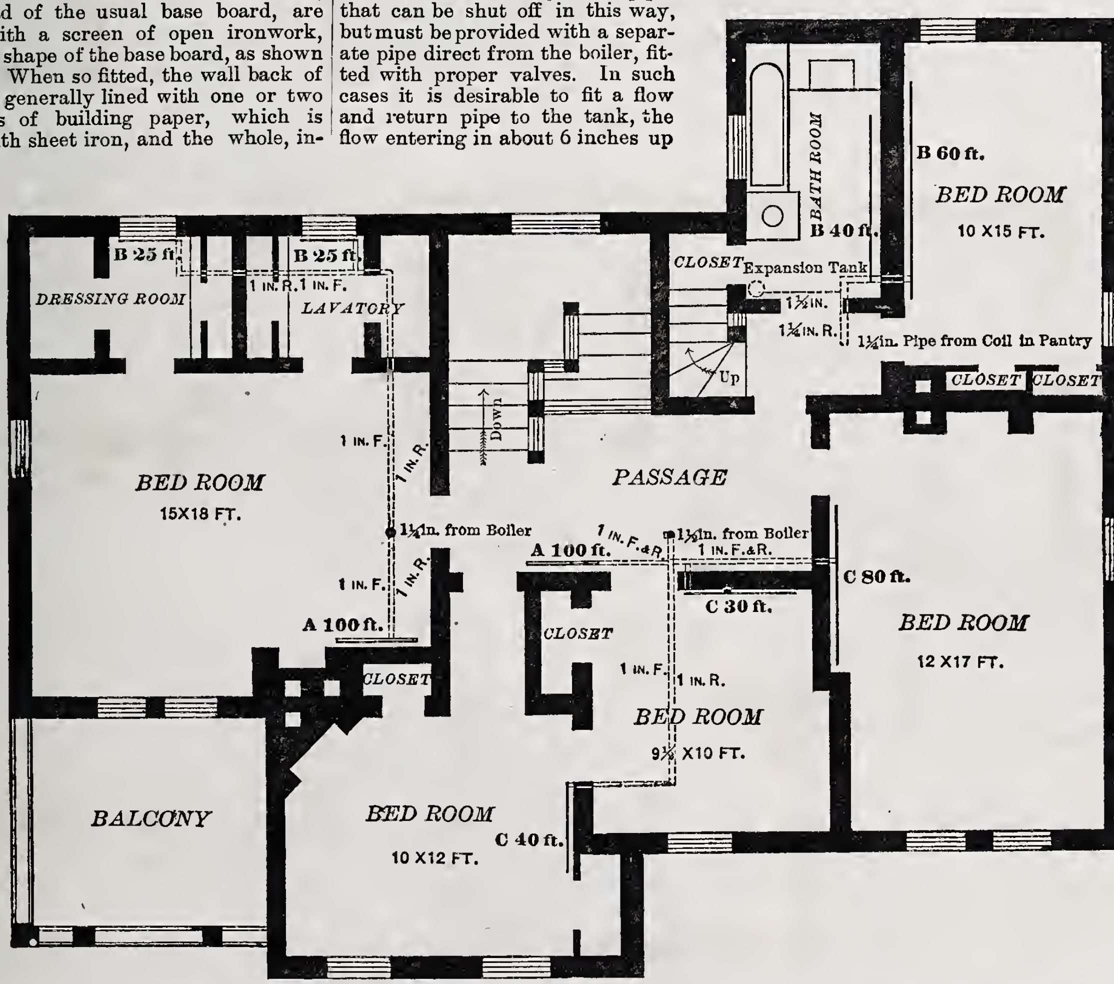
Hot Water Heating.—Fig. 8.—Circulation Coil with Branch Tees or Headers; Suitable for Running Long Distances Around Walls.—A, Valve. B, Air Vent. C, Hook Plates. D, Return Pipe. E Headers. F, Flow Pipe.

are fitted with screens and marble top the air vents and handles of the valves are brought outside of the screens.

Wall coils of the form shown in Fig. 8 are frequently fitted in the base of the room, and instead of the usual base board, are covered with a screen of open ironwork, taking the shape of the base board, as shown in Fig. 3. When so fitted, the wall back of the coils is generally lined with one or two thicknesses of building paper, which is covered with sheet iron, and the whole, including coils, painted black; sometimes tin is used for a back lining, and although this may possess some reflecting qualities it is not advisable, as the bright tin causes each row of pipes to be seen through the screen, thus defeating the object for which the screen is used.

The coils shown in Fig. 1 may be covered with screens and marble top in the ordinary way. The heat from hot water not being so excessive as steam, furniture may be placed close to or against the coils without injury. The wall coils, as shown in Fig. 5, are not usually placed in outside walls, but may be so fitted if precautions are taken to prevent freezing of water in pipes should circulation stop or fires be let out.

The sketch of boiler (Fig. 1) is introduced in order to show the pipes, connections, &c., rather than as indicating the shape of the boiler itself. In the arrangement of large jobs the valves and draw-off cocks are fitted in such a way that any section of the house may be shut off and emptied if required. When houses are fitted in this manner, however, the expansion tank must not be connected with any run of pipes that can be shut off in this way, but must be provided with a separate pipe direct from the boiler, fitted with proper valves. In such cases it is desirable to fit a flow and return pipe to the tank, the flow entering in about 6 inches up



Hot Water Heating.—Fig. 9.—Second Floor Plan of Suburban Residence, Showing Position of Fixtures, Runs of Pipe, &c.—Scale, ⅛ Inch to the Foot.

A.—Box or Cluster Coils, fitted with Screens and Marble Tops.
B.—Unscreened Wall Coils, fitted above base and secured by Fancy Straps.
C.—Screened Wall Coils, fitted in Base of Rooms.
F.—Flow Pipes. Accompanying figures indicate size.
R.—Return Pipes. Accompanying figures indicate size. Figures with coils indicate the number of feet of 1-inch pipe in them.

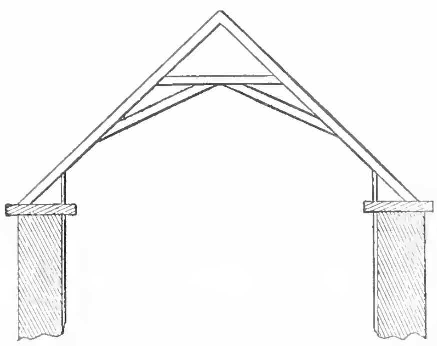
the side of the tank, coming from the top of the boiler, and the return pipe running from the bottom of the tank to the bottom of the boiler. Fig. 2 shows an expansion tank, with its connections.

When a cistern is used over a water-closet, it may be utilized for the expansion or supply tank, but when there is no cistern to attach to, an expansion tank is fitted. It is usually made of No. 26 galvanized iron, riveted and soldered, and is 1 foot 2 inches in diameter by 2 feet 6 inches high, fitted with a glass to show hight of water, and it must be placed above the highest coil. A tell-tale pipe may be fitted from it down to the side of the feed cock of boiler. A feed cock is generally attached to the usual water supply in city houses. In the country a funnel and cock may be fitted to the side of the tank for convenience of filling from a pail, or by other more convenient mode. The tank has a close-fitting top, with an open pipe from it that is generally carried over a cistern or into a soil pipe, and sometimes out through the roof, so that should water ever reach the boiling point, it can boil out of this pipe. Should water begin to boil, it should immediately be checked by regulating the fire, and any water boiled out be replaced. The apparatus should be filled very slowly, all the air vents being left open until the water runs freely and free from air out of them.

In indicating the fittings and arrangement of the apparatus which would be employed in a suburban house, as shown in Figs. 6 and 9, I have done it in such a manner as best to show the runs of pipes, regardless of correctness of position of the pipes. The sketches are self-explanatory, so that an extended description is rendered unnecessary. It may be well to remark here, however, that a pipe sometimes runs from the vestibule to underneath the coil in hall to admit fresh air. Such a pipe should be provided with a key. It requires considerable attention to make it entirely satisfactory, and is not usually fitted. Hall coils generally have an independent flow and return pipe from the boiler.

The form of apparatus here described is found to possess the following advantages: It is economical in fuel, and costs but a trifle for repairs as compared with steam; it is noiseless, the heat is mild and pleasant, not hot and scorching; it is suitable for all temperatures. In the mild weather of fall and spring a gentle fire may be kept which gives a circulation of warm water suitable for the weather, whereas, with a steam apparatus it is steam or nothing. The coils once heated retain their heat for a long time after the fire has gone out. It requires no skilled attendance; it is generally looked after here by the female servants, a man coming perhaps once a day to bring in fuel and clean out ashes. There has recently been introduced a combined cooking range and hot-water boiler that has given great satisfaction so far—the one fire heating the house, and serving for cooking purposes at the same time.

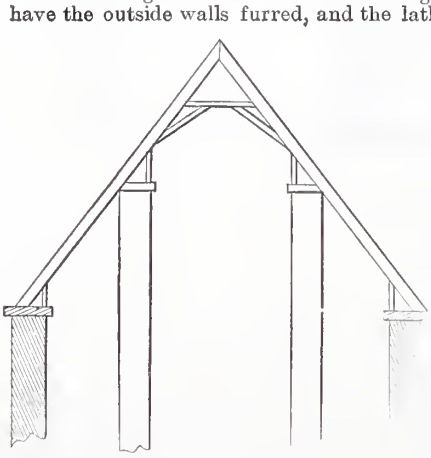
Mr. Hughes' paper closes with some general remarks upon the construction of buildings which apply with equal force to those houses in which stoves and furnaces are employed as heaters, and to buildings in the States as well as in Canada. We there-



Middle-Age Roofs.—Fig. 1.—Simple Trussed-Rafter Roof, Covering Porch of Heckington Church, Lincolnshire.

fore invite our readers' most careful attention thereto:

"In conclusion, I may state that we pay considerable attention to the construction of our buildings, so that they will keep out the cold. Unless this is done it is impossible to have a warm building. When I state that it is not uncommon for the temperature here to be at and below zero for several days, and sometimes weeks, at a time, you will see the necessity that exists for care in this respect. The absence of a few bricks under the front stoop, or the want of careful fitting and jointing of the door and window frames, or the want of attention in fitting the roof to the walls, is quite sufficient in extreme weather to neutralize the effects of a good and effective heating apparatus. Stone buildings are generally built with a lining of 4 inches of brick inside the walls, the brick being built out a couple of inches from the stone, leaving a space for confined air between the outer stone wall and the inside lining of brick. Buildings so constructed have the plaster laid on to the brick lining. Brick buildings and some stone buildings have the outside walls furred, and the lath



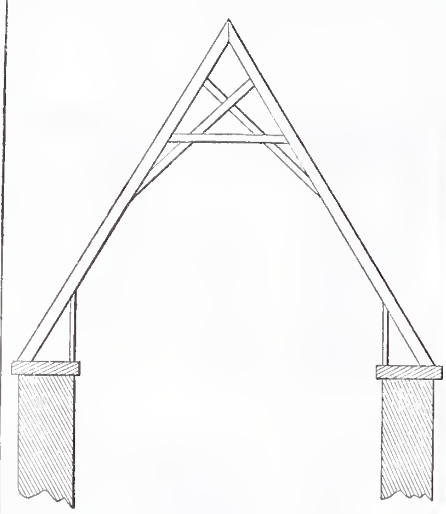
Middle-Age Roofs.—Fig. 2.—Roof over the Nave and Aisles of Long Stanton Church, Cambridgeshire.

and plaster are put on to the furring. Care is also taken to prevent the escape of the heat by the roof, the ceilings of the top floors being usually covered with from 4 to 6 inches of sawdust; and the space between the top ceiling and the roof should be ventilated. This secures warmth in winter and keeps the upper flats cool in summer, preventing the heat from the sun from being felt in the rooms nearest the roof. It also prevents the ill effects caused by the melting of the snow on the roofs in winter, when the temperature is not very low and the snow is lying on the roof to the depth of a foot or two, as is frequently the case with flat roofs. Door and window frames are carefully built into the walls, and in the best buildings they are then calked in with oakum and afterward pointed with mortar—or, better still, cemented. Double doors and double window sashes are also in general use. With all our precautions, there is still great room for improvement, and it is my firm opinion that until our buildings are so constructed that the walls are nearly perfect non-conductors of heat and cold, we shall never attain to that perfection of heating and ventilating that is so essential to health and comfort in a climate that is subject to great variations of temperature."

Roofs of the Middle Ages.

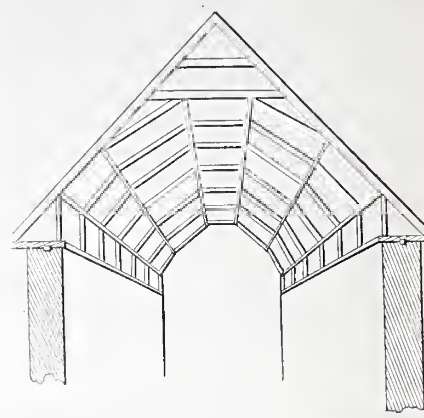
We have already considered the subject of gothic roofs (see *Carpentry and Building* for April, 1879). The second kind of middle-age roof which demands attention is that in which the principals consist of trussed rafters or diagonal ties. The porch of Stuston Church, Suffolk, England, is an example of the latter.

It is probable this expedient in construction was first adopted in porches to secure space overhead, and that its superiority in construction and appearance then became manifest. In wide spaces braces were in-



Middle-Age Roofs.—Fig. 3.—Roof over the Nave of Lympenhoe Church, Norfolk.

troduced to aid in strengthening the collars. These struts or braces sometimes crossed each other above the collar, and at others were tenoned to its under surface. The nave roof of Ely Cathedral presents an instance. Each pair of rafters is so trussed that the whole roof appears somewhat like an arched ceiling to a spectator below. This roof is of pentagonal section—two sides being formed by the lower part of the rafters; the next two sides by the braces, which are placed obliquely from each rafter to the opposite one; and the upper side of the pentagonal figure is formed by the collar beams. The rafters in this description of roof were generally extended beyond the walls, and, as the walls were very thick and never carried up above the wall-plates, a considerable space existed in the interior of the building, between the top of the wall and the under side of the rafter, which, if allowed to pitch on a plate placed near the outside of the wall, would have a very indifferent bearing. The remedy was self-evident, and led to the adoption of vertical struts or ashlar posts from the interior edge of the wall to the rafter, as shown in the French example at Fig. 7. The triangular base, thus secured, gave an excellent footing to the rafter, and probably gave the first idea of the beautiful hammer-beam roofs. Sometimes the underside of the trusses were boarded, thus forming a polygonal or coved ceiling, which was divided by molding at right angles, with carved bosses at their intersections. These roofs have frequently but one wall-plate, placed midway on the masonry, the rafter feet being halved to it. Others have both an external and internal plate, as at Fig. 7, or, again, as at the south porch of Heckington

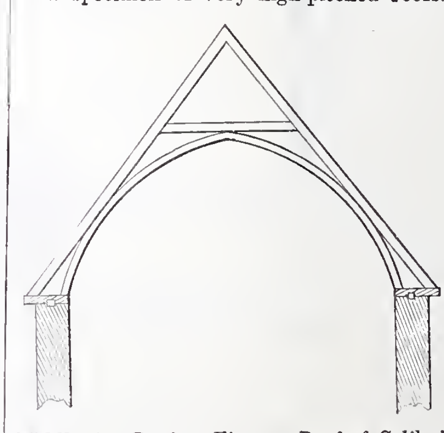


Middle-Age Roofs.—Fig. 4.—Roof of the Nave of St. Mary's Church, Wimsbotsham, Norfolk.

Church, with a central plate, and also an internal one, which forms also a cornice.

In early examples of this roof the tie-beam is still retained, as, for instance, in the chancel of Sandridge Church, near St. Albans. There are two tie-beams in the entire length of the chancel, with about 12 rafters between each. The tie-beam was soon, however, dispensed with, and the simple trussed rafters form the favorite style of roof during the Early English and Decorated periods, which they fully merit from the effectiveness and elegance of roofs so composed.

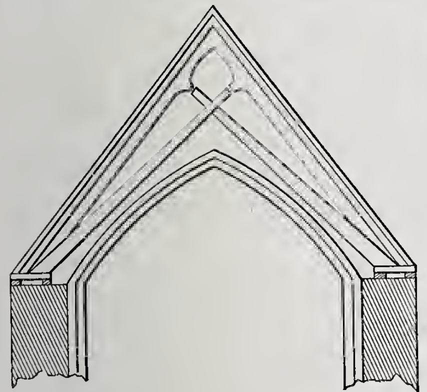
Fig. 1 shows a specimen of the simplest kind of trussed rafter roof, being that of the south porch of Heckington Church, Lincolnshire. The angle here formed by the rafters is too large to obtain an agreeable effect, as the sides of the polygon are too unequal. Fig. 2 (the roof over the nave and aisles of Long Stanton Church, Cambridgeshire) is steeper, but not more satisfactory in effect than the preceding. This roof has no longitudinal tie. It is a curious and interesting example, as exemplifying the manner of treating the aisle roofing. Fig. 3 (the nave of Lympenhoe Church, Norfolk) is a specimen of very high-pitched roofs.



Middle-Age Roofs.—Fig. 5.—Roof of Solihul Church, Warwickshire.

The braces here traverse the collar-beam, and intersect each other, being finally tenoned into the opposite rafters. The effect of this roof is very pleasing. The roof of the nave of St. Mary's Church, Wimsbotsham, Norfolk (Fig. 4), has a double collar-beam, and the whole internal surface is boarded; the planking being divided into ribs by small molded panels, with handsome carved bosses at their intersections. Sometimes the arch form was rendered perfect by the adoption of carved braces, fixed beneath the rafters, as at Solihul Church, Warwickshire (Fig. 5.) These arched ceilings are frequent in Somersetshire, and are generally divided into panels by horizontal ribs, with carved bosses at intersections. Sometimes the panels are plastered, as at Crowcombe Church. Although trussed rafter roofs are generally of tolerable pitch, some are very flat, as, for instance, that of the wide nave of Melliss Church, Suffolk. For most of the preceding particulars we are indebted to the splendid treatise on "Open Gothic Roofs" of the late Mr. Britton and his brother.

The early timber roofs of France resembled those of England in being, as a rule, modifications of the king-post truss. There were, however, minor differences of detail; for instance, the tie-beam and the king-post were both stop-chamfered, and an almost vertical strut, springing from the tie-beam, served to lessen the strain exercised upon the principal by the purlins. Unless the span covered was small, and the wall very massive, this plan gave a false bearing to the principal rafters. Later builders endeavored to neutralize this evil by tenoning the purlin into the rafters, and by placing its wider side next to them, in order to bring the backs of the principals and the common rafters to the same plane In the foregoing observations we are, of course, alluding to roofs as composed solely of timber trusses and their coverings; but a



Middle-Age Roofs.—Fig. 6.—An Example of Trussing the Principals in the Form of a St. Andrew's Cross.

word is necessary here respecting a form of roof truss which obtained at an early period in the North of France, and may have had much to do with the origination of the idea of high-pitched open roofs.

When, during the early Gallo-Roman period of French architecture, it was usual to throw an arched vault over the walls of important edifices, the covering was placed upon the extrados of the masonry. Experience, however, proves that this plan was inadvisable, for two reasons: It was difficult to perform repairs when necessary, and the infiltration of rain through the outer roof necessarily had a prejudicial effect upon the stone work beneath. It became, therefore, necessary to protect the vaulting by woodwork sufficiently elevated to raise the tiles from the masonry, and to permit easy access for the purposes of repairs when required. If we take the vault in Fig. 7, for instance, resembling those of the Cathedral d'Autun or the churches of Beaune and of Saulieu, we see that, while the principals rest upon the extrados, they are sufficiently supported; but if it is desired to elevate them, so as to raise the covering, some expedient must be adopted to replace the support taken away. Various rude expedients were adopted, such as forming piles of masonry above the vault and placing the principals thereon. It was found, however, that the weight of the timbers and the outer covering tended to destroy or deform the arc, and some more scientific expedient had to be sought for. Then came the invention of trussing the principals in the form of a St. Andrew's cross, as shown at Fig. 6. It soon, however, became evident that the weight of beams of enormous scantling, having an angle of scarcely 45 degrees, and bearing the superincumbent load of other timbers and heavy tiles, tore out the tenons at the feet of the principals and the struts. For this reason, in the greater number of these vaulted edifices, the architect was driven to the rude expedient of raising the exterior wall to the hight of the vault, in order that the tie beam should pass over it—this exigency causing a terrible waste of material and creating a useless void.

While these experiments were in course of being made the vaulting itself assumed another form, that of the Gothic pointed arch, and the roof had to accommodate itself to new conditions; and thus toward the close of the twelfth century we find a modification of the high-pitched roof adopted, the main features of which are shown at Fig. 7, which represents the feet of the rafters and their junction with the double wall-plates. Here the two wall-plates, A A, are shown in perspective, the widest side of these plates being placed downward. In order to give them more rigidity and stability they were strutted between, in the manner shown in plan at Fig. 9. The beams, B, were let into the dovetail mortises of the wall-plates, A A, Fig. 8, and the tassels, or short hammer beams, C, were cocked down at intervals between the tie-beams. It will be seen that both the tie and hammer receive, besides the foot of the rafter, that of an almost perpendicular stud, or ashlar piece, D D, which is tenoned in the rafter above. By this means, both the principal, E, and the common rafter, F, secure a broader basis. The feet of all the rafters are double tenoned, as at Fig. 8, A, and sometimes the principals are strengthened above the mortises for the ashlar posts, in the manner shown at B, Fig. 9. Such a roof as this, in which the purlins were abolished and the weight equally distributed, did not require either large scantling of timber or great width of footing, and hence was adapted for less massive walls.

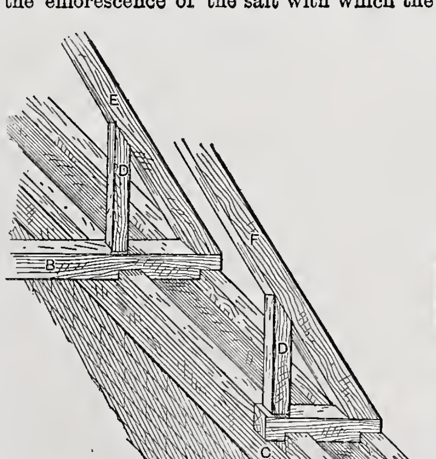
Building Stones.—Their Properties and Uses.

BY JAMES LEAL GREENLEAF.

(Concluded.)

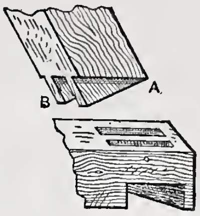
The following is a translation of Brard's method (to which allusion was made at the close of that part of the paper published in the February issue), the original of which may be found in the *Annales de Chimie et de Physique*, volume 38:

"To assure one's self that a stone is or is not susceptible to the action of frost, boil a piece in a cold saturated solution of sulphate of soda for half an hour. Then remove it and put it in a flat dish, and pour in enough of the same solution to cover the stone. In winter, place the dish in a warm room, and in summer in a loft or garret, to facilitate the efflorescence of the salt with which the



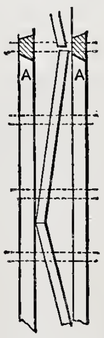
Middle-Age Roofs.—Fig. 7.—Modification of the Construction of High-Pitched Roofs.

stone is impregnated. At the end of 24 hours the specimen is covered with a white efflorescence and the liquid evaporated or absorbed. The stone is then lightly sprinkled with pure water till all the saline crystals have entirely disappeared, and then the stone, which should not be removed from the dish, is well washed. It is not rare to find about the specimen from the first solution grains, plates and angular fragments which have been detached, and still others already loosened if the experiment is made on weak stone. This is the first step, but the operation is not ended. It is necessary to allow the stone to effloresce again, then to sprinkle it, and repeat this five or six days.



Middle-Age Roofs.—Fig. 8.—Detail of Construction of Roof shown in the Preceding Figure.

At the end of this time, if the temperature has been dry and the efflorescence well carried out, the experimenter should be decided on the good or bad quality of the stone under consideration. The specimen is then washed with a large amount of water, and all that is detached during the course of the experiment is collected, and by the amount of the particles separated one judges of the degree of alteration which the stone would undergo in one day if exposed to the action of frost." He then continues: "The very weak stones which I have submitted to this experiment



Middle-Age Roofs.—Fig. 9.—Plan of Wall Plates of Fig. 7, showing Method of Strutting.

have deteriorated on the third day, some having fallen to pieces. Those which are more durable have resisted five or six days; but few stones, except hard granite, compact limestone, and white marble have been able to withstand the attack thirty consecutive days, and I think that eight days ought to suffice."

This method, it will be seen, depends on the assumption that the action of the salt in crystallizing and dissolving is similar to that of water in freezing and melting, which is not entirely correct, for the reason previously given. A better way, because it more nearly approaches the process of nature, but a longer one, is to saturate the stone with water by long boiling, and then subject it to a freezing mixture. It may be objected to these tests, and not without apparent reason, that a stone in actual practice will never be put to such a severe trial as boiling for hours in a liquid which is then frozen, or allowing the liquid to cover it with a coating of crystals, and then dissolving them; but, on the other hand, it must be remembered that the action of frost is continued many winters, and not only that, but is repeated many times during the same winter, so that, by continued action, the effect would not be so very different from that of the tests above described.

A stone which, when quarried, looks as if it were able to meet all that could be expected of it, and which will stand with remarkable success the previously mentioned tests and criticisms, may yet have locked up within its smooth exterior elements of weakness which will decompose and destroy the stone or stain it, and excess of weakening constituents.

It may happen that iron pyrites occur in considerable quantity in association with limestone. The sulphide of iron decomposes, forming sulphuric acid, which attacks tho carbonate of lime, setting free the carbonic acid, and thus tending to disintegrate the stone. Irou alone, iu the form of ferrous oxide, by its oxidation to ferric oxide, may stain the surface of a stone, which, with white marble, would be a very serious objection, although it may be tho means of improving the appearance of some stones by softening the tiuts aud giving them the subdued coloring which always accompanies age. Iron pyrites will have a like effect.

Clay, when it is largely present, absorbs moisture and dispels all strength, allowing the stone to crush like ordinary earth. The potash and silica of orthoclase may be carried off in solution as silicate of potash, leaviug only alumina or clay iu the form of kaolin.

This sometimes occurs with granite, large tracts of it being decayed. It is called by Dolemien, *la maladie du granite*. All this is sufficient to show that a somewhat intimate investigation of the chemical character of a stone and the impurities contained is advisable. Another point, which is of more importance under the heavy skies of the business centers of England than in our own country, is the following: The smoke and acid which often contaminate the air of manufacturing towns is very injurious to stone. Water is to air what a sponge is to water, absorbing all the impurities which it possesses, and then the rain, in passing through the atmosphere, carries all the acid down with it in a weak solution and spreads it over the surfaces of the buildings; hence, under such circumstances, it is unwise to employ stones which are easily affected by acids, such as the calcareous stones—especially the soft, porous ones. The best kinds for the purpose are the silicious sandstones, which do not have a calcareous cement.

The uses of stone, where it is subject to attrition, are on roadways, sidewalks, doorsteps, &c. Of course, the harder a stone the better under these circumstances, and it should also have, for roads especially, a small ratio for absorption, for a stone which crumbles will speedily be ground to powder. The order of excellence given by Professor Trowbridge, in his lectures of stones suitable for road coverings, is: 1st, basalt; 2d, granite; 3d, limestone; 4th, sandstone.

For flagging the material should not only be hard, but also of a coarse enough grain to give a firm hold to the foot. Granite and limestone are poor on this account—that they become slippery when wet. Some marbles make good flag stones, but they are liable to stain. Fine sandstones are the best, and of these the Hudson River bluestone is first.

It is eminently important for fire stones that they should be able to withstand the direct application of intense heat without fusing or cracking. The constituents of some stones render them entirely unfit for such purposes. Potash, when present, makes stones very fusible; also the alkali earths, except they are in the form of silicates, make a stone unable to withstand heat. Granite is very unsuitable for fire stone, as heat cracks and explodes it. Sandstone containing no feldspar is much better. Mica slate and soapstone are also well adapted to resist heat.

The property of strength is inseparably connected with the materials which are used in the erection of buildings, and this is especially true of stone, because of its weight. As a usual thing, the greater weight which comes upon a stone structure is not from the temporary or permanent loads imposed thereon, but from the weight of the stone itself; and stone walls, if of any considerable size, require to be built very massive.

It might be inferred from the above that all the strain to which stone is subjected in a building is a crushing pressure, and this is nearly so, but not quite. Stone is subjected to transverse strain in lintels, corbels, &c., and in large buildings this is a matter of some importance, and the transverse strength must be carefully computed; but the transverse and tensile strains are so little met with in comparisou with the crushing strain, that we will pass them over with this reference.

The weights of our most common building stones—as granite, sandstone and marble—vary from about 130 to 170 pounds to the cubic foot, that of ordinary masonry being about 140 pounds, and it is easy to satisfy one's self by a little calculation of the enormous pressure exerted on the lower courses of a high wall.

Some estimated in Trautwine's "Engineer's Pocket Book," on the hights of columns of different kinds of stone necessary to crush the lower courses, are as follows:

Name of Stone.	Weight per cubic feet in lbs.	Hight of column in ft.
Average granite........	165	8,145
" sandstone . .	145	4,158
Caen stone..............	130	1,376

Below is a table, copied partly from Prof. Trowbridge's lectures, and partly from Stoney's "Theory of Strains," giviug the pressure per square foot, iu tons, on the foundations of some well-known buildings:

Pillars of the Church of all Saints (Angers)..	43
St. Genevieve (Paris)........................	30
Pillars of the dome of the Pantheon (Paris)..	30
Dr. Spring's Church, corner Fifth avenue and Thirty-seventh street, New York......	7
New Dome of the United States Capitol......	6.7
Washington Monument......................	5
Bunker Hill Monument......................	5.5

Of these, Dr. Spring's church has settled somewhat.

It is not allowable, of course, to subject a stone to its crushing weight when used in a buildiug. Trautwiue states that a stone will begin to crack and split under about one-half that weight, and it is usual, in practice, to calculate the working load as only one-tenth to one-sixth of the crushing weight, using a safety factor of ten or six, while Stoney recommends that for ashlar voussoirs, the working pressure should not exceed one-twentieth the ultimate crushing strain, as in the case of any unevenness in the joints, the edges would be liable to chip off and iujure the appearance of the stone.

Some stones will show premonitory signs of weakness by slight cracks or breaking of the edges, thus warning those concerned to take means in time to prevent the total destruction of their buildings, while others, and, especially, sandstones, give way suddenly and without a warning, so it is especially advisable to use a large safety factor with them. It is necessary, in order to estimate the weight which a stone will support, to know the unit crushing strain—that is, the force per uuit of area necessary to crush it, the square inch being the uuit. This is obtained by direct application of force to a cube of the stone, from 1 to 2 inches on the edges, and cut as accurately as possible.

A number of experiments on the crushing strength of different specimens of stone have been made by Mr. Hutton in the School of Mines. The machine used was the testing machine manufactured by Fairbanks & Co., which is a combination of levers, and is arranged for finding the tensile, as well as the crushing strengtb. It consists of two frames, much like those used to support the walking beam of a ferry boat, and which are built very strong to withstand the straiu when tensile strength is tried. These are framed into a platform which is supported by steel knife edges on a system of levers. On this platform the specimens are placed. Two vertical iron screws standing between the frames, fastened firmly below the platform, and worked by worm wheels, move by means of their thread a heavy iron plate, which presses upon the specimen and finally crushes it. The system of levers before mentioned beneath the platform communicate by an extension of the system with an ordinary steelyard, by means of which the pressure is recorded.

Gen. Gilmore, in his experiments at Fort Tompkins, Staten Island, on the crushing strength of building stone, used a hydrostatic press and recorded the force exerted by pressure-guages made on Bourdon's principle.

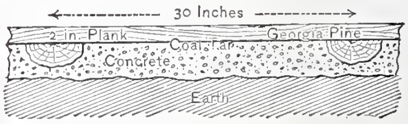
The extremes in crushing strength, as obtained by a comparison of several different tables, for the most prominent building stones are these:

Name.	Weight in pounds: Min.	Max.
Granite........................	3,173	22,750
Sandstone..................	2,120	25,500
Marble..........................	3,216	20,160
Limestone....................	3,050	25,000
Slate.............................	16,943	26,495

A Method of Constructing Factory Floors.

In the June number of last year we described what was called a curious method of laying floors, said to have bcon adopted in in France, and which it was declared had obtaiued a wide application. It was described as consisting in putting down a floor, not as hitherto ou sleepers, but in embedding tho boarding in asphalt. Pieces of oak, usually about 2½ to 4 inches broad and 12 to 30 inches long and 1 inch thick, were pressed down into a layer of solid asphalt, not quite half an inch thick, in the well-known herring-bone pattern. To insure a complete adhesion of the wood to the asphalt and obtain the smallest possible joint the edges of the pieces of wood were planed down, beveling toward the bottom, so that their cross-section became wedge-like. It was stated in that article that these floors were used mainly for ground stories, in barracks and in hospitals, and that they had been laid in the numerous newly-constructed forts around Metz. A number of advantages were cited in connection therewith. A plan in some respects resembling this has been employed in the construction of the floors iu a new factory recently erected by Messrs. Bliss & Williams, Brooklyn. It is similar, however, only iu some of the more general features, the details being altogether different. Sleepers are employed, but instead of stretching between supports they are solidly bended in concrete. Upon them planking is placed, each plank as laid being bedded in hot tar.

One of the most annoying points of many otherwise well-built factories is their poorly constructed floors. A tight, smooth, strong and durable floor is what is wanted, but in floors as commonly constructed some of these qualities, at least, are lacking. A floor on which heavy machinery can be placed without regard to the position of beams and girders, is a rarity. Floors which have to rest upon the ground, as ordinarily built, are constantly wearing out and are never to be depended upon. The construction employed in the factory above mentioned combines all of the desirable qualities which we have mentioned, and avoids the objectionable features. The business conducted in this factory, which is the manufacture of presses and dies, is such as will test any floor quite severely. Accordingly, whatever construction is satisfactory in this case is very likely to prove desirable iu other instances.



Construction of Floors in the Factory of Bliss & Williams, Brooklyn.

The accompanying illustration shows the construction employed. The surface of the ground after the top earth had been removed was thoroughly smoothed and rolled. Four inches of concrete was then applied, and while this was soft locust stringers were bedded in it. These striugers wero spaced about 30 inches between centers. After the concrete had become perfectly hard and solid, 2-inch planks of Georgia pine were laid, each plank in turn being bedded in hot tar, which was spread on to the coucrete as fast as the planks were laid and spiked. The result is a floor upou whieh the heaviest machines can stand in any convenient position without the necessity of any special foundations. Moreover, it is water-proof, damp proof, and no miasma can arise from the grouud through it. A floor of this kind is both cheap and solid, but an advantage which will appeal to every factory owner and builder is that such a floor will last until worn out from the top. There can be no decay from the under side.

It is reported that floors constructed upon this general plan have been iu use in some of the older factories upward of 25 years.

They have not come into general use, however, and this description, no doubt, will be entirely new to the majority of our readers. We recommend the plan to any of them who have charge of the construction of factories in which heavy machinery is used, believing it will be found of great advantage.

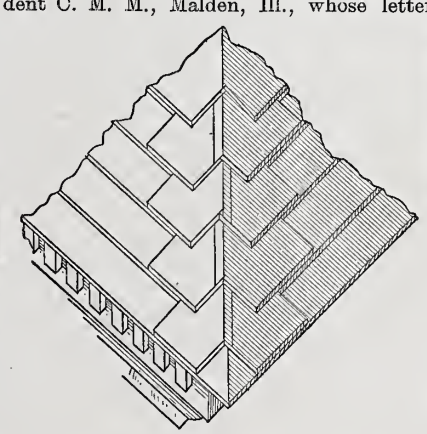
Increasing the Hight of Rooms.

It is frequently desirable to raise the roof of a dwelling house a few feet higher than it was originally built, for the purpose of making sleeping rooms in the attic story, or to render rooms that are too low, more pleasant and airy. But many builders dare not attempt such a job, unless they take the roof entirely down, for fear that they may get a dead-fall trap on stilts when they have lifted the roof from its original foundation. It will be found a comparatively easy job to raise the roof of any ordinary building 1 foot or 6 feet, with perfect safety, provided a workman will operate understandingly. Let us assume, for example, that it is desired to raise the entire roof of a dwelling house, or the roof of one wing, which is 30 feet long and 20 feet wide. If the lower ends of the rafters rest on plates 6 inches square or larger, it will be better to elevate the plates with the roof, by cutting openings through the side walls, about 6 feet from each end, to receive sticks of timber extending across the building beneath the plates. If the building has been erected with a balloon frame, there should be three sticks of square timber, one near each end and one near the middle. Let these timbers be blocked up close to the under side of the plates. The ends of these sticks need not extend beyond the outside of the plates so as to interfere with the cornice. If there are no collar-beams secured to the rafters, the plates must be fastened, temporarily, to the timbers, to prevent their spreading as soon as the roof is lifted. The next step will be to set a screw near the end of each stick of timber, on a foundation that will not topple nor sway as soon as it receives the superincumbent pressure of the roof. If strong iron jack-screws cannot be obtained conveniently, three 2-inch wooden bench-screws will elevate one side of a large or a small roof with perfect safety. The writer has frequently lifted one corner of a 30 by 40 feet barn with a pair of 2⅛-inch wooden screws. As soon as the timbers are secured in their proper places, and the screws are set to lift one side, remove a board just below the cornice, and saw off all the studs on both sides of the building. Let all the studs at the gable end be sawed in two at a point nearly in a horizontal line with the plates, and let the gable end walls and window rise bodily with the roof. Now let the screws be all worked together, blocking up every inch as fast as the roof rises. After one side has been elevated 6 inches, remove the screws to the opposite side, and elevate it about 1 foot, keeping the timbers beneath the plates and well blocked as fast as the roof rises.

In case there should be a chimney resting on a closet, or on the collar-beams supported by a partition, procure another wooden screw, and set it beneath the chimney. Four wooden screws will usually cost no more than proprietors of jack-screws are accustomed to charge for the use of a set of screws while performing such a job. If the screws are placed on the foundation so as to elevate the roof perpendicularly, by raising one side 6 inches, then the opposite side 1 foot, and after this lifting each side alternately 1 foot, there will be no difficulty in carrying up the roof in a perpendicular direction to any desired hight, provided the screws and the blocking are supported by a broad foundation of blocks that will not rock. Before removing the screws, see that the blocking is so secure that the roof cannot slip, in case the screws were not set perpendicularly on the opposite side. As the roof is lifted, let a plumb line be frequently employed, to determine whether it is not being carried in any direction away from a perpendicular line. In case the entire roof is 1 inch, or more, too far to the north, let the north side be lifted 1 foot higher than the opposite side and be blocked up; then set the screws under the opposite side, inclining about 1 inch per foot in hight. By this means the roof can be carried in any desired direction, the distance of ½ inch or 2 inches. If the screws are always set perpendicularly, the roof will rise in the right direction. If, for example, the plates beneath the roof to be raised were 4 feet from the chamber floor, in lieu of square blocks, make a strong platform for each screw to rest on, by placing four pieces of scantling 2 feet long, on the ends, for corner posts, and nailing stays from the top of one to the lower end of another. Then let the scantling stand on strong planks resting on the floor. A crib can then be carried up, on the tops of the corner posts, with pieces of plank, or studs or boards, and the foundation will not topple. As soon as the roof has been elevated to the desired hight on one side, let the space in the side wall be filled by nailing pieces of studs to the sides of the pieces attached to the plates and the sides of the studs beneath. Then lift the opposite side of the roof, and secure pieces of studs to the sides of any timbers that have been sawed in two. If studs, when lapped together, be nailed firmly, the side wall will be about as strong as if the studs were of one entire piece of timber. Should there be partitions extending from the floor to the roof, tear away the base boards and saw off the studs near the floor; and let another screw be employed to carry up such portions of the structure, or let a self-acting lever, with a weight at the further end, hold the partition wall up to the desired position as the roof is rising.

Patent on a Method of Shingling Hip Roofs.

It will be remembered that in the last number of *Carpentry and Building* a correspondent stated that he had been called upon for royalty for using the method of finishing hip roofs, described by our correspondent C. M. M., Malden, Ill., whose letter



Holcomb's Patent on Shingling Hips of Roofs.

was published in the October number. In our comments we promised to obtain particulars and publish them in this number of *Carpentry and Building.* The accompanying engraving represents the invention as described by the patentee, Asahel R. Holcomb, of Naples, N. Y. The date of the patent is September 22, 1863. The following description is taken from a circular issued by the firm of which Holcomb was a member, in advertising the invention:

"The improvement consists in dropping the corner shingle down over its fellow course, thereby having the full strength of the shingle, and leaving the corner not liable to warp or split off. The corner shingles should be of uniform width and about the same number of inches that shingles are laid to the weather. The corner of the first course should be covered with tin. For this purpose take a large sheet and quarter it for the four corners; commence the double shingling or dropping back with the second course. Every corner shingle should be nailed with a sixpenny nail near the edge of the shingle and midway of the course, as well as with the necessary shingle nails. Overlap alternately the corner of the other side of the hip to keep the corner straight and tight; all as will be clearly seen by the accompanying cut."

The following is the brief and claim of the patent, as contained in the Patent Office records for 1863:

"The angular piece which finishes the course on the edge of the hip is brought down one course below, so as to make an additional thickness at that point and afford means for a more secure attachment.

"*Claim.*—Substituting for the ordinary small triangular pieces that complete the courses at the hip, the joint shingles *b' c' d'*, each projecting to the base line of the course already laid, arranged so as to be securely laid, and held in place without splitting or warping, and without the necessity of weather-boards, and furnishing an extra thickness of covering, substantially as herein set forth."

From the date of the patent it will be seen that its course is very nearly run—in other words, that it will expire during the present year. Of the validity of the patent as to the original grant we have nothing to say. It dates so far back that it would be difficult at this time to prove that it was or was not a just patent.

We learn from our correspondent M. P. E. that since writing the letter published in the February number concerning this matter, the claimants have made him no further trouble in the way of demanding royalty or suing him in the United States courts, as was threatened. From this it would seem that the claimants, whoever they are, do not consider their rights very well defined in the matter.

We lay this matter before our readers, with all the information we have been able to obtain upon it, leaving it to their judgment whether or not to use the invention without license. As above remarked, it will be free in a very short time in any event.

Farm Barns.

There is no such thing as a plan of a farm barn that will be suitable for universal use. The ever-varying uses to which farms are devoted must call for barns especially designed for the crops produced and the animals supported in each individual case. The site of the barn is also to be considered, as well as the material of which it is to be constructed; yet there are some general principles that will so come into nearly every case that it will be well to state some of them. Barns are made to hold and protect crops and for sheltering and feeding animals, and to secure great storing and stabling capacity at the least cost is very important. The least outside surface for the most inside room is a point to be considered. The square form is, therefore, to be approached as nearly as consistent with the uses to which the building is to be put. Mechanical work and economical use of material are also points to be regarded in making plans. A circular barn would have more capacity, in proportion to its surface, than a square one, but would take too much mechanical work; and if made of wood, too great waste of material.

As the roof is the most costly as well as the most perishable part of a barn, the walls should be high, so that there may be less surface of roof required. For ordinary farm barns, wood is the best material above the foundation walls—and slate or tin makes the best roof. If the roof is of slate it must have considerable pitch; that is, the rafters should rise at least 1 foot to every 2 feet horizontal measurement, and what the carpenters call "one-third pitch" is still better, and this gives, for a roof of building 36 feet wide, 12 feet as the rise from the walls to the center of the roof. If tin is used a very little pitch is required, and much less strength of timber to support the weight of the roof. The cheapest siding for a barn is rough, unplaned inch boards, put on vertically, nailed to sill and plate, and intermediate horizontal timbers, not much more than 5 feet apart—boards 1 foot wide, should have 4 nails put in wherever they cross a timber, even to the braces, that should be at top and lower end of the main posts.

Paint on farm barns is ornamental, but a very unnecessary expense. I have a barn that is nearly 40 years old, 75 feet long by 40 feet wide, and 20 feet high above the basement to the top of the side walls. It was sided with unplaned and unpainted hemlock inch boards, and these boards are apparently uninjured by the "tooth of time," and bid fair to last another 40 years. The cost of one painting when this barn was built, put at interest, would long since have amounted to a sum more than sufficient to pay for new boards. But one painting would have only led to the necessity of re-painting as often as once in five years. If a man paint his outbuilding, let him not flatter himself that he does it to preserve the timber, but rather let him say "a painted barn looks well—so the expense is incurred."

CORRESPONDENCE.

Carpentry and Building has been favored with more letters from its readers the past month than during any other month since it has been published. It is simply impossible for us to find space in this issue for all that we have received, and hence some very interesting and valuable communications are necessarily laid over. But we do not wish this statement to deter any of our readers from writing to us in the future. We still request letters from all, and still promise careful attention to every letter received. It will undoubtedly be necessary, however, from this time forth, for us to sift and condense matters in this department a little more than has been our habit so far, and, where several letters are received upon one subject, to select from among them for publication one or two which cover the ground, simply acknowledging our obligations to the authors of the letters we are unable to publish, in the manner followed in one instance below. In no case will any reasonable request for information be passed unheeded, and no communication likely to be read with interest by any considerable number of our readers will fail to find a place sooner or later. Our correspondents may have to bear with us for laying their communications over from one month to another quite frequently. We shall always try to select for publication from the letters on hand such as are calculated to render each number of the paper of the greatest interest and value to the largest circle of readers. Very often, no doubt, in performing this duty, we shall leave unprinted letters quite as interesting as those we have selected. An excess of valuable matter brings its responsibilities and cares, as well as a dearth of material.

W. K. I.'s Brace Rule.

There has been no one item in the correspondence of *Carpentry and Building* which has called out so many letters as the brace rule forwarded by W. K. I., of Rockland, Ind., and published on page 37 of our last issue. We had some misgivings of mind at the time in allowing it to pass without comment, or, as our old friend "Wood Butcher" facetiously puts it in his letter published below, branding it "shaky." We desired, however, to see with what degree of care and criticism this department of the paper is being read by practical men. The result is eminently satisfactory. There have been, doubtless, at least 100 readers of the paper who have made a mental note of the fallacy of the rule to every one who has taken the trouble to write us about it. An estimate upon this basis shows that very few have have passed it over carelessly, much less accepted it as conclusive and reliable. It seems well demonstrated, therefore, that whatever rule or method of work may be advanced by any correspondent, is likely to be subjected to close criticism, and either its correctness or its fallacy established at the mouths of many witnesses. Such matters as this show the real scope and value of this department of the paper. It would be manifestly unfair to hold the Editor responsible for the opinions of correspondents. At best he can only give a supervisory care to letters received which are intended for publication in these columns. He may criticise and point out better plans than those advocated by the writers; he may answer questions and he may expose errors. But the full degree of usefulness of which this department is capable is reached only when every reader of the paper feels that he is a special committee of one, whose duty it is to co-operate with the Editor in criticising methods, in answering questions and pointing out mistakes. We trust this idea will gain foothold in the minds of all our readers. Everything in these columns, whether specially referred to readers or not, is before the meeting. Unlike parliamentary bodies, there is no need of any one waiting to obtain recognition from the presiding officer before addressing the assembled thousands. All have the opportunity of speaking at one time, and we hope all will avail themselves of the chance.

We cannot, of course, give space to all the letters we have received upon this subject, but some of them demand special attention. For the benefit of W. K. I., who evidently was convinced his rule was right at the time he sent it, we first annex a letter which in plain terms explains wherein he is wrong.

From A. H. F., *West Meriden, Conn.*—In the February number, W. K. I. gives the method he follows to obtain the lengths of braces and rafters, and by it obtains 4 feet 11½ inches as the length of a brace of 4 x 3 feet run. Now, this particular case should represent a right-angled triangle, with sides bearing the proportion of 3, 4 and 5, as he can prove by a mental operation in square root. If he still regards the method he follows as correct, let him take an extreme case, and by his rule obtain the diagonal of a rectangle whose length greatly exceeds its width.

As the diagonal of a square bears to its side the proportion of 16.9705 to 12, it is customary in off-hand calculations to allow 17 for the diagonal where the side is 12; and our young friend has naturally fallen into the error of supposing that as this is 17-12 of one-half the sum of the run added to the rise, the result would be the same where the run and rise are unequal.

He will see how the principle works by laying his 2-foot rule on his steel square, taking first the distance at 12 inches from the heel on the tongue and the same on the blade, then increase the length on the blade and lessen it on the arm, so that the sum of the two will still be 24 inches; by his rule the diagonal will be unchanged—in each case 17 inches—but if his rafters were framed this length for a run of 23 inches to a rise of 1 inch, his ridge pole would be stronger than is usually required.

While he has his steel square in his hands, I would like to suggest an idea which has been of service to me when using it to obtain the miter on the edge of stuff. Find by trial at what equal distance on the arm and blade from the heel the square balances, and let these points rest on the work. My square balances at 10⅜ inches from the heel; therefore, when I take 11 and 11 for my miter, the square rests quietly without showing a disposition to roll off.

We have received letters of a similar character, all pointing out the error in W. K. I.'s method, and each referring to the old rule of the arithmetics for finding the length of the hypothenuse of a right-angled triangle, by extracting the square root of the sum of the squares of base and perpendicular—from the following correspondents:

C. E. L., New Haven, Conn.
M. D. T., Triangle, N. Y.
R. R., Glenville, Conn.
G. W. B., Chatham, N. J.
J. P. F., South Acton, ——.
J. E. W., Royalton, Wis.
C. B. L., Schoharie, N. Y.

Besides the above, a large number of correspondents simply allude, in their communications upon other subjects, to the rule as being fallacious.

D. H. J., of Danielsonville, Ct., incloses a diagram and rule the same as that contributed by D. B. N., published on page 236 of the December number, and recommends it as being a convenient one for use, and which at the same time gives the bevels for cutting the ends of the brace. Several correspondents call attention to the method explained in the note to D. B. N.'s communication, on the page above named. Probably this latter rule is the best for practical purposes that can be devised.

W. H. C., of Orilla, Ontario, after calling attention to the fallacy of W. K. I.'s rule, writes as follows:

"It is also well to remember that we can avoid the rule of square root in obtaining the length of braces that have an equal run by use of the decimal factor 1.4142, which, multiplied by one of the sides, will give the brace. Example: The run of a brace is 5 x 5 feet; what is the length? $1.4142 \times 5 = 7.071$ feet, or 7 feet $\frac{27}{32}$ + ins., the length required. This is a very handy rule, and should be remembered, for it will be found reliable in finding the hypothenuse of any right-angled triangle of equal sides. By this rule a side would have to be 1000 feet before the hypothenuse would be one-eighth of an inch too short."

The following is decidedly the most sensational of all the communications we have received. Since there is a reward of $500 offered for proof of error, our readers will have a double incentive to examine into our correspondent's rule and brand it "sound," "shaky" or "rotten," as their judgment may determine. Those who claim the reward can obtain the address of the writer by applying at this office. Better make a note of this before going any further. You may forget it after reading to the end of this remarkable letter:

From H. McG. (journeyman carpenter), *Paterson, N. J.*—Brace rules "mathematically correct" seem to be in order. Wishing to see my initials in print, and for the glory of good old Paterson, I hasten to sling ink on it, for fear I should "croak" some fine morning and the glorious discovery I have made be forever and forever lost. Hold your breath while I announce it. It is original, and should cut rafters as well as anything else. Bang! here she goes! Add together the rise and run; add the rise and divide by 2. Example: Required, the length of brace for 3 feet rise and 4 feet run: $4 + 3 + 3 = 10 \div 2 = 5$. Another: Required, the length of brace for 8 feet run and 6 feet rise: $8 + 6 + 6 = 20 \div 2 = 10$. Again: Rafter, 16 feet run, 12 feet rise: $16 + 12 + 12 = 40 \div 2 = 20$. It's sure as death. There can be no error. It is—it must be—mathematically and absolutely correct; as sure as the truths of geometry, astronomy and mathematics. Age after age has sought for this practical, easy rule, but no one—not even Euclid himself—has printed it, even if some one did discover it, which I very much doubt. The hypothenuse of a right-angled triangle can always, under all circumstances, be divided by two, which simple fact all mathematicians seemed to ignore until my grand discovery. Now, I will give $500 to any scientific or mathematical genius who can discover any error in the results of the above figures—who can prove them incorrect. Nothing has yet appeared in your paper so grand as this discovery—nothing so well calculated to alleviate and soothe the tired brains of "ye old chip" bothering and cussing over some obdurate figure that won't "square root." Future ages—ages yet unborn—must immortalize my name. Oh! I am so glad that the honor of this grand discovery was reserved for me. Let us try it again:

Length of brace, 5 feet on run, 3 feet rise: $5 + 3 + 3 = 11 \div 2 = 5$ feet 6 inches. Halloa! What's up now? I cut a brace this morning, and it measured just 5 feet 10 inches. Another—6 feet run, 4 feet rise: $6 + 4 + 4 = 14 \div 2 = 7$. What the devil is the matter now? This one scales 7 feet 2 inches. Rafter, 20 feet run, 5 feet rise: $20 + 5 + 5 = 30 \div 2 = 15$. Now what's wrong? That can't be; a 15-foot rafter won't cover, on 5 feet rise, a 20-foot span. Let's try W. K. I.'s rules a little. His rule is: Add rise and run; divide by $2 \times 17 \div 12 =$ length of brace or rafter. His example, 4 feet rise, 3 feet run, is worked out: $4 + 3 \div 2 = 3\frac{1}{2} \times 17 = 59\frac{1}{2} \div 12 =$ 4 feet 11½ inches, which is incorrect, according to my infallible rule. His rule, worked out on 20 foot run and rise, given below, is as follows:

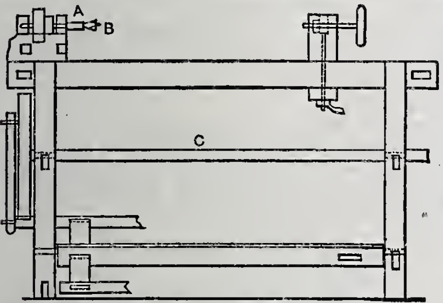
$$20 + 3 = 23 \div 2 = 11\frac{1}{2} \times 17 = 198\frac{1}{2} \div 12 = 16'\ 7\frac{1}{2}''.$$
$$20 + 8 = 28 \div 2 = 14 \times 17 = 238 \div 12 = 19'\ 10''.$$
$$20 + 5 = 25 \div 2 = 12\frac{1}{2} \times 17 = 212\frac{1}{2} \div 12 = 17'\ 8\frac{1}{2}''.$$
$$20 + 8^3 = 28^3 \div 2 = 14\frac{1}{8} \times 17 = 240\frac{1}{8} \div 12 = 20'\ \frac{1}{8}''.$$

Shades of Euclid! is this thus? Is it possible that a shed with a 20-foot span and rafter, rising 8 feet 3 inches, can be covered with a rafter 20 feet ⅛ inch long? Remarkable progress of science! W. K. I., my Christian friend, it seems to me that both of us had better go and soak our heads. My grand discovery is all mush, and yours ditto ditto. Your figures lie like the devil, and so do mine. The next time I make a grand discovery in mathematics I don't believe it will be when filled with 1½ pints corn juice, and don't you do yours when in the same condition. Too much learning is sometimes a very awful, dangerous thing to have in the house; but there is one grand solace, one consolation, one gleam of joy through it all, and that is, you can tell your old folks that there isn't any danger of my getting the brain fever, and to you I can only say ditto. We are not the only pair that ever "busted" on mathematics as a science, even though we are undoubtedly original—very original—discoverers. By-by until we meet again.

We have a number of other letters on the subject to which we should be pleased to give attention, but already more space has been consumed, we fear, than our readers will desire to see devoted to this simple problem. So we will rest here.

A Letter from "Wood Butcher."

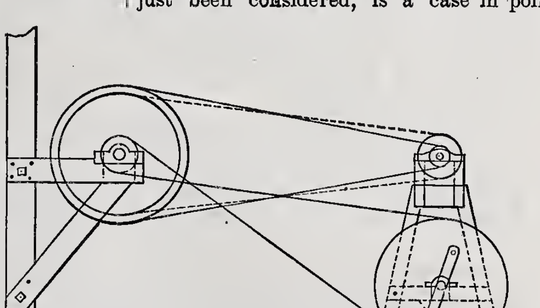
The following characteristic letter from a correspondent at Springfield, Mass., who writes under the *nom de plume* of "Wood Butcher," and who first introduced himself to this circle in the November number, was in all probability called out by the brace rule of W. K. I., but we have seen fit to consider it apart from the other letters upon that subject. His allusion to the brace rule is only a passing one by way of illustration. The letter is as follows:



Wooden Turning Lathe.—Fig. 1.—Front View of Lathe Used by F. S.

I find myself somewhat in the frame of mind of the meek individual who in his prayers said: "O Lord we would not wish to dictate, but would humbly suggest," &c. Now, I do not wish to dictate as to the management of the department of correspondence of *Carpentry and Building*, but I would very humbly suggest that the editorial scissors be applied with a little more vigor to some of the impractical ideas of some of the correspondents.

There is a great deal of miserable timber afloat in the way of approximate rules, and rules for reaching results by short cuts. Some of these do not come near enough to the work to deserve even the name approximate. They have not the semblance of reason upon which to lay their old bones. They may serve a good purpose, when their exact nature is understood, for getting lengths by which to order bills of stuff, but to use them in framing should not be thought of. No rules not based upon well defined mathematical principles should be used when timber is to be cut.



Wooden Turning Lathe.—Fig. 3.—End View of F. S.'s Lathe and Bracket Supporting Driving Pulley.

Now, I think before this old timber (which, as I have above said, is afloat) is used, all the rotten, doted and shaky pieces and loose knots should be cut out. It seems to me, as this stuff is now floating into your office, that as it comes out it should be properly branded according to its grade, either "sound," "shaky" or "rotten." The Editor is the man to do it.

The first three years of my connection with the carpenter's business were spent in acquring rules of the kind above referred to; the next six years in unlearning them or finding that they were not to be depended upon. In this section of country nearly all the old "carps" are full of such rules, which have been long in accumulating, and which have been handed down from time immemorial. Many of them have done duty over and over again in the columns of the trade papers, and have long gone uncontradicted. No doubt the reader's respect for their age and venerableness has secured to them exemption from the rough handling a younger crop of the same kind would receive. Gaping joints and crazy frames are the natural consequence of such rules.

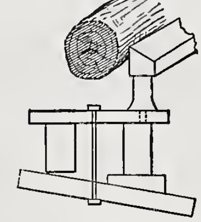
Wooden Turning Lathe.—Fig. 2.—Enlarged View of Spindle in Lathe Used by F. S.

Now, of course I refer to such things as G. H. H.'s mode of backing hip rafters in the number for November, and the brace rule of W. K. I. in the February issue. The latter is nothing but the old rule of a gain of 5 inches to the foot, and was given to mo in this shape: For every foot of run and rise add 5 inches, or in measuring off call 17 inches a foot, and "then add a little for squeeze." In the example given, W. K. I. would have to add a half inch before he got to the squeezing point, as the proper length of the brace is just 5 feet. My experience has been that the men who have to depend upon squeeze to make their calculations come out right, or for making their joints, have altogether more squeeze than workmanship upon which to depend.

I could give you any quantity of rules of the kind above mentioned; as, for example, three-fifths of the width of a building is the length of the rafter at one-third pitch. One-third the pitch of a hopper-shaped box added to the square line gives the correct bevel or pitch to which to cut for a butt joint, and so on, but they will not be useful to your readers, and I will not occupy space with them.

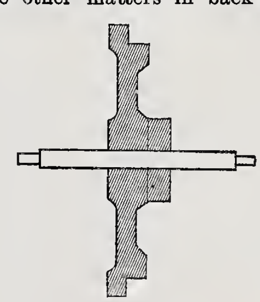
I am much pleased with *Carpentry and Building*, and with the department of correspondence in particular, but I would "humbly suggest" that the Editor, in publishing the rules sent in, state from time to time, as occasion demands, that their truth is open to question. In other words, brand this driftwood as it passes, so no one need get a rotten log when he needs a sound timber.

Note.—W. B. has our thanks for his suggestion. We will try it at once. We brand the above "sound." In a general way, however, we do not think the Editor alone should be expected to use the branding-iron. Since we have got so many keen-eyed, practical correspondents, we propose to let them do a part of this work. There is good reason for such a decision. The brace rule, the correspondence called out by which has just been considered, is a case in point. Had we branded W. K. I's rule "shaky," or used a stronger term, as it really merited, few or no letters would ever have been written about it. The carefully prepared letter of A. H. F., printed above, and those of other correspondents who have written on the subject, to say nothing of the humorous view of the case presented by H. McG, and even the letter from "Wood Butcher" himself, would never have seen the light. Now, we submit it to our readers whether the danger of some one carelessly picking up and applying the rule of W. K. I., published in the February number, is not more than counterbalanced by the thorough exposition of the subject in this issue? In other words, the branding-irons of our readers have put marks all over that log—there have been so many engaged in branding it that it was necessary to go along the whole surface to find room for them—while if the editor alone had branded it as it drifted through his sanctum a month since, only one mark, although probably a well-defined and very proper mark, would have been put upon it. Then, after a while, when it had drifted long enough for the mark to become obscure, some other correspondent would have shoved it this way again and the process would be repeated. As it is now, so far as the readers of *Carpentry and Building* are concerned, this particular log will be allowed to float upon its own course to oblivion.



Wooden Turning Lathe.—Fig. 4.—Tool Rest Used with F. S.'s Lathe.

We propose to give careful attention to every letter received from our readers. Whatever is likely to be of interest to any considerable number of them will be published—space permitting. In some cases we shall dispose of subjects as we go along. In others we shall leave them for our readers, as in the case just referred to. In no event, however, shall we leave permanently any fallacious rule or method without the attention it deserves, whether our correspondents notice it or not. W. B. refers to a rule for backing hip rafters, published some time since. We have already prepared something upon that point, and it is crowded out of this issue only by lack of space. There are some other matters in back numbers which will receive due attention, all in their turn.



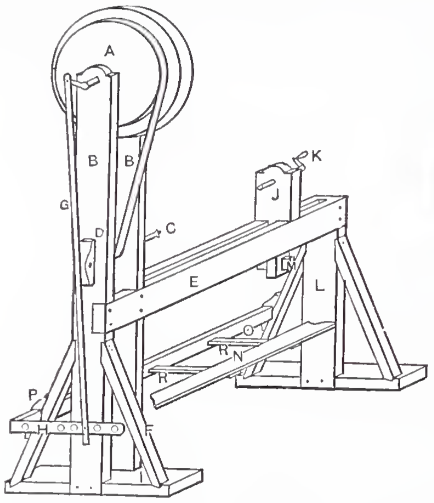
Wooden Turning Lathe.—Fig. 5.—Section Through Driving Pulley Used with F. S.'s Lathe.

We are glad W. B. has seen fit to offer the suggestion. We have stated our views, not in the spirit of arguing with a contributor, but for the purpose of better informing our readers of our intentions, and thereby calling out from them the freest possible discussion and interchange of criticism. We believe W. B. will agree to the wisdom of our course.

Construction of a Wooden Turning Lathe.

From E. H. C., *East Rochester, N. Y.*—With regard to J. F. W.'s request for design and instruction for making a wood-turning lathe, I think it would be of great benefit to many of the readers of *Carpentry and Building* to have a good design for a lathe. I admit that no mechanic can afford to spend time in building a lathe if he has steady employment at his trade; but with many mechanics there are off days and times during which they are idle, when it would be a pleasure to construct so useful a machine as a wood-turning lathe. I trust, therefore, readers of the paper who have experience will furnish some designs to publish.

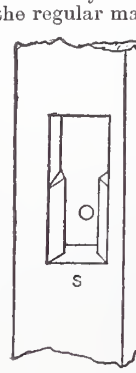
From F. S., *La Porte, Ind.*—In answer to the inquiry of J. F. W., Danville, Peun., I inclose a diagram of my coustruction of a home-made turning lathe, it has a speed of 2000 revolutions per minute and works quite easy. Fig. 1 represents the front view, Fig. 2 is an enlarged view of the irou shaft, showing the bit corresponding to A B of Fig. 1. Fig. 3 represents an end view of the lathe, together with a bracket upon which the driving pulley is placed. Fig. 4 shows the construction of the tool rest. Fig. 5 is a section of the pulley shown in Fig. 3. The



Wooden Turning Lathe.—Fig. 6.—Lathe as Used by A. E. V.

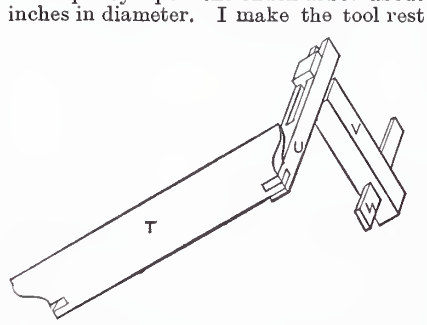
pulley is placed upon an iron shaft, as indicated. The small pulleys shown in Fig. 1 are 2½ and 5 inches in diameter. In Fig. 3 the small pulley is 7 inches, and the larger one 19½ and 22 inches in diameter respectively. The large pulley of the lathe itself, shown in Fig. 3, is 21 inches in diameter, All are 2 inches face width. The large pulleys are made of soft wood and the smaller ones of maple. Shaft C, shown in Fig. 1, may be of wood, 1½ and 1¾ inches square. The boxes should be of cast Babbitt metal or lead.

From A. E. V., *Brainard, Minn.*—I notice, in the January number of *Carpentry and Building*, that one of your correspondents wishes a design for a home-made foot lathe. I respond by inclosing a rough drawing of such a lathe as I am using in my shop. I have made a number of them, and in my experience find them to work more satisfactorily than any lathe I have ever seen built by the regular manufacturers. In



Wooden Turning Lathe.—Fig. 7.—Manner of Putting in the Chuck Boxes in A. E. V.'s Lathe.

point of expense, a lathe of this character does not cost a quarter as much money. In the lathe I am using I have uo difficulty in turning 3 x 3 oak, 4 feet long, without overworking. An ordinary blacksmith can make the irons and any carpenter can do the woodwork. The bed pieces E, as shown in Fig. 6, are 2 x 6 oak, and should be about 6 feet long. They are gained or boxed into the standards B B, 2 inches deep, as shown in the cut. The distance from the floor to top of bed pieces is 3 feet 3 inches. The hight of standards above the bed pieces may be regulated by the hight of room in which it is to be used. A piece of plank makes the foot-piece I. The braces F are boxed at the ends, as shown. The various parts are bolted together with ten 3-iuch bolts of proper length. The tail block J is 2 x 6 oak, keyed in place with the key M. The crank K may be put on a ⅝-inch iron rod, with a thread turned on it. It will work in timber or boxing simply by boring the hole one sixteenth of an inch smaller than the screw. The chuck C is separated at the end by the block D. The manner of putting in the chuck boxes is shown in the detailed drawing, Fig. 7, by S. This drawing shows a section of the standards B. The boxes are cut V-shaped at the ends, and are put in and held down by a key over them. The shaft of the tread O may be 4 x 4 oak, or a straight round pole may be used. It is held in place by the boxes screwed on to the braces, as indicated. The arms R are mortised into the shaft, and the tread board N screwed on to them about plumb with front of bed-piece. The crank H may be of old wagon tire or any old iron of proper size. The crank H should be turned square at the ends, so as to bolt upon the back of shaft O, with a lag screw put into the end of shaft. The connecting rod G should be light—about 1 x 2 inches. The wheel crank at the top can be made of 1 inch or 1¼-inch round iron, with the crank on end 3½ to 4 inches sweep. The wheel A may be made of wood leaded, but an iron wheel is preferable. It should weigh from 100 to 130 pounds. If too heavy it will work hard. The belt may run upon the face of the wheel, but will work better by running upon a pulley bolted against the side wheel, which is a few inches less in diameter than the wheel itself. The belt wheel should be about 22 or 23 inches in diameter, and the pulley upon the chuck arbor about 2 inches in diameter. I make the tool rest



Wooden Turning Lathe.—Fig. 8.—Construction of Tool Rest in A. E. V.'s Lathe.

as shown in Fig. 8. The head T is 2-inch plank, made to come upon a level with the center points of chuck aud tail screw. The piece I is attached to the piece U, which lies across the bed of lathe, by gaining. This is held down in place by the clamp-piece V, keyed by the key W under bed of lathe. The clamp V is made so that it will slide easily in the gain in U.

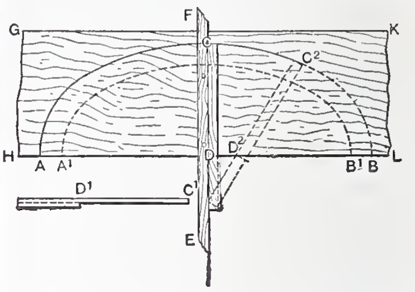
I hope you will be able to understand my drawing and explanation, and that what I have sent may meet the wants of the several correspondents who have asked questions concerning home-made lathes.

From R., *Buffalo, N. Y.*—Replying to your correspondent J. F. W., Danville, Penn., I would say that I tried the experiment of home-made turning lathe, but without satisfactory results. I took great pains in constructing the machine, but there was that lack of stability which is only found in iron. If your correspondent has ever turned on a lathe, he will give up the idea of a woodeu one. I have got a 12-inch swing-iron lathe, and would not exchange it for 300 wooden ones. If J. F. W. will take my advice he will get a good iron lathe. He will find it a pleasure, iustead of something to disgust him.

I think, however, your correspondent J. F. W. made a good point when he asked for a mode of constructing a wooden turning lathe. There are a great many mechanics using such tools who would like to learn something both concerning the construction of the tool and rules for turning iu different materials. If some good turner am ng your readers would contribute something in the way of directions in the matter of turning, I think many would be thankful to receive the instruction. Something could be done, although, as I have had occasion to remark, in reply to another correspondent, full instruction cannot be communicated by letters and drawings; there must be practice upon the tool itself, directed by a competent instructor.

Lessons in Wood Turning.

From R., *Buffalo, N. Y.*—To your correspondent, G. D. B., Pittsford, Vt., I would say that to teach a man to turn by means of a book or writing is as difficult as to teach him to skate by means of a book. Practice



Drawing Semi-Ellipses.—Diagram Illustrating Letters from J. H. T. and A. M.

and a visit to some turning shop once in a while to watch the movements of the tools, are the only methods that can be recommended.

If a few hints from a turner will do him good, I volunteer the following: 1. In turning a cove or concave, cut a small shoulder so that the gouge may rest against it, and if the tool runs down, will not be inclined to jump into the work. 2. Never run your tool up hill on cross-grained wood, for in that case it will be sure to jump and cut in. 3. After roughing, put your left hand around the work, leaving the thumb clear to press slightly on the tool and guide it; hold the tool firmly with the right hand.

Drawing Semi-Ellipses.

From J. H. T., *Little Rock, Ark.*—I am a subscriber and constant reader of *Carpentry and Building*, and have given especial attention to the department of correspondence. I have felt a disposition, however, to keep closed mouth in order to hear what others have to say. In the January number of last year I was pleased to see the diagram of the ellipse, and to know the various rules for constructing it. As Figs. 4 and 5 there given come so near my mode of constructiug the figure, I thought it would be useless for me to send you anything on the subject; but I notice in the January number of the present year that correspondence is still invited on that subject, so I inclose you a rough sketch of my method, aud will try to describe it in such a manner that my fellow readers can employ it if they see fit. First, I will suggest that it is well for every mechanic to be quite familiar with the modes of obtaining the figure by the use of the trammels, string and intersecting lines. I claim that I can complete the figure in half the time that one would ordinarily spend in finding the points from which to strike with the string. While I do not pretend that my rule puts the question at rest for ever, as W. J. says, I do wish, however, that those who are interested in the subject will give it a thorough trial.

Let A B be the width of opening and C D the rise of the arch. I think the figure is best proportioned when C D is equal to one-third of A B. Of course this is optional with the designer, as it does not interfere with the rule for strikiug it. From D mark the ceuter liue, by squaring from the line A B. Take any strip that is convenient, so that it is straight and of sufficient length, and tack on the line C D, as showu in the drawing. Next make a trammel as follows: Take a piece, say, ⅞ x ⅞, equal in length to half of the width of the opening or arch; mark the rise or distance from C to D, as shown in the edge view of trammel, and tack on any small strip, so it is the same width as the trammel strip, and then proceed as shown in the sketch by the dotted lines. After one side has been struck, take off the straight edge and place it on the other side, proceeding as before. Now, if it is desirable to have an ellipse smaller than the one first struck, as indicated by the dotted lines in the drawing, cut off the upper end of the trammel just what distance you desire to have between the two lines, and proceed as before. If it be desirable to retain the former trammel for further use, construct a smaller one, making it as much shorter as may be necessary. If carefully drawn, as true and perfect an ellipse may be constructed by this plan as can be made. Anyway, I suggest to your readers that they try it and be convinced. I see I have taken now more space than I intended to; but, as I don't speak often, I trust you will be patient.

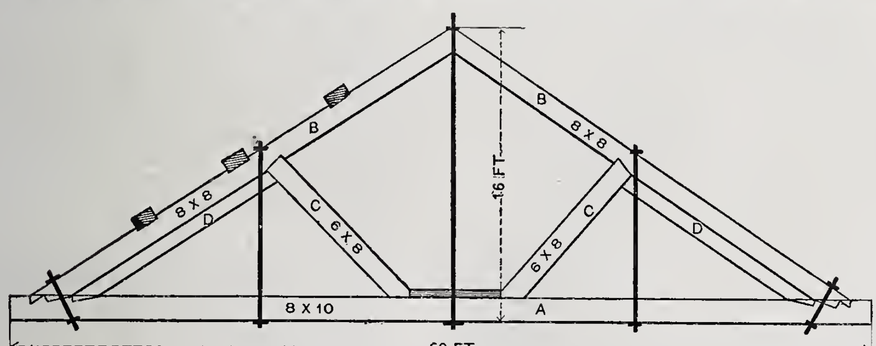
From A. M., *Baltimore, Md.*—On seeing H. D. C.'s method of drawing a semi-ellipse in the January number, I thought I would send you a method which in a great many cases will be found to be very convenient. No doubt many of your readers are already familiar with it, but as it has not been published, I hope my account of it may be of benefit to some. Suppose we want to lay off semi-ellipse for a frame, sash, center, or for any other purpose. First joint the edge of the board on which the figure is to be laid off; then equidistant from the ends draw a line square with the jointed edge; next tack a straight edge on one side of this line, as indicated in my sketch inclosed. Cut out a strip, as shown in the small figure to one side, making the distance from the end to the shoulder equal to the hight of the semi-ellipse, and from end to end equal to half the width of the semi-ellipse. Place the shoulder against the jointed edge of the board, and with a pencil at the end, keeping the opposite end hard against the straight edge on the other side, move toward the right; then tack the straight edge on the other side of the center line, and repeat the operation, thus completing the figure.

Note.—The engraving presented herewith is made from the sketch accompanying the letter from J. H. T. It is almost exactly the same, however, as that inclosed in the letter from our correspondent A. M. Accordingly we print the latter's letter without his sketch, the two methods being identically the same. We trust our correspondent whose letter is first printed above, will not be disposed hereafter to hold his peace for such a long time as in the present case. We shall welcome his letters whenever he is disposed to write, and we trust he will not be one of the sort to take benefits from the paper without contributing in return. We shall hope to hear from him regularly hereafter.

A Roof Truss Strongly Indorsed.

From R., *Buffalo, N. Y.*—I have just read *Carpentry and Building* for January, and find it crowded, as usual, with good things for all in our trade. I become so anxious for it from month to month that I can hardly wait until the time for its arrival comes around.

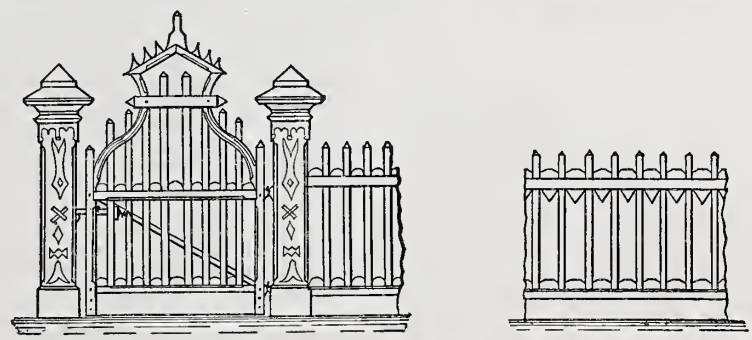
I inclose a sketch of a truss roof which I can recommend for simplicity and strength. The purlins may be mortised in or laid on top. I have put up this style of roofing and found it to stand a very sovere test. In one instanco the floor that was hung from the truss was loaded with about 400 tons. It was supported by wooden posts from the foundation underneath, which in the course of time settled, leaving the full weight of the floor upon the roof. The strain was so great as to split the tie beam lengthwise, drawing the nut through (the washer being broken underneath the nut.) But all this took place before the roof settled a particle. The sketch I inclose will be readily understood by your readers, and therefore no further description is necessary.



Roof Truss.—Highly Recommended by R.

Gate and Fence.

From W. A. G., *Watsonville, Michgan.*—Noting the inquiry of G. W. C., in a recent number of *Carpentry and Building*, for a design for fence and gate, I inclose a sketch which I trust will be useful to him. The posts are to be 8 inches square, with chamfered corners, and in construction are to bo double cased; the outside casing is to be scroll sawed, as indicated in the design. The hight of the fence should be 3½ feet from the bottom of the base to the top of the pickets. The pickets should extend 7 inches above the rail, and in spacing should be 3 inches apart. The design shows two forms of blocks to be used between the pickets, one having a semicircular top and the other a top with corners clipped. The use of blocks between pickets, as indicated in the design, the blocks being nailed from the back, greatly improves the appearance of a fence, and at the same time adds but very little to the cost.



Design of Gate and Fence.—Contributed by W. A. G.

Note.—We are pleased to publish this design of a gate and fence, but trust that our readers will favor us with other designs, not only in answer to the correspondent whose inquiry has drawn out this present design, but in the way of showing up fence designs and construction in general. There are some good designs of fences in use in the country, and there are many more which are entirely objectionable. The columns of *Carpentry and Building* offer a fine opportunity for a discussion of the subject of fences in genoral. Contributions from our readers upon this subject cannot fail to be of great interest, and no doubt will accomplish much good in tending to substitute good designs and good construction, in the place of the unsatisfactory work that is in common use at present in many places.

Foolish Questions.

From D. U. S., *Oswego, Kansas.*—I am a constant reader of *Carpentry and Building* and like it very much. It is just what a great many carpenters need. I notice a number of inquiries in recent numbers referred to the readers which to me are quite amusing. If the authors of them were mechanics they would have no occasion to make so many inquiries on such small pieces of work, so I conclude they are men who are willing to deadhead from mechanics in the trade what information they need, and by means of it do work themselves which they had better employ mechanics to perform. Now, I don't think that a mechanic can offer to draw plans, specifications and lumber bills for that class of men. If they were really mechanics they might be expected to contribute something in return.

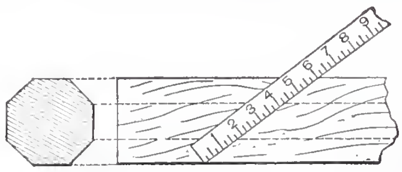
Note.—Although we have published in the numbers of *Carpentry and Building* already issued some inquiries which, from the mechanic's standpoint seem foolish or amusing, as our correspondent puts it, we are not disposed to think that in all cases, or even in a considerable number of cases, they come from men who are disposed to get something for nothing. We think that in nearly all instances they are *bona fide* questions from men who are anxious to learn. There is no trade in the country that does not contain men among the workmen engaged at it who need to ask what may be termed by some the most foolish of questions. It is to just such men that *Carpentry and Building* offers a helping hand. Send along your questions, foolish and otherwise, and *Carpentry and Building* will endeavor to obtain answers for them. Of course we address only those who are acting in good faith. If any are disposed to obtain something for nothing—that is, get information from the trade without contributing anything from their own stock—we don't feel like encouraging them. Let every one who is disposed to ask a question through the columns of *Carpentry and Building*, look over the back numbers of the paper and see if he cannot find some question to which he can give some sort of an answer. If it has been replied to already, send along your answer anyhow; there may be something in it which the former answer did not cover.

Braces in Truss Roofs.

From L. F. A., *Paterson, N. J.*—I have just read the communication from E. H. C., published in the February number of *Carpentry and Building*. With uncovered head and on bended knee I humbly beg your correspondent's pardon for presuming to answer his question in a tone that he don't like. He requests another answer, which I am afraid to give, for fear the music this time won't be any moro pleasant than the last tune sung to him. However, I will try to please him, Mr. Editor; but if I don't sugar it enough, won't you kindly pour in enough honey to suit his most fastidious taste?

To start with, E. H. C. did not treat us fairly when he drew that first truss 20 feet run and 8 feet rise, when actually it was 20 feet run and 3 feet rise. A comparison of the drawings accompanying his letters will make this point clear. When drawings vary, opinions vary and calculations vary. Further, your correspondent does not give us a fair showing even now. He forgets to state the kind of timber employed in the truss, the size of center bolt, whether there are any foot bolts ; also, where on the tie beams the immense weight of shafting was placed ; whether the cover of the roof was tin or gravel, and, worst of all, he does not even indicate the exact spot on the roof where the snow is expected to hit it. Calculations cannot be made without all the elements being present.

Now, to business. Whatever I stated in my letter that was objectionable in the truss, your correspondent will please consider intensified in an inverse ratio to the difference of pitch between the two sketches. The braces are 3 x 8 and 15 feet long—60 feet of timber ; if the rafters were made 8 x 9 instead of 8 x 8, the difference would be 27 feet. E. H. C. could have saved all work on the braces, saved 33 feet of timber, and had a stronger roof, so far as rafters are concerned, if he had left out the braces and used heavier rafters. The braces will hold as compression members if the weight is applied at right angles with, and directly through their center—about 1200 pounds for each brace, before they commence to bend. The braces are seated 3 feet 6 inches from the king bolt, which is too close to obtain any benefit from it as far as the added strength to the rafter is concerned. At the angle at which the braces

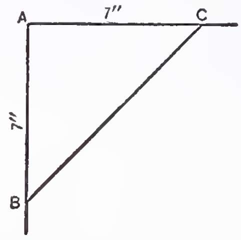


Making a Square Stick Octagonal.—Fig. 1.—Sketch Accompanying Letter from F. G. O.

are set it would only require a weight of 200 pounds, acting vertically and directly over the braces, to send a strain of 1200 pounds through them. If more weight is applied the braces bend and cease to act. As I understand the problem, the principal part of the weight is in machinery and shafting, and must of course be applied on the lower cord or tie-beam. Now to the point. The brace is let in into the tie-beam the full thickness, 3 inches, and seated in the center between the king bolt and walls. At the seat it reduces the timber from 8 x 12 to 8 x 9, and each brace can stand 1200 pounds where it is not needed at the head of the rafter, or would not be needed if the rafter was 8 x 9 inches. To get that extra 1200 pounds, the tie beam is diminished in strength on each side of the king bolt 11,300 pounds as the breaking weight. It is hardly necessary to pursue this subject further ; the figures employed are sufficient to convince. But a passing thought. In case a snow slide, say 25 feet long, 8 feet wide and 1 foot deep, should take a notion to fall upon that 40 feet and strike that 8 x 8 rafter in the middle in a solid mass, I would advise E. H. C. not to trust himself under it ; if he did he should make preparations for his funeral beforehand, for undoubtedly the corpse would be ready in due time.

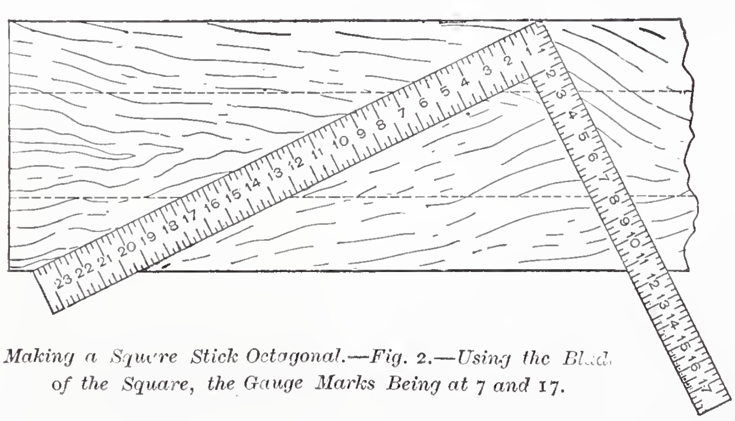
I heartily agree with E. H. C. that no one man knows it all ; but two of us do. It is unnecessary that I should know anything, judging from the tone of his last letter. Probably other and abler hands will more fully discuss this truss and will show up points in it which I am not able to show, and perhaps in a far more comprehensive manner than I have attempted. Before the discussion is ended, I trust E. H. C. will have discovered that there is so much for him to learn that it would be better for him to modify his tone in reply to answers obtained to questions he propounds.

Now, Mr. Editor, for one I would like to know, in this connection, what the correspondence department in *Carpentry and Building* is used for ? Is it simply to put



Making a Square Stick Octagonal.—Fig. 3.—A Section Through a Corner of a Stick 24 Inches Square.

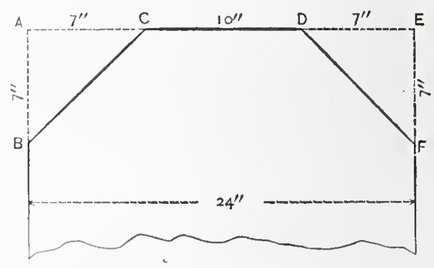
men on their backs and make them believe that they are great I am's, that their pet theories are the only theories that are right ? Is it to fill the paper with false ideas, false construction, false mechanism and poor workmanship ? Is it to bring forward ideas that will not stand criticism for a moment ? Is it to show up rules which are asserted to be mathematically correct, without allowing them to be challenged ? My idea has been that its use is the promulgation of true construction, true workmanship, true principles, and a general diffusion among the craft of true and useful knowledge and science. I have supposed that the men who entered its columns with their ideas, were ready to be handled without gloves if occasion required. I have supposed they sought after truth in all sincerity, and were not looking for insults. I have supposed that those who came into this department possessed skins thick enough to stand ordinary pricking, without getting up on their hind legs and howling. A fair illustration of the usefulness of this department of the paper was afforded in the discussion of the tank frame problem. The letters of J. H. P., E. H. W., E. M. B., A. B. and others brought out many a point which the original articles left dark in the minds of inexperienced craftsmen. None of those letters were Chesterfield, either in tone or construction, but they served a useful purpose nevertheless. This department of *Carpentry and Building* has been so far, and can be made in the future, the most interesting and profitable part of it. It has opened up subjects and can still open up such as are unattainable in books. It is practical ; it is just what is wanted, and is just what we have wanted. I for one am ready to impart any information I may possess for the benefit of the trade. I am prepared to take all the rapping over my knuckles that any of the readers see fit to give me. I believe, like the Irishman at the fair, that the best means to obtain the best results from the correspondence department will be to observe the motto, " Wherever you see a head hit it." It is not sweet words, it is knowledge we want, no matter from what source it is obtained, nor in what language it is communicated.



Making a Square Stick Octagonal.—Fig. 2.—Using the Blade of the Square, the Gauge Marks Being at 7 and 17.

Making a Square Stick Octagonal by Rule and Square.

From F. G. O., *Marblehead.*—I was very much pleased to be informed by *Carpentry and Building* what those dots on my square mean which you denoted as the octagonal scale. By your description of the square I was reminded of a rule for laying out an octagonal post which I learned several years since. Lay a rule or square obliquely across the face of the stick, as shown in my sketch (Fig. 1), so that just 6 inches will be on the stick. At 1¾ inches from each corner draw gauge marks, which will be the corners of octagon. If the timber is over 6 inches square, lay 12 inches of the rule upon the face and gauge at 3½ inches from each corner. If over 12 inches, lay 24 inches of the rule upon the face and gauge at 7 inches from each corner. The rule given in *Carpentry and Building* for using the dots upon the square is first rate for timber which is whole inches in size. It does not work so well where fractions of an inch are involved. The rule which I give above is applicable to any timber the size of which is expressed in inches or inches and fractions.



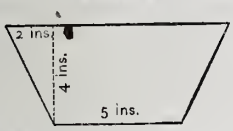
Making a Square Stick Octagonal.—Fig. 4.—Part Section Through a Stick 24 Inches Square after Shaping.

Note.—Our correspondent's plan of using 6 inches of the rule, as he has clearly shown in the sketch which he inclosed and which we have engraved as Fig. 1 of the accompanying cuts, is a little different application of a rule which is in common use, from that generally employed. He, however, refers to the usual method of using the rule in the latter part of his description, when he speaks of taking 24 inches and setting off gauge marks at 7 inches from the two ends. This rule is in such general use that a moment's consideration of it cannot be without profit to our readers.

Fig. 2 shows the method of using the square in applying this rule to a piece of timber. The dotted lines represent the gauge marks. Fig. 3 shows a section through one corner of a timber ; B and C represent the gauge marks on an adjacent face of the timber, and are each 7 inches removed from the corner A. The timber, of course, is to be dressed until the line B C becomes a surface. Now, if the rule were accurate, the diagonal B C in Fig. 3 should measure exactly 10 inches, because the adjacent faces, by the rule, would be laid off by measurement to that dimension, and all the faces of the octagon should be the same dimension. That B C in this case is not exactly 10 inches may be easily proven. Since C A B is a right angle, the length of C B must be equal to the square root of the sum of the squares of B A and A C ($7 \times 7 = 49$, $49 \times 49 = 98$) the square root of which is less than 10, the square of 10 being 100. It follows that a stick of timber reduced to octagon shape by this rule will have four of its sides 10 inches in width and four of its sides a fraction less than 10 inches, equal to the square root of 98. Fig. 4 shows the same thing in a little different shape, by representing a partial section through a timber 24 inches square. The gauge marks C and D are each 7 inches from the corners A and B ; the side C D is 10 inches, but the sides C B and D F are less than 10 inches. As this rule, like some others in common use, is supposed to be mathematically accurate, we think the diagrams we have introduced will be of interest to our readers.

Directions for Filing Saws.

From H. D. C., *Philadelphia, Pa.*—I notice inquiry from W. G. S., Chattanooga, concerning saw filing. Being a filer of saws of long experience, I think I can give your correspondent some information that may prove useful to him and also furnish desirable reading to some others in the trade. Commencing with the rip saw, the shape of the front part of the teeth should be at about right angles with the edge of the blade. The file should be held as nearly level as possible, and as square across the saw as it can be got. In cut-off saws, use the point of the file toward the handle of the saw, and at the same time let the front of the teeth fall back a trifle, to be determined somewhat by experience in using the saw. Teeth of saws must in all cases be got into line before the set can be used to proper advantage, and great care should be taken not to let the set clip the teeth more than about half way on.



The Bevels in a Square Hopper.—Fig. 1.—The Problem Stated.

If it strikes further on it will begin to bend the blade, and by the time the length of the saw has been set the blade will be a pretty good representation of a rainbow, and some difficulty will be experienced in getting it straight again.

From "FILER," *Waverley Station, Va.*—My attention has been called to the inquiry of W. G. S., in the January number of *Carpentry and Building*, concerning instruction in saw filing. As I have had considerable experience in that part of the business, perhaps I may be able to give him an idea or two. In filing a cutting-off saw, I always give the tooth all the cut possible, by dropping the handle of the file quite low and throwing it at the same time well back toward the handle of the saw. By this means a very sharp and keen front is given to the tooth. Should a feather edge remain on the tooth after filing, it can be easily removed by using a whetstone, laying the saw down on the bench for the purpose and rubbing the stone along the edge once or twice. After setting and filing, I set about four teeth from each opposite side, so the points will come in the center. This will cut the center saw kerf out clean and will make the saw cut much faster. Accordingly, I file a rip saw with the cut edge of the teeth at right angles to the blade of the saw, and give them a slight bevel. The top edge of the tooth I file square across. I file one side of two teeth at the same time, the same as in cutting-off saw. I use a lever set and never set a saw any more than is absolutely necessary.

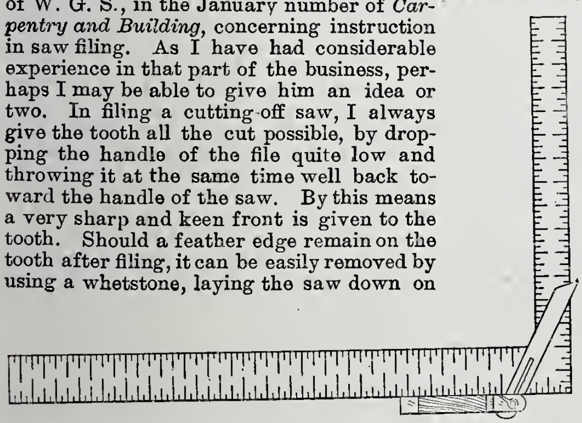
From D. Y. S., *Oswego, Kan.*—Your correspondent W. G. S. asks for practical hints on saw filing. I will give for his benefit an account of my way of filing and setting saws. Place the saw in a clamp with the teeth upward. Commence filing at the handle. Hold the file horizontally at an angle of 45 degrees with the length of the saw, the point of the file toward the handle of the saw. To file a rip-saw, hold the file at right angles with the blade, with a slight inclination toward the handle of the file. File one side at a time, the same as cross-cut. The best saw-set that I know of is a nail-set, a hammer and a block of very hard wood.

The Bevels in a Square Hopper.

From J. L., *Dubuque, Iowa.*—Will you please give, through the columns of *Carpentry and Building*, a method of finding the bevels of a hopper or beveled box? I have been trying some rules given me, taken from one of the building papers, but if the engraver has copied them correctly, they are not practicable so far as my experience gives me an opportunity of judging. Some of them are very complicated. I am working in a mill, and work of this character comes up very frequently. I have built several hoppers, and my method is as follows: Having found my upright bevel, to bevel the bottom so that when the hopper is finished it will set solid on the frame, I square across the bevel edge, which gives the required bevel. Now, what I really desire to know is a method of finding the bevel on the square edge of the board, instead of being compelled to bevel it and work from that.

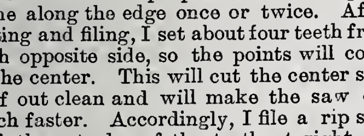
Answer.—We take pleasure in complying with our correspondent's request, and since the question he raises is one likely to be asked by many in the trade, we shall give a more detailed account of the method we recommend than would perhaps be necessary to make J. L. thoroughly comprehend it. The problem which our correspondent presents is likely to be given to workmen in something like this shape. Make a hopper 5 inches square at the bottom, having 4 inches straight hight and a flare of 2 inches, the flare to be alike on all sides, and let it be butt-jointed at the corners.

The first step is to set the bevel, supposing for the moment that we use that very convenient tool; for the problem can be solved without it, using the square alone. We would set the bevel as shown in Fig. 2, taking two inches from the heel of the square along the blade for the flare, and four inches from the heel of the square along the tongue for the straight hight of the hopper. By this means the pitch of the sides of the hopper is obtained without a drawing. If it were desirable to lay off the work by a drawing, we would proceed in a little different manner.



The Bevels in a Square Hopper.—Fig. 2.—Setting the Bevel by the Square.

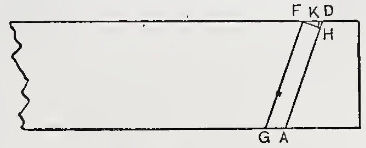
Having set the bevel, as shown in Fig. 2, we next select a piece of stuff in width equal to the slant hight of the hopper, which can be ascertained by measuring the distance across the corners of the square from two of the tongue to four of the blade; in other words, by measuring on the square just as we have set the bevel. Having the stuff of proper width, we apply the bevel to it and scribe the line A E, as shown in Fig. 3. A E now represents the bevel of the hopper in elevation, and from it we must obtain the bevel of the sides, which must be such that when the sides are in position their bevel will be the same as A E, just drawn. Since A E represents the bevel in elevation or of a side when pitched, the bevel of a side in the flat will be less than A E. It must be just so much less as is necessary to make it correspond to to A E when the piece on which it is cut is pitched forward in the position it will occupy in the finished hopper. Therefore we set off on A E the width of the stuff, A B, as shown by A C, and square up from C, obtaining the point D. Connect A D. Then A D is the pitch of the side in the flat.



The Bevels in a Square Hopper.—Fig. 3.—Describing the Bevels of the Sides.

A moment's examination of Fig. 3 will make the reason for this plain. Suppose the board to be cut through on the line A D; suppose also that A E be drawn as a gauge mark by which to determine the course of the bevel A D. Revolve the board on the line X A, as an axis. Now, as the board turns it is readily seen that the point D moves in the line D C from D to C. Starting with D as it lies flat, it ends at C, when the correct pitch has been reached. In other words, when the point D comes over C, D A corresponds to our imaginary gauge line A E. Since A B represents the actual width of the board, and A E the pitch at which it is to be placed in the finished structure, by setting off on A E the distance A B, as shown by A C, we obtain the point C, the same as though we had revolved the board in the imaginary manner above described. Hence we square up from C to D, and connect D and A, which gives the bevel we are seeking.

The next element entering into the problem is the thickness of the stuff employed. We will suppose that the board we are using is three-quarters of an inch thick. To obtain the end bevel of the piece, we proceed as follows: Parallel to A D, the method of obtaining which we have just described,



The Bevels in a Square Hopper.—Fig. 4.—The Thickness of the Stuff.

draw G F, as shown in Fig. 4, making the distance between G F and A D, measuring at right angles, three-quarters of an inch, or, in other words, equal to the thickness of the stuff. From F square across to A D, as shown by F H, thus obtaining the point H. Square up from H, as shown by H K, obtaining the point K; then the distance K D on the edge of the board represents the difference in length between the inside and outside faces of the piece. Having the point K and D in the corner of the stuff, the next step necessary is to carry K across the edge, as shown by K L in Fig. 5. By connecting L and the point D, we obtain the end bevel of the piece.

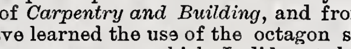
So far, we have considered the problem upon the supposition that the corners were to be butt-jointed. If it is required to make them miter-jointed, there will be no change in the steps described save in the last one.

The Bevels in a Square Hopper.—Fig. 5.—The Lines on the Edge of the Stuff for Butt Joints.

Instead of K D in Fig. 4 representing the difference in length between the inside and outside faces of the stuff, the difference will be represented by F K. Accordingly, as shown in Fig. 6, we square across from K, as shown by K L, obtaining the point L on the opposite side of the piece. We then connect F and L, which represents the bevel for a miter corner.

Can Steel Squares be Improved?

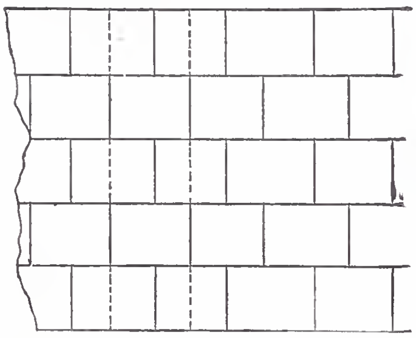
From D. H. J., *Danielsonville, Conn.*—I have read with great interest the article on steel squares published in the January number of *Carpentry and Building*, and from it I have learned the use of the octagon scale upon my square, which I did not know about previously. I have always used the square shown by Fig. 3 of the illustrations, and have only seen the square shown in the other two figures at rare intervals. I have followed the building business for some 10 years and thought I understood the square



The Bevels in a Square Hopper.—Fig. 6.—The Lines on the Edge of the Stuff for Miter Joints.

pretty well. I have studied how to cut bevels for various purposes with the square. One question I have asked a great many times without obtaining a satisfactory answer, and that is why it is that the diagonal scale on the square is always divided into 10 parts. It would be much better for us if it were divided into 12 parts. In that event the spaces could be used as inches when one wanted to make an accurate draft on a small scale. Drafts are often made one inch to the foot. In that case each twelfth of an inch represents an inch full size.

Answer.—Upon squares of the better class, one edge of both blade and tongue is divided into twelfths of an inch, an arrangement that supplies the want to which our correspondent refers. In that case the diagonal scale represents divisions of an inch that are not to be obtained by marks upon the edges of the square, and hence serves a useful purpose. Our correspondent's query above, where he says that he has asked the question repeatedly without obtaining a satisfactory answer, reminds us of one peculiarity of the square business which we encountered when obtaining the information from which we wrote the article upon the steel square in the January number. Upon asking both dealers and manufacturers what the marks and divisions on the squares they



WRONG.

Diagram Accompanying Letter from W. H.

had in stock were for, the invariable reply was, "We don't know." "We have never been able to find out." "Squares are made in this form because the trade want them made so." "We don't know how they are used, nor why they are wanted in this particular shape." We were very much surprised at replies of this kind. We call the attention of our readers to the circumstance in the way of a suggestion. If there are any other marks and scales which it would be convenient to have upon the steel square, it will be well for mechanics to indicate their wants in such a way that the manufacturers will hear of them. Since manufacturers make squares, not upon any knowledge of their requirements, but simply after the pattern handed down by their predecessors and from a general conception of what the trade wants, we think it proper that carpenters should have just what is best for their purpose. Accordingly, if any one has any suggestion to make concerning changes in the arrangement of the marks upon carpenters' squares, we shall be pleased to hear from him. Can steel squares be improved? If so, wherein?

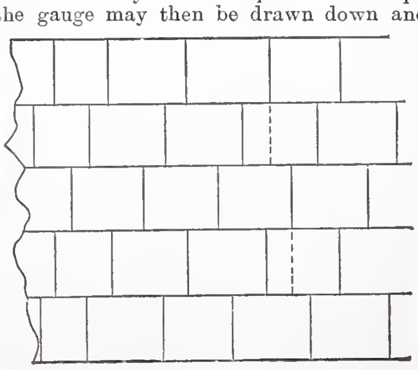
Shingling.

From W. H., *Marietta, Ohio.*—I received the December number of *Carpentry and Building* in due time, with which I was much pleased, as usual. The year's numbers are now in course of binding. About the first thing that attracted my attention were several communications on the subject of shingling. Now, I will wager a year's subscription to *Carpentry and Building* that not one of those shinglers understands the first principle of shingling, from the very fact that they shingle entirely too much in a day. It is possible for a man to nail 5000 shingles on a roof in a day's time, but that is not shingling. We have men in this place who talk about laying their four or five squares a day; but they never laid a square of shingles right in their lives, and when they work with green shingles the chances are the roofs leak the first year. We have plenty of just such jobs in this vicinity. Now, in order to show how shingling should be done, I have made two diagrams, which I send you herewith. One I designate "right" and the other "wrong." In the latter the dotted lines represent cracks which lead from the joint in the first course to a joint in the third. Such a thing as this never occurs where shingling is done right. The fast shingler generally starts his roof with two courses, then goes on and breaks joints on the last course only, which is shown in my diagram as wrong. Now, in shingling in the proper manner you have two courses to watch as you lay your shingles. A course may break joints with the last course laid, but on slipping a shingle down to the course preceding the last, you find the joints match the joints there made. Accordingly, the shingle in the hand must be laid aside and another one tried. When a shingle is found which breaks joints in both courses it is nailed down. When a workman has learned to do this he has learned to shingle, and not before. He will never shingle five squares in a day of ten hours. However, he must not forget to start his roof three courses thick; all the water that falls down the roof passes over the eaves, and all other parts of the roof are three courses thick and a little more. It stands to reason, therefore, that the eave should be shingled three courses instead of two courses, as is the common practice. I suggest to some of the fast shinglers that they examine their work and see if they don't find it in the condition of the diagram I send marked "wrong." Now, we are never too old to learn. I learned something out of the first number of *Carpentry and Building* upon the subject of framing that I never thought of before, and it is 41 years since I went to learn the trade.

A correspondent whose name and address does not appear upon the sheet containing his communication, sends the following:

I inclose you herewith a drawing of a method of shingling which I hit upon once where a house roof was was open and the weather came on damp, almost a rain, so as to prevent the use of a chalk line. I took a strip of sheeting 5½ inches wide, that being the width to which I was laying and upon it I fastened three tips of shingles, say, 1½ or 2 inches wide and 8 inches long, somewhat after the manner shown in Fig. 1. In using this gauge, it is turned over from the position represented in the sketch; in other words, so that the tips of shingles by which it is fastened on the roof come underneath. Within half an inch of the upper end of each tip I drove one nail, by which to hold it in position. Now, by this means I had a straight-edge ready for use, and I found by experience that by using it one man, with a smart boy for helper, could lay 4000 shingles in 10 hours, the boy laying and the man nailing. Fig. 2 of the inclosed sketch represents the method of using the gauge. A number of sheeting boards may be employed when the roof is longer than the length of a single piece.

Where a man and boy are employed together in shingling, as above mentioned, if the shingles run badly the boy may have a a handful which have been tapered the other way, by the use of which to straighten up occasionally. When he has laid through a course he may go back to the other end, strike carefully on the strip near each tip; the gauge may then be drawn down and

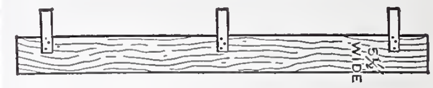


RIGHT.

Diagram Accompanying Letter from W. H.

out, and in turn placed on top of the course already nailed, by which to begin to lay again. I think some of your readers will be interested in this, but in any event I give it to you for what it is worth.

From J. L., *Dubuque, Iowa.*—With regard to shingling, I desire to say that in my opinion if a man lays 2000 shingles per day of 10 hours he is doing a good day's work. The shingles we use in this locality are pine "sawed." I have heard some men boast of laying 3000 and 4000 shingles per day, but when working alongside of them I have found I could lay as many, and sometimes even more. A thousand shingles laid 4½ inches to the weather will cover 1¼ squares; hence a man laying 2000 shingles will cover 2½ squares of the roof. It takes a quick, active man to

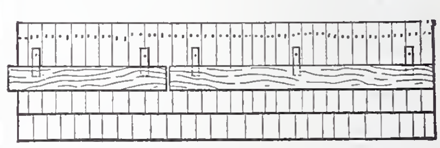


A Help in Shingling.—Fig. 1.—*Construction of the Gauge.*

do that, putting two nails in every shingle, and, of course, laying them well. I worked for a man once who laid the first shingle loose, and, putting one nail in the second course, made one nail hold two shingles, laying in two separate courses; that is, he would lay two lines at a time. I don't call that shingling; it may be in name, but certainly it is not in reality. In shingling a large roof where, say, 10 to 12 men were employed, the average is about 1500 shingles per man per day. I do not give these figures altogether from my own experience. I have similar statements from several boss carpenters who are reliable men.

Glycerine for Oil Stones.

From P. E. W., *New York City.*—I am moved to say in regard to oil stones, that I think none of the correspondents of *Carpentry and Building* who write on the subject have ever tried glycerine. I think if they had used this instead of kerosene, they would have found that it had a great many advantages over that or any other substance. It is without smell, which is a great objection to kerosene; can be removed at any time with a wet rag; it does not gum the stone, and is in every way preferable to any material I have ever used. A stone upon which glycerine has been used for ten years ought to be as bright and fresh, after a good washing with a wet rag, as when it



A Help in Shingling.—Fig. 2.—*Manner of Using the Gauge.*

first came out of the shop. I think the iron stains the stone less with glycerine than with any other kind of oil, and glycerine does not alter the "temper" of the stone.

Method of Indicating Quantities in Recipes.

From P. E. W., *New York City.*—In general it is supposed that when directions are given in recipes for compounding a mixture and the proportions are stated in "parts," these are supposed to refer to "parts by weight." If all the ingredients are liquids, the parts very likely refer to "parts by measure." Chemists and scientific people in general give recipes which are to be mixed by weight, and commonly this is the most convenient way for them. This hint may help O'Baz, of Mount Vernon, N. Y.

REFERRED TO OUR READERS.

Tool Chests and Scaffolding as Topics for Discussion.

From W. A. G., *Hammond, Wis.*—Success to our paper. I call it our paper because evidently it is published in the interests of those connected with the building trades. Those of us who have worked long with plane or trowel can throw in a hint now and then upon what are called "tricks of the trade," and thereby save a fellow workman many of the puzzling and vexing things which rise up like great mountains before him. I have been much interested in the papers on stair building, problems in framing and jointings in wood. I hope the end of each of them is not yet. The article on the square in the January number suited me to a T. I hope all readers of *Carpentry and Building* who can give rules for working out various problems by means of the square, will write to the Editor. Let us hear from all who are able to throw any light upon the subject. The object of this letter is to make some suggestions of topics which I should like to have discussed through the columns of *Carpentry and Building*. The first is the matter of a tool chest. Will the readers of *Carpentry and Building* forward plans for a neat, handy and compact tool chest for a carpenter and joiner, which shall be so arranged that all the tools will have a place and not require to be handled in getting at some particular article. The second is the subject of scaffolding. I would like to see scaffolding treated in *Carpentry and Building*, with illustrations as to the proper and safe way of building scaffolding for common use, and also a method of building scaffolding around particular structures, church spires, &c.

Note.—We are much obliged to this correspondent, as to all those who are pleased with what we have published and take the trouble to write and say so. We think the above suggestions of topics for discussion of more than common importance. It should be the pride of every mechanic to possess a fine set of tools and to keep them in the best order. For this purpose a tool chest is of prime importance. The difference between workmen can often be determined by a glance at their tool chests and the condition in which they keep their tools. Some are slovenly, while others are extremely careful. Among the many readers of *Carpentry and Building* there are hundreds who possess tool chests embodying desirable features, while many others of our readers who lack the knowledge of how to plan a chest, are using boxes which are anything but satisfactory for the purpose. The practical working out of our correspondent's suggestion, therefore, will be for all who have desirable chests to forward plans of them for publication, which will enable others to build equally satisfactory ones. Those of our readers who believe they have chests altogether perfect in arrangement and capacity, need not fear to send communications, for undoubtedly, without disparagement to what they are at present using, there are some ideas they have not thought of which they will obtain by comparing notes with others who have made the subject a study. It seems hardly necessary to urge upon our readers the importance of the subject of scaffolding. The construction of scaffolding is seldom made a study of; old lumber is frequently employed; no time is allowed in which it may be erected, and very generally workmen are employed upon it who have not the least knowledge or experience in that line of work. A thorough discussion of the subject cannot fail to be of service.

Removing Kalsomine.

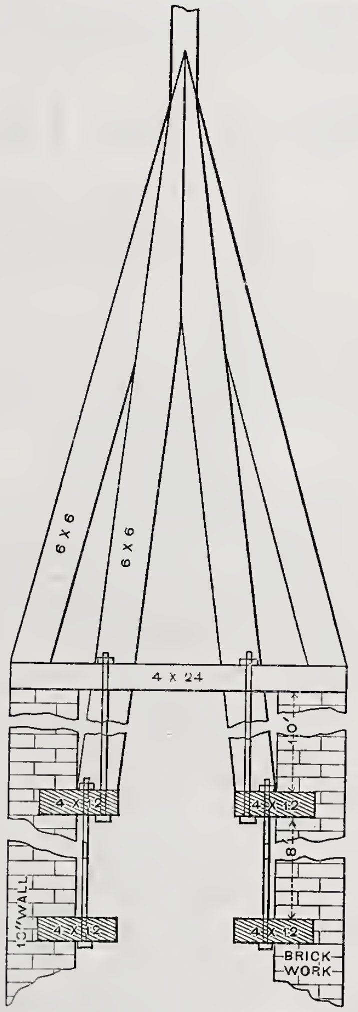
From J. H. E., *Philadelphia, Pa.*—I desire some of the readers of *Carpentry and Building* to inform me what will remove kalsomine from walls and a mode of preparing walls for painting? I have some plastered walls which have been very poorly kalsomined, and I wish to remove the kalsomining in order to finish them in paint. Any reader who can furnish me with this information will confer a particular favor.

Plan for Odd Fellows' Hall.

From W. A. B., *Silvara, Pa.*—Will some reader of *Carpentry and Building* furnish me with a design for a two-story building, 25 x 50 feet in size, the first story to be used for a store room and the second story for an Odd Fellows' hall, suitable for erection in a small town. I desire to have the stairs leading to the lodge room in the inside. The building is to stand entirely separate from others, so that all sides will show. I would like to have front elevation and a plan of the second story, together with such details as may be conveniently furnished. Should the design show a square front, which I prefer, I desire to have some directions concerning the eave cornice where it joins the front. I intend building entirely of wood, and trust to receive a neat and tasty design which is not too expensive for erection in a place of this size. I presume my requirements are not different in many respects from those which exist in a great many small towns through the country. Accordingly, I hope to receive a reply from some reader of the paper, based upon his practical experience with a structure of this kind.

Framing a Church Spire.

From J. M. F., *Middletown, Del.*—I am working upon a church spire, and wish to gain all the information concerning such work that I can. After completing the present building I have a contract to perform which also includes a church spire. It is the remodeling of a church already erected. The building is two stories, and it is desirable to build the spire in front of it. The church in size is 40 feet front by 60 feet deep,



Framing of Church Spire.—Suggested by J. M. F.

and stands end to the street. Now, I propose to build brickwork 18 feet square at the base, and to make the whole hight of the spire to top of the rod 80 feet. I propose to frame as represented in the inclosed sketch. I would like to know from the practical readers of *Carpentry and Building* if there is any better way of framing it than I have shown. The inside posts are calculated solely for weight, tohold the structure down in time of high wind. The lower braces are bolted to the upper ones, as indicated in the sketch. Am I employing the right proportions of timbers? I will be under obligations if some of your many readers will publish a design of a nice looking steeple, together with the details of construction—something which in cost will not exceed $1000.

Raising a Pole.

From C. C., *St. Louis, Mo.*—I desire advice from some readers of *Carpentry and Building* with regard to raising a long pole, such as a flag pole. I have constructed a pole of yellow pine, 60 feet long and 10 inches in diameter throughout. Will some of your readers inform me of a practical and economical way of raising this pole? I shall have to make or purchase the necessary appliances, and therefore desire to get what are best.

Framing a Gothic Roof.

From O. M., *Espyville, Penn.*—I desire to inquire, through the columns of *Carpentry and Building*, for a rule for framing Gothic roofs. There is something about them which I do not understand. I think some of your readers can furnish me the information I need, and also at the same time confer a benefit upon other readers.

Note.—We are in doubt as to our correspondent's meaning in the use of the term Gothic roofs, and just what there is about a Gothic roof, whatever he may mean by that term, which he does not understand. In all probability he will not obtain a satisfactory answer to his question in this shape. If he will forward a sketch, showing just what he wishes to accomplish, we shall be pleased to answer him or refer the problem to our readers. He may rest assured that in one way or the other a satisfactory answer will be made.

Repairing an Old Building.

From P. S. S., *Pine Grove, Maryland.*—I have read *Carpentry and Building* for several months, and I would be at a loss without the valuable information which its many writers have contributed. I desire to ask a question, upon which I hope builders generally will be disposed to express their views. I have a two-story house, 18 x 38 feet in size. The roof is one-third pitch. It has two outside chimneys. The frame, roof and the chimneys are good, but the clapboards of the building are unsound, and the eaves boxing is entirely too narrow. Now, what I desire to know is this: How can I remove the old clapboards and put on new, 2 or 3 inches narrower than those at present in use, without taking down the chimneys, and, at the same time, make a respectable job of it? How can I make the eaves boxing wider without upsetting the roof? I should be under many obligations to any who may advise me in this matter.

Furring Brick Walls for Lathing.

From M. W. C., *St. Johnsbury, Vt.*—Will some of the many readers of *Carpentry and Building* tell us the best way to fur brick walls for lathing. Is it well to lay in the wall 2 x 4-inch joists to nail to, or to lay the wall irrespective of wood, and then drive a wedge into the joints for receiving the nail? A discussion of this subject, it seems to me, will be of general benefit.

Concealing Cracks in a Plastered Ceiling.

From G. N. C., *Hancock, N. H.*—I have a room, 14 x 15 feet in size, which was plastered in very warm weather, and as a result the plastering has cracked very badly. Now, I desire to ask of the practical readers of *Carpentry and Building*, Can I cover the cracks by using kalsomine? Will some of them give me information about papering ceilings? I have thought of papering the ceiling of this room with plain tinted paper to match the ground of the wall paper, using a center-piece of the same material if I can find something appropriate. If any of the readers can give me hints based upon their experience, I will be greatly obliged.

Hip Rafters for Mansard Roofs.

I would like to have the opinion of some of the correspondents of *Carpentry and Building* in regard to the method of giving shape to the corners of hip rafters for a French roof, in which the sides are concave. The radius of the cavity is about 3 feet 6 inches.

Dry Coating for Walls.

From W. L., *Junction City, Kansas.*—In the June number of *Carpentry and Building* for 1879, there is a recipe for dry coating for basement walls. Will some reader of *Carpentry and Building* who has had experience in using the same, inform me how much sur face the amount mentioned in the recipe will cover? Such items in connection with recipes render them much more desirable than they can be without.

Sliding Doors to Run on the Floor.

From A. K., *Smith's Falls, Ontario.*—I have read with interest the description of the method of constructing sliding doors by hanging them from the top, published in a recent number of *Carpentry and Building.* Will some practical reader of the paper forward for my benefit a plan for constructing doors which run on the floor; also please state what hight doors should be in a room the ceiling of which is 10 feet above the floor?

Foundations for Bridge Piers.

From M. H. S., *Boise City, Idaho.*—Will some reader of *Carpentry and Building* inform me what is the best kind of support for the spans of bridges where gravel bottoms occur? The gravel bed is from 8 to 12 feet in depth and the water from 3 to 6 feet, and the current is very rapid during freshets. I desire, in the construction, to guard against ice gorges and to build as cheaply as possible. Any suggestions or designs will be thankfully received.

Dry Kiln for Lumber.

From T. L. G., *Union Springs, Ala.*—Will some of the practical readers of "our paper" give me the best and simplest plan for constructing a dry kiln for lumber?

Question in Hand Rails.

From W. R. T., *Rockport, Ind.*—Will some one interested in stair building please give me an easy, as well as practical, rule for squaring the wreath of a hand rail?

Measuring Brickwork.

From J. A. W., *Greeley, Col.*—Will some of the readers of *Carpentry and Building* furnish me a rule for measuring brickwork? I desire instruction as to the measurement of plain walls, arches, cornices, chimneys, shafts, caps, &c. In my experience I find considerable disparity among masons in their modes of measuring their work, and would like to ascertain the correct plan.

Framing a Flat Roof.

From T. L. G., *Union Springs, Ala.*—I desire to ask, from the readers of *Carpentry and Building*, the best plan for framing a flat roof of about 60 feet span, to cover a brick building?

ADDRESSES WANTED.

Will G. E. F., of Buffalo, a query from whom was published in the February number, please send his address to this office. We have mislaid his letter and are unable to forward a communication we have received for him.

For similar reasons we also desire the address of W. F. R., of Malden, Ct., for whom we have a letter.

Prices of Building Materials in New York, February 20, 1880.

Blinds.—OUTSIDE.

Per lineal, up to 2.10 wide....$ .... @ 0.24
Per lineal, up to 3.1 wide..... .... @ 0.28
Per lineal, up to 3.4 wide...... .... @ 0.31
Per lineal, paint'd and trim'd 0.45 @ 0.55

INSIDE.

Per lineal, 4 folds, Pine....... .... @ .56
Per lineal, 4 folds, ash or chstnut.......... .... @ .90
Per lin'l, 4 folds, cherry or butternut.......... .... @ 1.07
Per lineal, 4 folds, bl'k wal't. .... @ 1.30

Bricks—(Afloat.)

Pale.................₩ M. $7 00 @ 7.50
Jersey.............. 9 75 @ 10.00
Long Island......... " 10 25 @ 10.50
Up-River............ " 10.00 @ 10.25
Havers'aw Bay, 2ds. " 10 25 @ 10.50
Havers'aw Bay, 1sts. " 10.75 @ 11.00

FRONTS.

Croton—Brown.........₩ M. .... @ $10.00
Croton—Dark.......... " .... @ 11.00
Croton—Red........... " .... @ 11.00
Philadelphia.......... " 18.00 @ 20.00
Trenton.............. " 17.00 @ 19.00
Baltimore............ " 34.00 @ 38.00

Yard prices 50c. ₩ M higher, or, with delivery added, $1.50 per M for Hard and $2.50 per M for front Brick.

FIRE BRICK. (yard prices).

Red Welsh....................$35 00 @ ....
Scotch....................... 30.00 @ ....
English...................... 30.00 @ ....
Silica....................... 45.00 @ 55 00
Stourbridge.................. 55.00 @ ....
American..................... 40.00 @ 50.00
Afloat, 500 ₩ M less

Cement.—(Cargo rate, nominal.)

Rosendale, ₩ bbl............ $ @ 1.25
Portland Saylor's American, ₩ bbl........ 2.55 @ 2.65
Portland (imported) ₩ bbl.. 2.90 @ 3.00
Roman.............. " .. 2.85 @ 3.00
Keene's coarse..... " .. 6.00 @ 6.25
Keene's fine........ " .. 9.75 @ 10.00
Add 25 cts. to above rates for yard prices.

Doors.

RAISED PANELS, TWO SIDES.

2.0 x 6.0	1¼ in.	$0.84	....
2.6 x 6 6	1¼ in.	1.18	....
2.6 x 6 8	1¼ in.	1.24	....
2.8 x 6.8	1¼ in.	1.30	....

MOULDED.

Size.	1¼ in.	1½ in.	1¾ in
2.0 x 6.0	$1.54	....	....
2.6 x 6.6	1.90	2.41	....
2.6 x 6.8	1.96	2.43	....
2.6 x 6.10	1.98	2.51	....
2.6 x 7.0	2.02	2.61	....
2.8 x 6 8	2.02	2.61	3.21
2.8 x 7 0	2.11	2.71	3.36
2.10 x 6.10	2.23	2.82	3.55
3.0 x 7.0	2.33	3.06	3 75

2nd quality 15 cts. less.

Drain and Sewer Pipe.

Discount 50 to 60 per cent. according to quality and size of order.

Pipe, per foot.	Bends & Elbows, Each.	Branches—Slng.	Branches—D'bl. & V.		Traps, Each.
2 in..$ .13	$ .40	$ .48	$ ...	Longer than 1 ft. charged as pipe.	$1.00
3 " .. .16	.50	.61	...		1.25
4 " .. .20	.65	.75	1.30		1.75
5 " .. 25	.85	.90	1.55		2.50
6 " .. .30	1.15	1.05	1.80		3 50
7 " .. .35	1.50	1.20	2.05		5 00
8 " .. .45	2.00	1.45	2 45		6.00
9 " .. .55	2.50	1.70	2.85		7.00
10 " .. .70	3.00	2.00	3.30		8.00
12 " .. .80	3.75	2.52	4.24		10 00
15 " .. 1.25	5.00				
18 " .. 1.60	7.50				

House Branches pr. lin. ft.: 15x6 $1.75; 18x6 2.50. Sewer Branches pr. lin. ft.: 15 in. $2.25; 18 " 3.00

Glass.—(American.)

Prices current per box of 50 feet.

SINGLE.

Sizes.	1st.	2d.	3d.	4th.
6x 8—10x15	$7.50	$6 75	$6 25	$5.75
11x14—16x24	8.50	7.75	7 25	6.50
18x22—20x30	10.75	9 75	8 75	7 75
15x36—24x30	12.25	10 75	9 00	8.50
26x28—24x36	13.00	11 50	9 75	9.00
26x36—26x44	14.50	13 25	10.75	9.50
26x46—30x50	15.00	14 00	11 25	10.50
30x52—30x54	16 00	14 50	12 00	...
30x56—34x56	17.25	15 50	13 50	....
34x58—34x60	18.25	17 25	15 00	....
36x60—40x60	20 75	18 75	17 25	....

DOUBLE.

Sizes.	1st.	2d.	3d.	4th.
6x 8—10x15	$12 00	$11.00	$10.00	$9.25
11x14—16x24	13.75	12.50	11.75	10.50
18x22—20x30	17.25	15.75	14 00	....
15x36—24x30	19.75	17.25	14.50	....
26x28—24x36	21.00	18.50	15 75	....
26x36—26x44	23 25	21 25	17.25	....
26x46—30x50	24.00	22.50	18.00	....
30x52—30x54	25 75	23 25	19 25	....
x56—34x56	27.75	25.00	21.75	....
34x58—34x60	29.25	27 75	24 00	....
36x60—40x60	33.25	30 00	27 75	....

Sizes above—$10 per box extra for every five inches.

An additional 10 per cent. will be charged for all glass more than 40 inches wide. All sizes above 52 inches in length, and not making more than 81 inches, will be charged in the 84 united inches' bracket. Discounts: Single, 50 @ 5%; Double, 50 & 15

French

WINDOW, PICTURE AND CAR GLASS.

Prices current per box of 50 feet.

SINGLE.

Sizes.	1st.	2d.	3d.	4th.
6x 8—10x15	$8 00	$6 75	$6.25	$5.75
11x14—16x24	8 75	8 00	7 50	7.00
18x22—20x30	11 25	10 50	9 75	8.75
15x36—24x30	12 75	11 50	10.00	. .
26x28—24x36	13 50	12 25	11.25	. .
26x36—26x44	14 75	13 75	11.75	..
26x46—30x50	16 25	15.00	13 00	....
30x52—30x54	17 25	16 00	13 50	...
30x56—34x56	18 75	16 75	15 00	...
34x58—34x60	19.50	18.00	16.00	....
36x60—40x60	21 00	19.50	18.00	..

DOUBLE.

Sizes.	1st.	2d.	3d.	4th.
6x 8—10x15	$12 00	$11 00	$10.00	$9.25
11x14—16x24	14 75	13 75	12 75	11.75
18x22—20x30	19 00	17 75	16 00	....
15x36—24x30	21 50	19 25	16.50	....
26x28—24x36	23 00	20 75	18 25	....
26x36—26x44	25 00	23 00	19 25	....
26x46—30x50	27 00	25 00	21.25	....
30x52—30x54	28 50	26 00	22.25	....
30x56—34x56	30 00	27 75	24 75	....
34x58x34x60	31 75	30 00	27.00	....
36x60—40x60	35 50	32 50	30.25	....

Sizes above—$10 per box extra for every five inches.

An additional 10 per cent. will be charged for all glass more than 40 inches wide. All sizes above 52 inches in length, and not making more than 81 united inches, will be charged in the 84 united inches' bracket.

Discounts: Single, 50; Double, 60 & 5%.

GREENHOUSE, SKYLIGHT AND FLOOR GLASS.

Per square foot, net cash.

⅛ Fluted plate....................18 @ 20
3-16 Fluted plate..................20 @ 24
¼ Fluted plate....................24 @ 26
¼ Rough plate......................24 @ 26
⅜ Rough plate...................... @ 35
½ Rough plate...................... @ 45
¾ Rough plate...................... @ 60
1 Rough plate...................... @ 70

Hair.

Cattle..............₩ bushel..$ .... @ 0.12
Goat.................. " .... @ 0.15

Lath.

Cargo rate............ ₩ M $ 2.35 @ 2.50

Lime.

Glen's Falls, or Keenan's common, cargo rate ₩ bbl.............. 1.00 @ 1.10
Glen's Falls, or Keenan's finishing Jointa.............. 1.20 @ 1.25
Rockland, common.............. 1.00 @ 1.05
Rockland, finishing.............. 1.25 @ 1.30
Add 25c. to above figures for yard rates.

Lumber.—(Yard prices.)

Market firm with upward tendency.

Pine, very choice and ex.. dry, ₩ M. ft. thick........$60.00 @ $65.00
Pine, clear.................. 50.00 @ 60.00
Pine, selects................ 40.00 @ 50.00
Pine, selected, box......... 18.00 @ 20.00
Pine, common box............ 16 00 @ 18.00
Pine, common box, ⅝...... 13.00 @ 15.00
Pine 1¼x10, 13 ft., matched, each.............. .40 @ .43
Pine, 1¼x10, 13 ft., culls.... .25 @ .28
Pine, 1x10, 13 ft., good matched, each.............. .28 @ .30
Pine, 1x10, 13 ft., common, matched, each.............. .20 @ .22
Pine, 1x4½, clear, match'd, each.............. .22 @ .25
Pine, 1x4½, merchantable, matched, each.............. .16 @ .18
Pine, 1¼x4½, cl'r, match'd, each.............. .33 @ .35
Pine, 1¼x4½, merchantable, matched, each....... .28 @ .30
Spruce, 1x9, 13 ft., rough... .18 @ .20
Spruce, 1x9, 13 ft. matched, each.............. .20 @ .22
Spruce, 1¼x9, 13 ft., rough. .20 @ .22
Spruce, 1¼x9, 13 ft., matched, each.............. .23 @ .25
Spruce, 2x9, 13 ft., rough.. .35 @ —
Spruce, 2x9, 13 ft., match'd, each.............. .40 @ .42
Spruce, 2x4, 13 ft.............. .12½ @ .13
Spruce timber, flat, ₩ M ft 18.00 @ 20.00
Spruce timber, square, ₩ M ft.............. 20.00 @ 25.00
Hemlock, 1x10, 13 ft., each. — @ .16
Hemlock, 2½x4, 13 ft., each. .14 @ .15
Hemlock, 3x4, 13 ft., each.. @ .16
Hemlock, 4x6, 13 ft., each.. .40 @ .43
Ash, good, ₩ M ft.......... 40.00 @ 45 00
Oak.............. 45 00 @ 55 00
Oak, quartered .... 70 0 @ 90.00
Maple, common.............. 25.00 @ 35 00
Maple, good to 2 in.......... 40.00 @ 45 00
Maple good thick.......... 45 00 @ 55.00
Maple white.............. 55 00 @ 60.00
Chestnut.............. 45 00 @ 60 00
Bl'k walnut, good to choice 85.00 @ 100 00
Black Walnut, 2d.......... 55.00 @ 65.00
Black walnut, ⅝.......... 75.00 @ 85.00
Black walnut, selected and seasoned.............. 100.00 @ 120.00
Bl'k walnut counters, ₩ ft. .12½ @ .20
Cherry, wide, ₩ M ft...... 85 00 @ 100.00
Cherry, ordinary.......... 60.00 @ 80.00
Whitewood, or Poplar 1 to 1½ inch.............. 35.00 @ 4.500
Whitewood, or Poplar ⅝ in. 30.00 @ 35.00
Whitewood, or Poplar ⅝ panels.............. 35.00 @ 45.00
Shingles, extra sawed pine, 18 in.,.............. 5.00 @ 6.00
Shingles, clear sawed pine, 18 in., 2 md.............. 4 00 @ 5.00
Shingles, cypress, 7x24...... 14.00 @ 18.00
Shingles, cypress, 6x20...... 12.00 @ 14.00
Shingles, Cedar, 6x24, No. 1 — @ 22.00
Shingles, Cedar, 6x14, A's.. — @ 16.00
Shingles, Cedar, 6x20, No. 1 — @ 12.50
Shingles, Cedar, 6x20, A's.. — @ 10.00
Yellow pine dressed flooring, wide, ₩ M ft.......... 30.00 @ [illegible]5.00
Narrow ditto.............. 32.00 @ 37 00
Yellow pine timber........ 30.00 @ 45 00
Locust posts, 8 ft., ₩ in...... .18 @ .20
Locust posts, 10 ft.,.......... .24 @ .25
Locust posts, 12 ft........... .25 @ .30
Chestnut posts, ₩ ft .... .3 @ .3½
Mahogany, ⅛ in. ₩ ft....... .5 @ .7
Mahogany, ⅜ in. ₩ ft....... .8 @ .10
Mahogany, ½ in. ₩ ft....... .10 @ .12
Mahogany, ⅝ in. ₩ ft....... .12 @ .11
Mahogany, ¾ in. ₩ ft....... .14 @ .16
Mahogany 1 in. ₩ ft....... .16 @ .18
Rosewood, ⅛ in. ₩ ft....... .11 @ .15
Rosewood, ¼ in. ₩ ft....... .16 @ .20
Rosewood, ⅜ in. ₩ ft....... .24 @ .28
Rosewood, ⅝ in. ₩ ft....... .40 @ .45
Rosewood, 1 in. ₩ ft....... .60 @ .75
Satin wood, ½ in. ₩ ft....... .25 @ .35
Satin wood, 1 in. ₩ ft....... .35 @ .50
White holley ¼-inch........ .10 @ .12
White holley ⅜-inch........ .15 @ .18
Cedar (Cuban and Mexican) ₩ ft.............. .10 @ .14
Cedar (Florida).............. @
Less than 1 inch........ .16 @ .24
1 inch and over .... .25 @ .30

Moldings.

5c. to 6c. per inch per 100 feet, according to quality.

Paper.

Rope, waterproof building, ₩ lb .16 @ .17
Rosin Sized Sheathing, ₩ lb. .4 @ .5
Dry Sheathing ₩ lb.......... .3 @ 3½
Tarred Felt. ₩ lb.......... .2 @ .2¼

Plaster.

Calcined City........Mill rate..$1.05 @ 1.10

Sash.

GLAZED.

Dimensions of windows.	12 Lights. 1¼ pl.	1¼ c.	1½ c.	1¾ c.	8 L's. 4 Lights. 1¼ c.	1½ c.
2.1x3.6	$1.08	1.15	....	....	....	....
2.4x4.10	1.20	1.27	1.37	....	1.38	....
2.7x4.6	1.47	1.54	1.67	....	1.71	1.82
2.7x4.10	1.56	1.64	1.79	....	1.85	1.99
2.7x5.2	1.69	1.77	1.91	2.21	2.19	2.34
2.7x5.6	....	1.88	2.06	2.30	2.35	2.53
2.7x5.10	....	1.98	2.17	2.41	2.49	2.68
2.10x4.6	1.61	1.69	1.83	....	1.86	2.00
2.10x5.2	1.81	1.91	2.12	2.33	2.36	2.57
2.10x5.6	1.91	1.99	2.23	2.51	2.46	2.70
2.10x5.10	2.17	2.25	2.51	2.59	2.61	2.87

c. means counted checked—plowed and bored for weights.

Hot bed sash, glazed....................$2.35

HEAD LIGHT.

Two or three Lights, Glazed.

Size.	1¼	1½	Size.	1¼	1½
2.6x1.0	56	68	2.10x1.10.	56	73
2.6x1.6	68	79	2.10x1.6	73	84
2.8x1.0	56	68	3 0x1 0	62	79
2.8x1.6	68	84	3.0x1.6	90	1.07

Slate.

By car load, delivered in New York.

Purple roofing slate, ₩ sq're.$5.00 @ $5.50
Green slate.................... 5.00 @ 5.50
Red slate...................... .... @ 9.50
Black slate, Pennsylvania... .... @ 4.00
Tiles, 1¼ in. rubbed, ₩ sq. ft. .20 @ .25

₩ sup. ft.

Steps and platforms, 1 in. thick........28c
" " 1½ " 35c
" " 2 " 42c
Risers, 1 inch thick....................27c
Coping, 1½ " 27c
" 2 " 31c

Lineal ft.

Window sills, 4x7......................45c
" 3x7......................36c
Window caps, 4x10, plain..............65c
" 4x8, " 50c
" 3x10, " 47c
" 3x8, " 42c

Stair Material.

BALUSTERS.

Black Walnut.	1½ in.	1¾ in.	2 in.	2½ in
Fancy Turned	7c	9c	10c	16c
Neck Turned	9c	10c	12c	19c
Fluted or Octagon	12c	14c	17c	25c

OCTAGON PANELED NEWELS.

Panels Veneered with French Walnut.

8-inch Newels, with Cap............ $6.12
9 " " " 6.88
10 " " " 7.60

SOLID NEWELS, WITH CAPS.

Black Walnut.	5 in.	6 in.	7 in.	8 in.
Fancy Turned	$1.60	$1.90	$2.50	$3.40
Octagon	2.10	2.40	3.00	3.90

STAIR RAIL.

Worked out and finished ready to put up. Easements and cylinders counted double. Price per foot (Newels and Balusters not included).

Black Walnut.	3 in.	3½ in.	4 in.	4½ in
Molded	40c	45c	50c	53c
Toad Back	45c	50c	63c	68c

STAIR RAIL, UNFINISHED.

Price per foot.

Black Walnut.	3 in.	3½ in.	4 in.	4½ in
Molded	11c	13c	15c	17c
Toad Back	12c	14c	16c	18c

Stone.

Cargo rates, delivered at New York.

Amherst freestone, in rough, ₩ C ft....................$.... @ $0.90
Berlin freestone, in rough... .... @ .90
Berea freestone, in rough.... .... @ .80
Brown stone, Portland, Ct... 1.25 @ 1.50
Brown stone, Belleville, N. J. 1.00 @ 1.50
Granite rough................ .50 @ 1.00
Dorchester, N. B., stone, rough..............₩ foot. .... @ 1.00

BLUE STONE

Rubbed hearth, 10 ft. or under........ 20c
Rubbed hearth, 20 ft. or under........ 30c
Rubbed hearth, 30 ft. or under........ 45c
Rubbed hearth, 40 ft. or under........ 55c
Rubbed sills, imported................ 28c
Rubbed sills, domestic................ 33c
Sills and lintels........ .... @ 18c
Sills and lintels, fine quarry cut sills.................... .... @ 35c
Coping, 11 to 18 in. wide......... 20c @ 34c
Coping, 20 to 28 in. wide......... 38c @ 60c
Coping, 30 to 36 in. wide......... 65c @ 80c
Steps, 8 in.......................... .... @ 55c
Steps, 7 in.......................... .... @ 40c
Steps, 6 in.......................... .... @ 25c
Steps, door, per in. wide......... .... @ 2c
Platforms, promiscuous, 4 in... .... @ 32c

Vault Lights.—Nominal.

Platform, sq ft.................... ....$3.50
Step and risers, sq. ft.................... 3.50
Floor light, sq. ft.................... 2.50
Roof light, sq. ft.................... 2.50
Platform, 2d quality, sq. ft........... 2.60

COVERS.

Diameter.	Round.	Hexagon.
14 inch	$3.00	$0.00
16 "	3.75	4.00
18 "	5.50	6.00
20 "	8.00	8.50
24 "	14.00	15.0
26 "	16.00	17.0
30 "	23.50	25.0
36 "	31.00	33.0

Window Frames.

Up to 3.4 x 7.2, put together.. ....@ 20c

CARPENTRY AND BUILDING

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Design for Church.

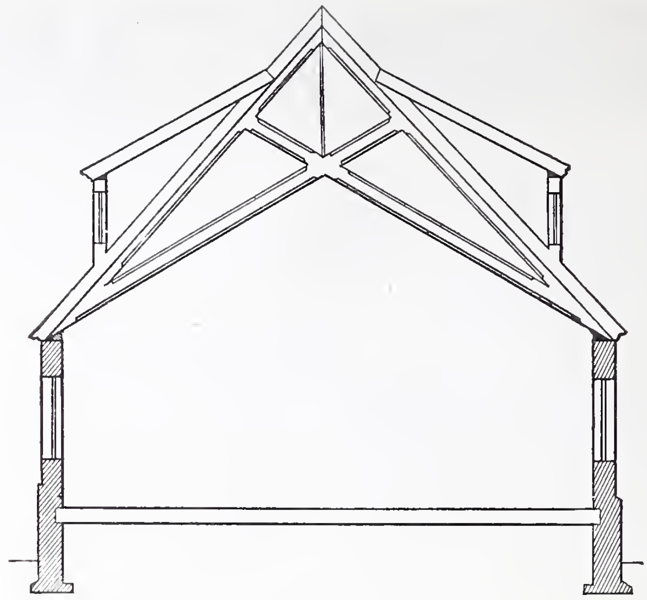
A number of readers have requested us to publish a design for a church, suitable for erection in a small town or in the suburbs of a city. The cost specified by their letters ranges from $4000 upward. As meeting the wants quite as well as any design we have seen, we present the accompanying illustrations, prepared from drawings furnished by Mr. Joseph Ireland, architect, of Cleveland, Ohio. We shall not attempt to give an estimate of cost, because the locality in which the building may be erected will determine that to a very considerable extent, and accordingly the figures we might present would be of but little value for places remote from the markets upon which they were based. This design was built some two years since, in the vicinity of Omaha, Neb., if we are not mistaken. The cost was very low, and proved conclusively that it is a design admitting of economical execution, while at the same time it presents a very attractive appearance. The material out of which it may be constructed, the manner of finishing the interior, as well as the general quality of trimmings and style of fittings employed, also have a material influence upon prices, and render it still more difficult to present any estimate which is calculated to be of real service to our readers.

The plan of the building is one which commends itself in various ways. Two front entrances, communicating with a capacious central lobby, afford ample space for entry and exit of a large congregation. The passage from the aisles to the outer doors is as nearly a straight line as is consistent with other requirements. The arrangement of pulpit, platform, choir and organ is a good one, and the church parlors in the rear part of the building, furnished with their own appropriate entrance ways, afford convenient rooms for Sunday-school classes and special church meetings, as well as desirable accommodations for social occasions.

The exterior appearance of the building is pleasing. In style it presents general features that are now quite popular. The tall tower, which may be viewed for miles around, gives it a commanding effect, while the neat porches to the entrances give it a cosey look, and suggests the quiet of subdued light, pouring through stained-glass windows, to be found within. When neatly roofed with slate of some appropriate pattern, and the tower furnished with a sweet-toned bell, the church represented in this design will form a conspicuous as well as pleasing object in any community in which it may be built.

Design for Church.—Perspective Elevation.—Joseph Ireland, Architect, Cleveland, Ohio.

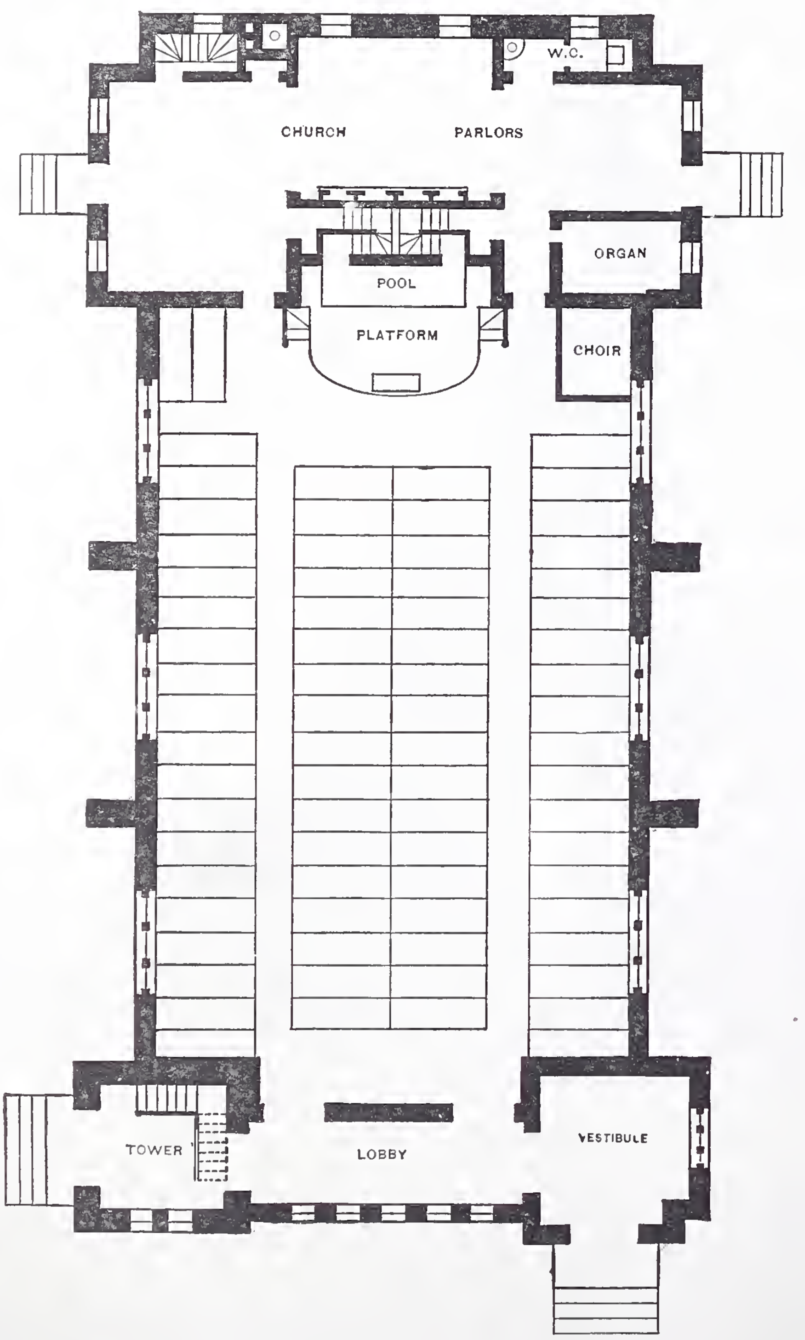
Hollow Brick.—Much attention has of late been given to the manufacture of hollow brick, to inclose air spaces between the interior and exterior surfaces of walls, so as to exclude dampness and secure greater warmth. This is of great importance, and especially where "furring off" the wall is avoided, as it should be for many good reasons. But the great cause of dampness, and the consequent great couducting power of walls, is not likely to be avoided by even hollow brick of the best construction, unless access of water to the outside and the foundations is prevented by impervious materials. The capillary power of raising water in walls is well known, particularly in Paris, where dampness has been known to rise 32 feet above the foundations. Long, driving rains fully saturate brick walls and chimneys, and exudations of water are found inside of dwellings about chimneys where no leak can be discovered. The capacity of absorptiou of water by bricks is probably not less than a pint to each one.



Design for Church.—Fig. 3.—Transverse Section.

Use of Terra Cotta in Architecture.

Of terra cotta, or burnt earth, which the artist and art commissioner love as they do all good things, little practical use has yet been made ; and that is the more wonderful, inasmuch as it is practically indestructible, retains the touch of the artist perfectly, and is therefore like a permanent investment of art power. The most notable example of the use of terra cotta in modern days is in the construction of the permanent portion of the Lord Kensington Museum in London. Every fraction of the facade, in a sort of Venetian-Renaissance style, is built of burnt earth—the main body of red brick, the enriched portions of cream-colored terra cotta. The columns, which are richly covered with figures emblematic of the seven ages and of the arts and sciences, in relief, are in blocks 7 feet in length and diameter, and the string courses and moldings, and wherever the main color of red brick is relieved by the lighter colored terra cotta, there are immense blocks of the material as straight and square as worked stone, while the surface is as hard as cast iron, non-absorbent, dead in surface and almost uniform in color. Where the color is varied, the variety is not so great as in veins of white marble. Altogether it is a brilliaut success, and it has these advantages: the miserable climate and dense atmosphere of London cannot defile it, for the surface is hard and smooth, and every storm of rain and every gale of wind remove the impurities as they would from a white plate. I examined these terra-cotta encrichments in September, 1871, after they had been exposed for several years, and they were as fresh as on the day of their erection; while stone work that had been up as long was as black as the inside of a chimney.



Design for Church.—Fig. 2.—Floor Plan.—Scale, 1-16 Inch to the Foot.

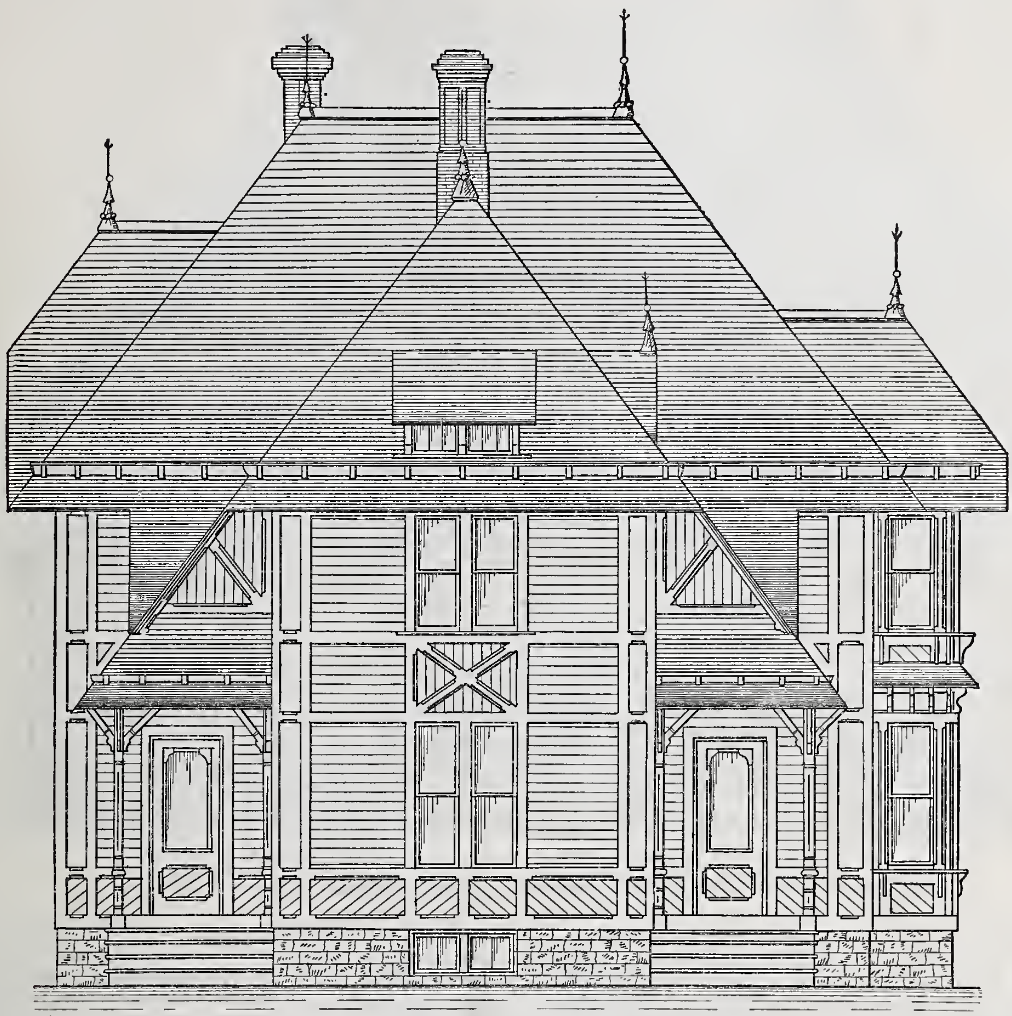
Encaustic tiles, which are another form of terra cotta, display every color known in art, except gold and silver; and their colors no possible condition of the atmosphere can destroy. Even when the earth is consumed with a fervent heat, these tiles and the Greek vases will be left behind us as a permanent record of past civilizations. You may reduce all the pictures in the world to tinder ; melt all the bronze statues until they run in the gutters ; calcine the marble statues into plaster of Paris ; burn all the buildings into lime, and all animal creatures and vegetation into ashes ; and all this while terra cotta will glow red-hot, and remain uninjured, and cool down again into the shape we fashioned it. It is the noblest of all vehicles for the expression of art.

Soapstone Kitchen Ware.—Wash basins, sinks and other articles of a similar character of soapstone, are growing quite rapidly in favor. Their cost is only about 30 per cent. more than wooden articles of the same kind, and they have many advantages. They do not warp, smell nor shrink under the action of water or dry weather. When not in use they require no attention, and have the additional advantage of being non-absorbent. This is of especial advantage for wash trays. Mr. J. H. Serene, 310 Pearl street, New York, is making sinks, tanks and wash trays from soapstone, besides solid soapstone registers. Many of the best houses in this city are using soapstone wash trays.

When a man's house is building he never thinks the carpenter puts in one-third enough nails, and frequently, and with biting sarcasm, asks him if he doesn't think the house would stand if he just simply leaned it up against itself aud saved all his nails? Then, a few years afterward, when he tears down his summer kitchen to build a new one, he growls and scolds, and sarcastically wonders why that fellow did'nt make the house entirely of nails and just put in enough lumber to hold the nails together.

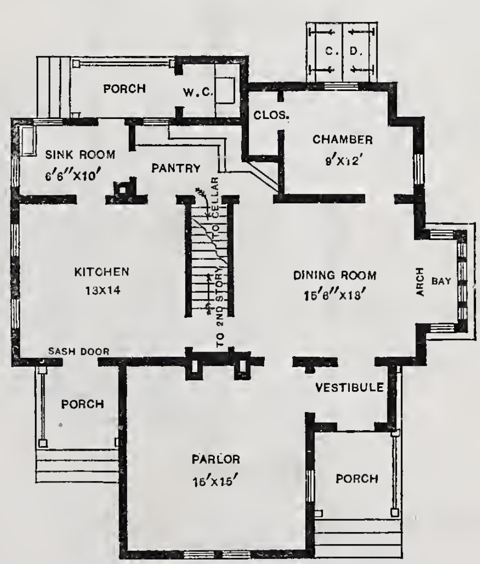
A Suburban House.

We present herewith plans, elevations and details of a suburban house by J. D. Sibley, architect, of Middletown, Conn. The care with which the design has been elaborated, the plans perfected and the details of construction anticipated, must commend the drawings to all practical men. Very seldom are plans so thoroughly considered in all respects as these, and it is not often so complete a set of drawings is furnished a builder to work by, even when made to order, as we present to our readers in this number.



Suburban House.—Fig. 1.—Front Elevation.—Scale, ⅛ Inch to the Foot.—J. D. Sibley, Architect. Middletown, Conn.

No doubt many who inspect this set of drawings, as well as some of those we have already published, will discover features they would prefer to see differently arranged. This indeed is necessarily the case with all plans and designs, and arises from differences in requirements and variations in taste, to say nothing of local influences. If one set of plans pleased every one, even restricting the supposition to one general grade of houses, the architect's business would suffer thereby, and the houses built from it would present a monotonous sameness. For ourselves, considering the set of plans before us, we should prefer a different location for the bath room. In point of construction, as well as convenience, we think the bath room located over the sink room, instead of in its present position, would be a material improvement. We shall not stop to specify further as to our own preferences, but will submit the plans, which all must agree are quite desirable in their general features, to the judgment of our practical readers.



Suburban House.—Fig. 2.—First Floor Plan. Scale, 1-16 Inch to the Foot.

From a letter by the architect, accompanying the plans, we make the following extracts: "I do not know that there are any special features to recommend the design I send you herewith above those of others that are being adopted every day. It seems to me, however, to be a desirable plan for persons in moderate circumstances and with a small family. It is suitable for the country or the suburbs of small cities. By the floor plans it will be noticed that the building is in a very compact form, and that every inch of available space is utilized by closets, &c. The exterior of the building is broken up by angles and roof lines that give a very pleasing effect. The entrance from the front to the kitchen may be open to criticism, but to my mind it adds greatly to the convenience of the house, while it also adds to the appearance, inasmuch as it balances the front, thus obviating the one-sided, half-finished look that is common to houses having a front of that kind.

"A house built to this design and painted in good taste cannot fail to give satisfaction in point of general effect. My idea of painting the exterior would be to use a deep red for the body, with the ends of rafters, gutters, bed molding blocks, chamfers, &c., painted black. A strong contrast will bring into relief the details of the design.

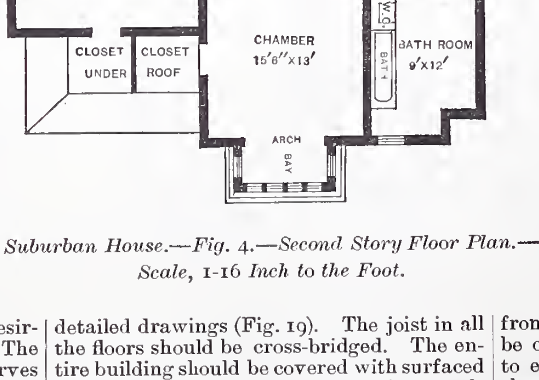
"It seems to me almost superfluous to speak of the cellar work; but in preparing for the excavation of the cellar there is something to be said deserving attention. The soil should be removed from the place where the house is to stand and for the space of some 10 or 12 feet around it, and stacked at some convenient point away from the building, in order that when all is done it may be used for soiling. Time and expense will be saved by this in bringing the premises into a sightly condition after the grading has been performed. If the nature of the ground requires it the body walls, chimneys and piers should have a course of footing stone projecting from the face of the wall, chimney or pier, as the case may be, 4 inches all around. This footing course should be well bedded in cement and the top surface should lie at least 3 inches below the finished cellar bottom. The earth should be dug away from the cellar walls at least one foot all around, so that the wall may be laid to line on both sides. A wall laid up against a bank is too great a temptation to the workman for slighting his work. By experience I have found that where walls are built against the bank their outer sides receive too little attention, and often the wall stone is bedded in the banks, instead of on the stone beneath it, making no end of trouble when acted upon by frosts. The underpinning of

Suburban House.—Fig. 3.—Side Elevation (Right).—Scale, ⅛ Inch to the Foot.

such a house as this might be of good hard-burnt brick or of stone, according to locality.

"In construction I have attempted to combine cheapness with strength, yet never sacrificing strength for cheapness. A house built as it ought to be should have no necessity for repairs under ten years at least. In the arrangement of rooms I have tried to remember the many steps the busy housewife and servants are required to take, and to make them, accordingly, as few as possible. I think I have attained this end in the arrangement given to kitchen, pantry, sink room and dining room. A front hall, though desirable, adds considerably to the cost of a dwelling, and is gained only at a great loss of room. The stairs in this plan are isolated from both kitchen and dining room, and yet they are so located as to furnish easy and convenient access to the second story from both apartments. The chimney, located in the entry, serves the three principal rooms. The chimney in the sink room may not be considered absolutely necessary, but still it will prove a great convenience. It might, however, be omitted for the sake of economy. The water-closet off from the rear piazza is gained at no sacrifice of room, and is completely isolated from the house. Many of the unpleasant features of a closet are thus obviated. An earth closet, arranged after the manner described in a recent number of *Carpentry and Building*, might be more desirable in this place than a water-closet. The brick wall between pantry and closets serves as a deafening and also as prevention against unpleasant odors.

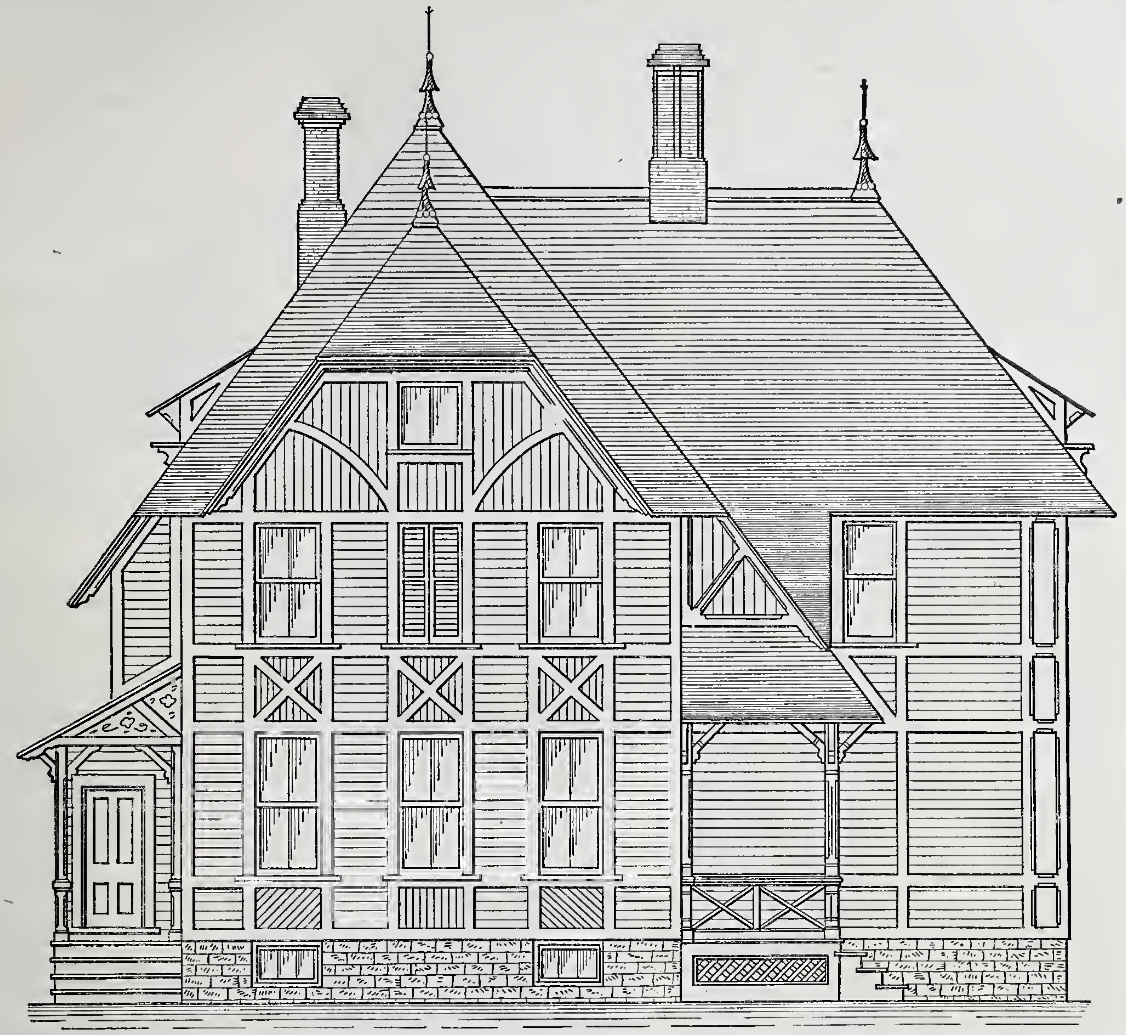
"If built in this locality, I should specify the frame of the house to be of good sound chestnut and spruce timber sawed die square. The first floor timbers I would make of chestnut; all other timber to be of spruce, and the whole framed after the manner designated as half-balloon, namely, the sills framed together, and the joists and bottom of posts and studding framed into them, and braced with long braces nailed in wherever practicable (Figs. 11 and 18). The second and attic story joists should rest on a ribbon strip let into the studding, with the joists firmly spiked—all as indicated in the detailed drawings (Fig. 19). The joist in all the floors should be cross-bridged. The entire building should be covered with surfaced hemlock boards, except where the panels that are not boarded occur. The surface of each elevation, as may be seen by examining the engravings (Figs. 1, 3, 5 and 6), save only the rear, is broken up into panels by horizontal and perpendicular bands, and either filled with clap-boarding or beaded sheathing, worked narrow. The corner panels may be formed of 12-inch second clear boards, all as shown in the details of construction, backed up strongly with studding and 1⅛ furrings, chamfered. The frieze panels may be formed of beaded sheathing, worked narrow, all of which is clearly shown in the details of construction (Figs. 8 and 17). The cornice should be executed as shown in Figs. 15 and 17, with sawed brackets. The end of rafters should be plain cut and chamfered according to the design (Fig. 15). Crown molding to be as indicated. The roof boards from the outside of the line of plate to the eaves to be of 1⅛ inch pine sheathing worked narrow, beaded and laid with the worked side down; the bed molding to be executed in blocks, as shown in the detail (Fig. 17).



Suburban House.—Fig. 4.—Second Story Floor Plan.—Scale, 1-16 Inch to the Foot.

"The roof may be covered with shingles or slate. If for slate, the roof timbers should be somewhat stronger than would be required for shingles. The dormer windows in the roof light the attic. Gutters are to be backed up with pine plank and lined with tin, painted upon both sides before being laid. Valleys should be lined with tin, painted in the same manner as specified for the gutters. White pine ridge boards and galvanized iron finials complete the roof.

"The flooring of the house should be as follows: For the kitchen, pantry and sink room, Southern yellow pine, ⅞-inch thick, mill worked, from 4-inch strips; all other floors should be of good sound mill-worked spruce, not to exceed 4½ inches in width. The best should be selected for the first and second floors, and the remainder used for the attic. The flooring in all cases should be laid out to the outer edge of the studding, forming a tight joint with the sheathing boards, thus preventing rats and mice from circulating through the house. It must not be forgotten that rats and mice vex the life



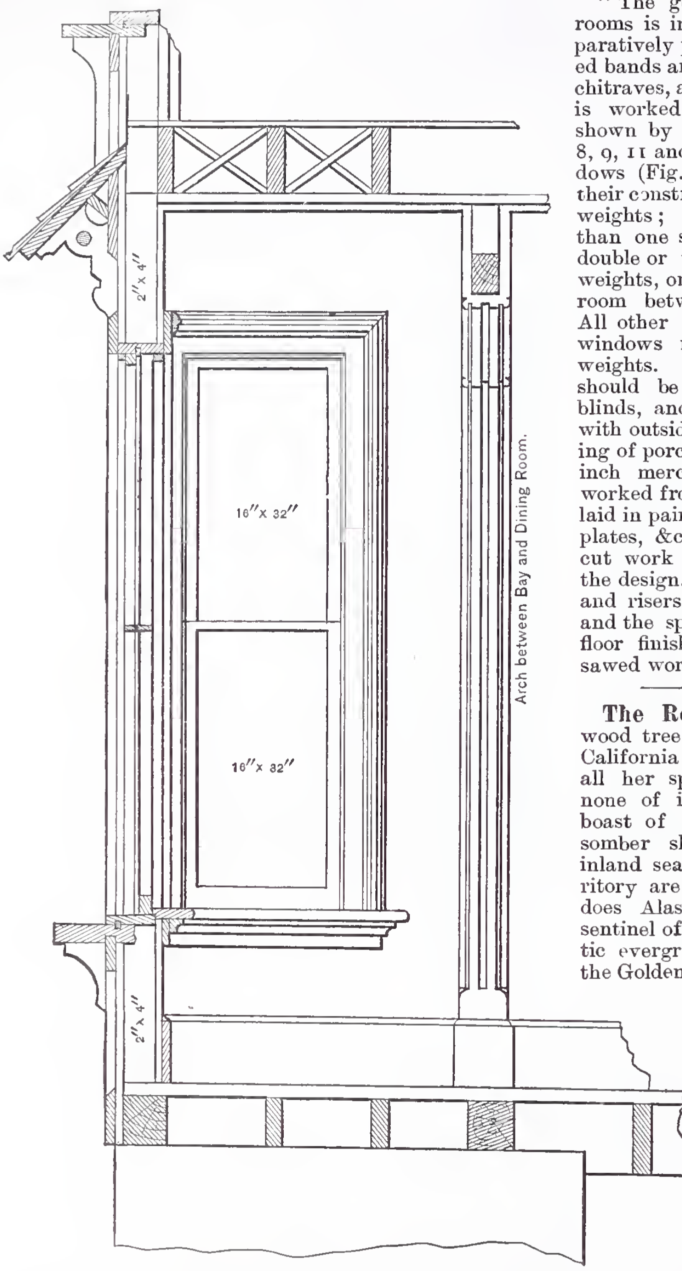
Suburban House.—Fig. 5.—Side Elevation (Left)—Scale, ⅛ Inch to the Foot.

Suburban House.—Fig. 6.—Rear Elevation.—Scale, ⅛ Inch to the Foot.

out of a good housekeeper, and I would protect the pantry from their ravages by lining it throughout with plain, but matched, hemlock boards, using the same under the floor, after which fur out the spaces in the usual manner. Construction of this kind will make a pantry vermin-proof. Whether it is the acid in the hemlock boards which is offensive to vermin, or that the needle-like grain of hemlock is troublesome for rats and mice to gnaw, I cannot say, but by experience I know vermin avoid hemlock. I know of a feed-box that is kept filled with meal, and which has stood in a stable for some 20 years in which rats and mice have held high carnival, and yet this box shows no indications of even an attempt upon it.

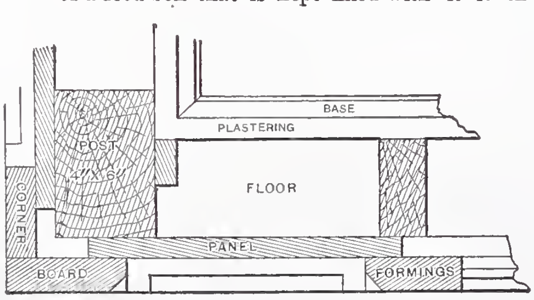
"Referring to the arrangemment of the second story (Fig. 4), it will be observed that all the rooms open directly from the hall; also, that each room is provided with a closet. The construction of porch roofs affords a good closet or trunk room under each, which in location are accessible from the three principal rooms in this part of the house. The floors of these closets should be formed by the ceiling of the porches.

"The general finish of the rooms is intended to be comparatively plain. Simply molded bands are employed for architraves, and a plain molding is worked on the bases, all shown by the details (Figs. 7, 8, 9, 11 and 13). The bay windows (Fig. 13), by nature of their construction, can have no weights; neither can more than one side window of the double or twin windows have weights, on account of lack of room between window jambs. All other two and four light windows may be hung with weights. The bay windows should be fitted with inside blinds, and all other windows with outside blinds. The flooring of porches should be of 1¾-inch merchantable pine, mill worked from 4-inch strips, and laid in paint. The posts, rail, plates, &c., to be of pine, with cut work in accordance with the design. White pine steps and risers should be furnished, and the space underneath the floor finished with lattice or sawed work."



Suburban House.—Fig. 7.—Section through Bay Window.—Scale, ½ Inch to the Foot.

The Redwood.—The redwood tree is a peculiarity of California forests. Oregon, in all her splendid groves, has none of it, nor can Nevada boast of a single one. The somber shores of the great inland sea of Washington Territory are also without it, nor does Alaska boast a solitary sentinel of this family of gigantic evergreens. It belongs to the Golden State alone, and is a distinctive resource of her fast accmulating wealth. No other lumber splits so true to the grain, and none other can ever supplant it as perfectly in the uses to which it is now devoted. For fence-posts and railroad ties it is the most durable wood ever found, resisting the action of both air and water with unparalleled stability. Below San Francisco it is comparatively scarce, Santa Cruz and San Mateo being the only counties which have an average growth of it. And the rapid improvement of elegant farms in those counties is fast thinning out the towering forests. But on the north coast there is wealth enough to last for years, and the question is, How will these forests be replaced when they are thinned out by the insatiable demands of a growing commerce? In Japan every man who cuts down a tree must plant another instead; but no such stringent legislation prevails in this country. Sonoma, Mendocino, and Humboldt counties employ thousands of men, and are building up a substantial prosperity from their redwoods. Deserted logging camps are soon converted into dairy farms, and the once nomadic trampers who swung the ax in the silent woods, settle down to grow up with the country, advancing toward opulence.

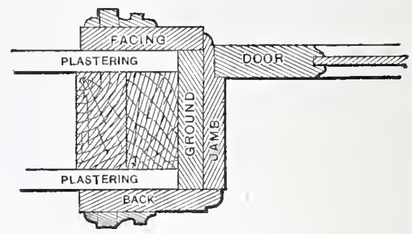


Suburban House.—Fig. 8.—Section through Corner of House.—Scale, 1½ Inch to the Foot.

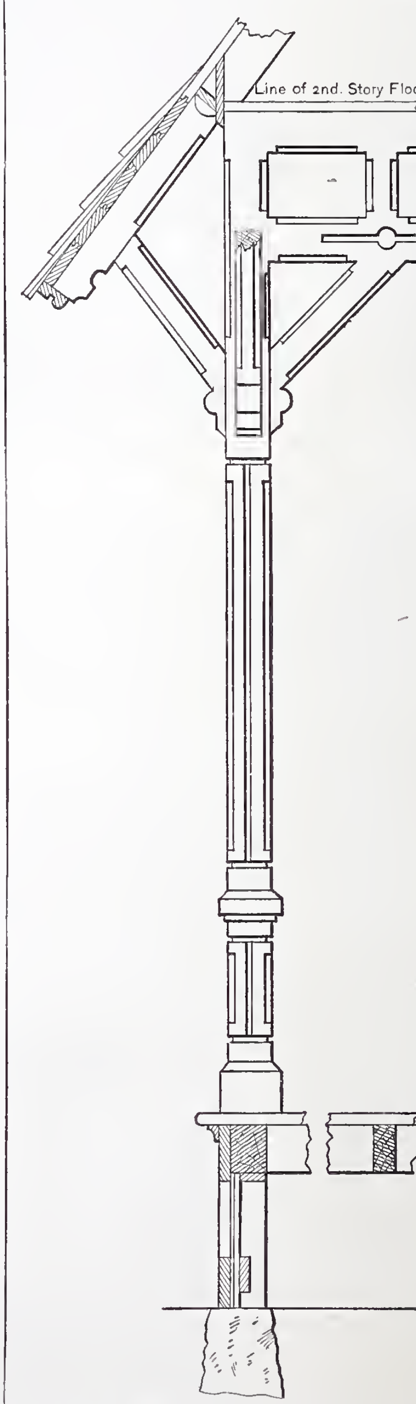
The Use of Asbestos for Fire-proof Construction.

BY CHARLES J. UNDERWOOD.

Since buildings absolutely fire-proof involve in their construction such an outlay of material, mind and money as to render them like angel's visits, few and far between, even in a great city, any form of construction by which a fire shall be rendered slow of progress, limited in extent, and conse-

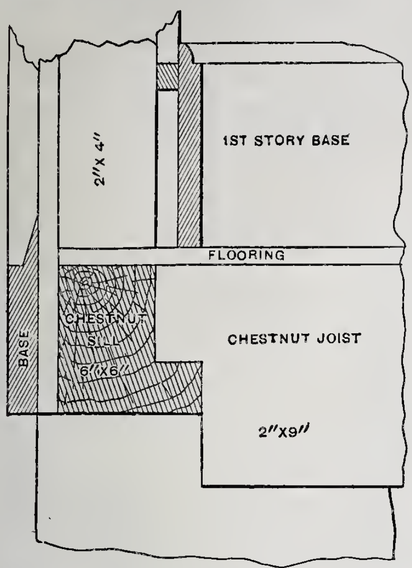


Suburban House.—Fig. 9.—Section through Door and Door Trimming.—Scale, 1½ Inch to the Foot.



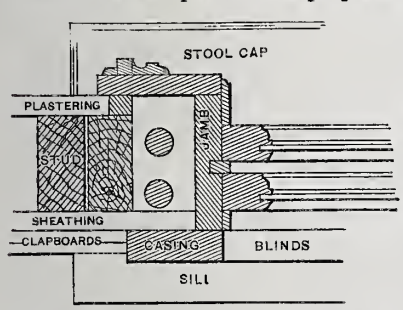
Suburban House.—Fig. 10.—Details of Porch. Scale, ½ Inch to the Foot.

quently harmless, is a great desideratum. Asbestos is a material which has been long known for its fire-resisting qualities, but which has long been allowed to lie unem-



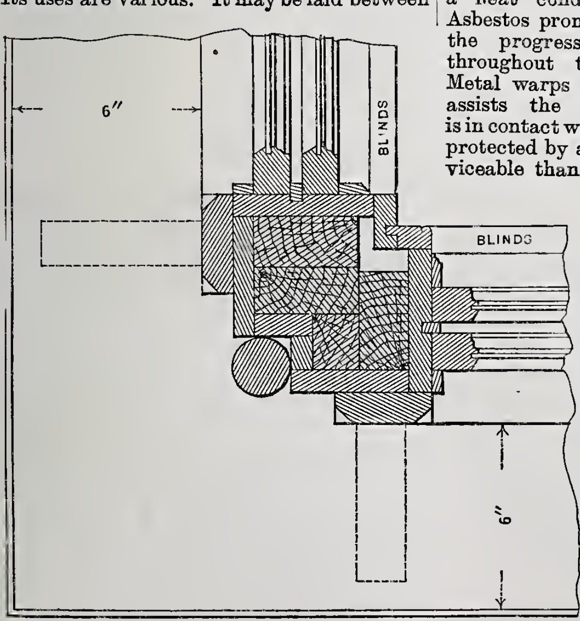
Suburban House.—Fig. 11.— Construction at Line of First Floor.—Scale, 1½ Inch to the Foot.

ployed by human art, for the lack of knowledge how to apply it successfully. Man's skill has, at last, developed from it a form of fabric well adapted to the purposes of



Suburban House.—Fig. 12.—Section through Window.—Scale, 1½ Inch to the Foot.

fire-proofing buildings. I refer to Asbestos paper or felt. It is manufactured in rolls containing 100 yards, of a width of 44 inches. Its uses are various. It may be laid between



Suburban House.—Fig. 13.—Detail of Corner of Bay Window.—Scale, 1½ Inch to the Foot.

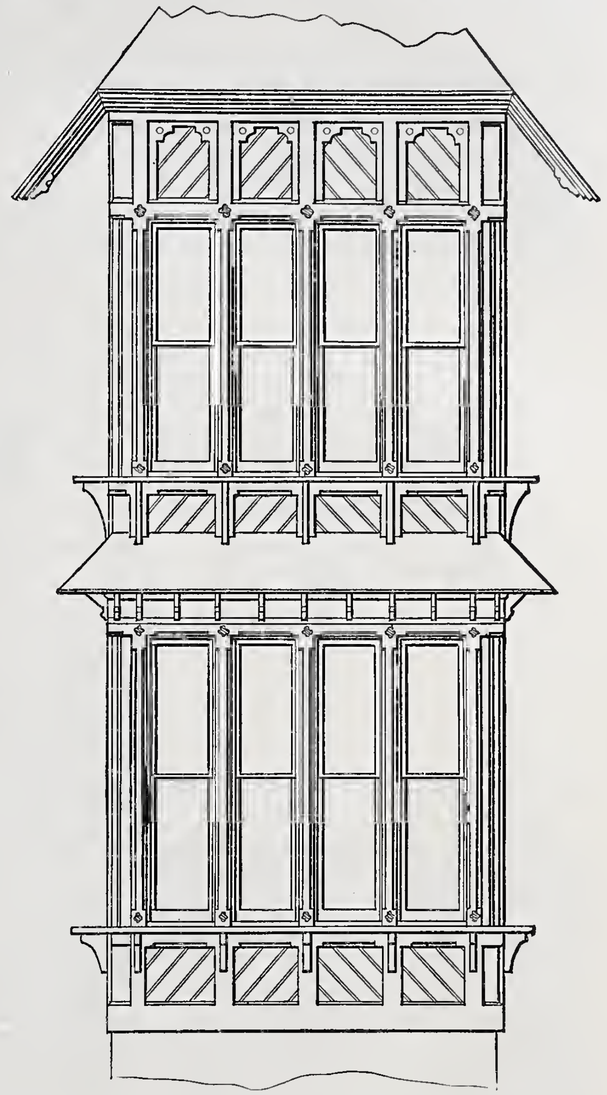
flooring boards and on the ceiling before plastering. It may be carried on the walls a sufficient distance to permit the furring to be nailed upon its face, thus effectually excluding fire from its favorite resort behind the plaster. By the use of asbestos cement the paper may be firmly connected with the walls, thus securing the same end. Doors of pine or other wood may be so constructed as to have a sheet of asbestos paper in their center, thus insuring one side of the door remaining intact, even though the other is burned. Halls, schoolrooms and elevator flues may be sheathed with this paper. Apartments so protected exclude the fire from without, and confine it if within, thus affording the Fire Department ample time to come to the rescue.

Asbestos paper yields no dust, has a pressure resisting power equal to that of hard pine, cannot decay, and is subject to no hurt that will impair its usefulness, while it serves materially to deaden the floors. Besides the asbestos paper so strongly recommended for use, asbestos cement placed as a coating, say 1 inch thick, upon pillars of iron or wood, completely protects them from even the altering effects of heat. It is a well-known fact that iron as a building material does not by itself satisfactorily withstand heat. It warps, bends and finally gives way. The fall of floors frequently results from the overheated condition of iron columns during the progress of a conflagration. By the use of asbestos cement this condition of things can be prevented. Encasing the columns with a coat of cement an inch thick successfully preserves them from the enfeebling effects of heat and keeps them, even in a fierce fire, in a rigid and vigorous state. Asbestos is a very poor conductor of heat, and is also a non-radiator of heat, while, on the contrary, iron is both a heat conductor and a heat radiator. Asbestos promptly and permanently arrests the progress of flame, and maintains throughout the ordeal of its integrity. Metal warps and yields under heat; it even assists the spread of fire whenever it is in contact with inflammable material. Iron protected by asbestos becomes far more serviceable than it can be when left without such protection.

Stores, factories, apartments, tenement and other houses, protected by the means of asbestos after the general manner here suggested, are rendered sufficiently fire-proof, at a small cost, to guard the life of all their inmates from the dangers of fire. The damage from a fire, should a fire occur in them, is restricted to the rooms in which it commences, and is confined to the mere consumption of the furniture and finish of these rooms.

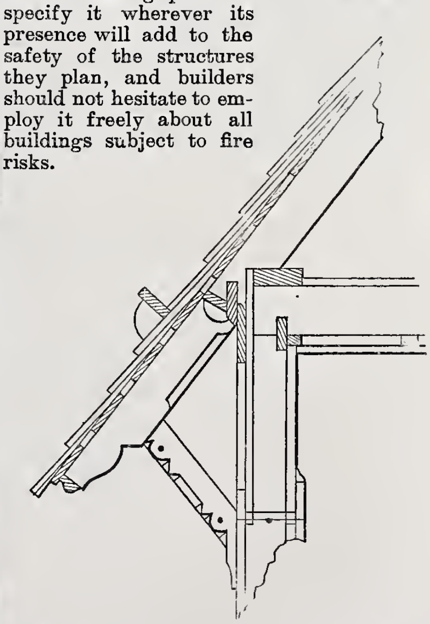
There are other uses to which asbestos may be put in the construction of buildings. The ends of raftars and timbers where they enter walls may be shod with asbestos, thus preventing their burning off in a fire, thereby preserving the floors from falling. No fire can assume large proportions while roof and floors rest in position. The timbers of a building may be further protected by asbestos paper, which will give them additional security against the ravages of any fire that may occur below them.

Since by the use of this comparatively cheap material buildings may be rendered



Suburban House.—Fig. 14.—Elevation of Bay Window.—Scale, ¼ Inch to the Foot.

fire-resisting, if not absolutely fire-proof, asbestos deserves the careful consideration of the building public. Architects should specify it wherever its presence will add to the safety of the structures they plan, and builders should not hesitate to employ it freely about all buildings subject to fire risks.



Suburban House.—Fig. 15.—Detail of Eaves and Cornice.—Scale, ½ Inch to the Foot.

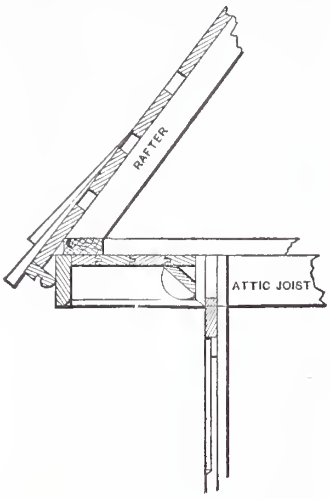
Thick Tracing Paper.—Drawing paper of any thickness may be made perfectly transparent by damping it with benzine. India ink and water colors can be used on this paper. The paper resumes its opacity as the benzine evaporates, so that any place that has not been duly traced requires to be redamped with the benzine for that purpose. A sponge should be used for the application.

Wooden Roof and Bridge Trusses—Strengths of Materials.

BY GASTON M. ALVES.

Material used in construction is subjected chiefly to three strains, viz., tensile strain, crushing strain and transverse strain.

The *tensile strain* is that where the material is subjected to a pull in the direction

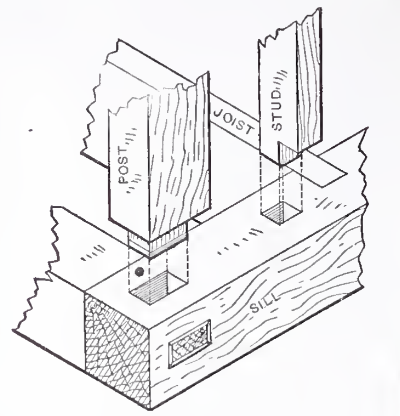


Suburban House.—Fig. 16.—Detail of Roof of Bay.—Scale, ½ Inch to the Foot.

of its length. In ordinary good building timber the ultimate, or breaking, tensile strength ranges between 8000 and 12,000 pounds per square inch. That is to say, it will take a pull of from 8000 to 12,000 pounds to tear asunder a rod one inch square of ordinary good building timber. The full breaking strength of material, however, is never taken in practice. In proportioning structures it is customary to take only from one-quarter to one-sixth, and sometimes less, of the breaking strength, dependent on the importance of the work. It is proposed here to take 2000 pounds as the safe tensile strength. The amount thrown off will be a sufficient allowance for timber that is not well seasoned, for slight defects in the timber that might escape observation, and for a reserve for occasional unexpected strains and the ravages of time.

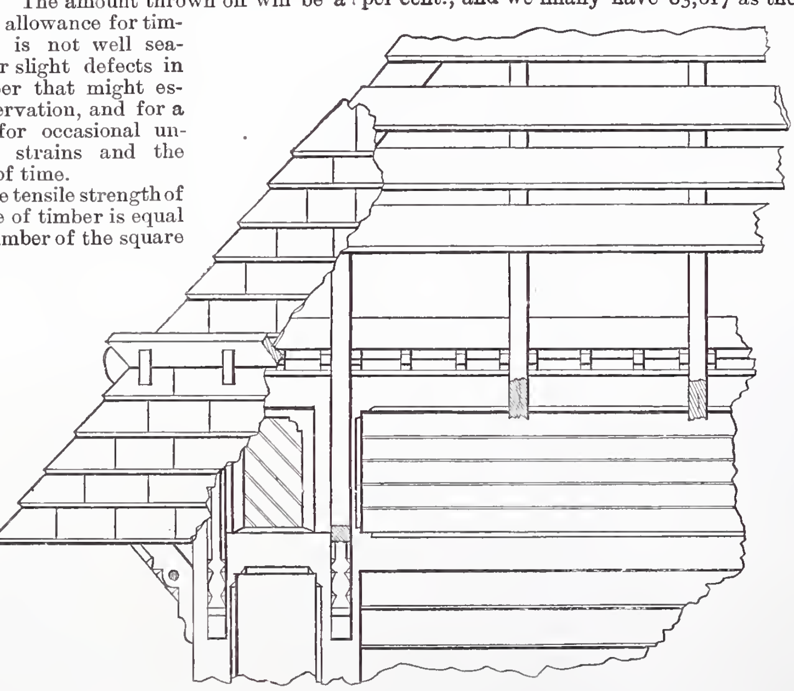
The safe tensile strength of any piece of timber is equal to the number of the square inches of its cross-section multiplied by the safe strength of one square inch. Example: Required the safe tensile strength of a scantling of timber 4 by 6 inches—4 multiplied by 6 gives 24 square inches, and 24 by 2000 gives 48,000 pounds as its safe strength.

The tensile strength of wrought iron may be taken at 50,000 pounds per square inch (in this connection wrought iron is only subjected to a tensile strain). Good practice, however, only admits of 10,000 pounds per square inch as the safe strength. It is generally used in round bars, and in this case 7854 pounds must be taken for a bar one inch in diameter as the safe strength, the area of a round inch being to the area of a square inch as 7854 is to 10,000. It has



Suburban House.—Fig. 18.—Perspective Detail of Framing.

been found that wrought-iron bars, unlike timber, decrease in strength per square inch as the cross-section increases in size. Thus, if a bar one inch square will take 50,000 pounds to break it, a bar 2 inches square, which equals 4 square inches, will not bear four times 50,000 equals 200,000 pounds, but will break with a strain 5 per cent. less than 200,000, hence it will break with a strain of 190,000 pounds; and so the tensile strength has been found to decrease per square inch 5 per cent. for every inch that the side or diameter is over 1 inch. Example: Required the safe tensile strength of a round wrought iron bar 3 inches in diameter. The safe tensile strength of a bar 1 inch square is 10,000 pounds; for a bar 3 inches square it would be 3 times 3 equals 9 square inches, which, multiplied by the 10,000, gives 90,000 pounds. Now multiply 90,000 by decimal .7854, as the bar is round, and we have 70,686 pounds. But as 3 inches is 2 inches more than 1 inch, we have 5 and 5 equals 10 per cent. deduction for the increase in size; deducting this 10 per cent., and we finally have 63,617 as the required safe strength. The following table gives the safe strengths (10,000 pounds per square inch) of round rolled wrought iron from ⅛-inch to 4 inches in diameter. Rods of this kind are used in construction generally with screws cut at the ends for nuts. When this is the case they should be enlarged at the ends by heating and hammering the ends, that the threads of the screws may be cut without lessening the diameter of the rod. If this is not done, and the screw is cut into the rod without enlarging the end, one-quarter must be taken off the strengths found in the table. When the threads of the screw and the nuts are properly made and fitted, there will be little danger of the nuts slipping the threads.

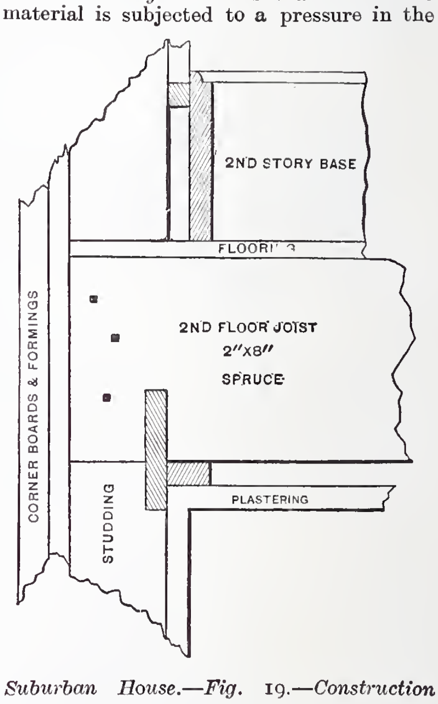


Suburban House.—Fig. 17.—Detail of Roof Construction.—Scale, ½ Inch to the Foot.

Table of the Safe Tensile Strengths of Round Wrought Iron Rods. ⅛-inch to 4 inches in diameter, and the Weights per foot. The Safe Strength is taken at 10,000 pounds per square inch.

Diameters in inches.	Weights per foot.	Safe strengths in lbs.
⅛	.041	123
¼	.165	491
⅜	.373	1,104
½	.663	1,963
⅝	1.04	3,068
¾	1.49	4,418
⅞	2.03	6,013
1	2.65	7,854
1⅛	3.36	9,740
1¼	4.17	11,871
1⅜	5.02	14,248
1½	5.97	16,871
1⅝	7.01	19,739
1¾	8.13	22,852
1⅞	9.33	26,211
2	10.62	29,844
2⅛	11.99	33,195
2¼	13.44	36,790
2⅜	14.98	40,632
2½	16.69	44,717
2⅝	18.29	49,049
2¾	20.08	53,625
2⅞	21.94	58,448
3	23.89	63,617
3¼	28.04	72,888
3½	32.51	83,142
3¾	37.33	94,377
4	42.46	106,815

The *crushing strain* is that where the material is subjected to a pressure in the



Suburban House.—Fig. 19.—Construction at Line of Second Floor.

direction of its length. The crushing strength of the ordinary woods used in construction range between 5000 and 6000 pounds per square inch. We will here use only 1000 pounds per square inch as the safe strength. The crushing strength of materials rapidly decreases as the length increases. The law of this decrease is not precisely known, and it is a subject upon which authorities widely differ. Tredgold is altogether unreliable on this subject; for short pillars or columns his diameters or sides are too small, and for long ones too large. Gordon is generally accepted as the best authority on the subject. Taking 1000 pounds as the safe strength of timber per square inch, Gordon's formula put into words would be as follows: Divide the square of the length of the pillar in inches by the square of the least side in inches; multiply this quotient by decimal 004; add to the product 1, and then divide 1000 by the sum obtained, and we have the safe strength per square inch of the pillar; multiply this strength by the number of square inches in the cross-section of the pillar and we have the safe strength of the pillar.

The following rule is more easily applied, and approximates sufficiently close to the above for practical purposes.

For the safe strength of rectangular wooden pillars or columns, multiply the number of square inches of the cross-section by

1000	when	the length is	3	times	the least	side.
870	"	"	6	"	"	"
760	"	"	9	"	"	"
630	"	"	12	"	"	"
530	"	"	15	"	"	"
440	"	"	18	"	"	"
360	"	"	21	"	"	"
300	"	"	24	"	"	"
260	"	"	27	"	"	"
220	"	"	30	"	"	"
190	"	"	33	"	"	"
160	"	"	36	"	"	"
140	"	"	39	"	"	"
120	"	"	42	"	"	"
110	"	"	45	"	"	"
100	"	"	48	"	"	"
90	"	"	51	"	"	"
80	"	"	54	"	"	"
70	"	"	57	"	"	"
65	"	"	60	"	"	"
60	"	"	63	"	"	"
55	"	"	66	"	"	"

Examples.—Required the safe strength of a wooden pillar, post or brace 6 by 8 inches and 12 feet long. Here the length is 24 times the least side; hence, by the rule we multiply the cross-section, 48 square inches, by 300, which gives us 14,400 pounds as the safe strength.

Required the safe strength of a brace 3 by 16 inches and 12 feet long. Here the length is 48 times the least side; hence, by the rule we multiply the cross-section 48 by 100, which gives us 4800 pounds as the safe strength. It will be seen in the above two pieces that there is the same amount of lumber in each, and yet the first is three times as strong as the other; hence will appear the propriety of proportioning the cross-sections of all rectangular pieces that are subjected to a crushing strain as nearly square as possible, where it does not interfere with other important considerations. Tredgold gives 6 by 10 as the best proportion for the sides, but he is in error here, as in other things connected with crushing strains.

The *transverse strain* is that where the material is subjected to a strain across its length, as in the case of beams. The following are laws concerning this strain:

1. If we represent the transverse strength of a horizontal beam, fixed at one end and loaded at the other, by 1
2. Then, when the beam is uniformly loaded along its entire length, its strength will be twice as great or will be represented by...... 2
3. When the same beam is supported at each end and loaded in the center, its strength will be represented by.......................... 4
4. When supported at each end and uniformly loaded along its length, its strength will be represented by.............................. 8
5. When firmly fastened to its supports at each end and loaded in the middle, its strength will be represented by.......................... 8
6. When firmly fastened to its supports at each end and uniformly loaded along its entire length, its strength will be represented by.... 16

The transverse breaking strength of a beam of the ordinary building woods 1 inch square, supported at each end, the supports 1 foot apart, and the load uniformly distributed along the entire foot, will range between 800 and 1200 pounds. As any defects in timber are more damaging when the material is subjected to a transverse strain than when subjected to a tensile or crushing strain, it is necessary to take a smaller per cent. of the ultimate breaking strength. We will here take 125 pounds as the safe strength. It will readily be seen, assuming 125 pounds as the safe strength of a beam 1 inch square and 1 foot long, and uniformly loaded, that for a beam of like dimensions in the above cases, their safe strengths will be as follows: For the first, 15⅝ pounds; for the second, 31¼ pounds; for the third, 62½ pounds; for the fourth, 125 pounds; for the fifth, 125 pounds, and for the sixth, 250 pounds.

The transverse strength of beams increases as their breadths and as the square of their depths, and decreases as their length increases. Thus, if the breadth of a beam be doubled its strength will be twice as great; if its depth be doubled its strength will be four times as great, and if its length be doubled its strength will only be one half as great. Required the safe strength of a wooden beam 10 feet long, 9 inches deep and 4 inches broad, placed over supports at each end, and uniformly loaded along its length. The safe strength of a beam 1 inch square and 1 foot long, under like conditions, would be 125 pounds, but as the required beam is 4 inches broad, we will have four times 125 equals 500 pounds; it is also 9 inches in depth; the square of 9 is 81, and 81 times 500 gives 40,500 pounds; its length is 10 feet; divide 40,500 by 10 and we finally have 4050 pounds as the required safe strength.

The following table gives the safe transverse strength in pounds for wooden beams 1 inch broad, and for the depths and lengths contained therein. The safe strength taken is 125 pounds for beams 1 inch square, on supports 1 foot apart, and uniformly loaded along its length.

TABLE OF THE SAFE TRANSVERSE STRENGTH IN POUNDS FOR WOOD ONE INCH BROAD, OF THE DEPTHS AND LENGTHS SPECIFIED.

Depths in inches.	Length in Feet.											
	6.	7.	8.	9.	10.	12.	14.	16.	18.	20.	22.	24.
3	187	161	140	125	112	94	....	....	....	....	....	....
4	333	286	250	222	200	167	143	....	....	....	....	....
5	521	446	390	347	312	260	223	195	....	....	....	....
6	750	642	562	500	450	375	321	281	250	....	....	....
7	1,021	875	766	681	612	510	437	383	340	306	....	....
8	1,333	1,143	1,000	889	800	667	571	500	444	400	364	....
9	1,687	1,446	1,266	1,125	1,012	843	723	633	562	506	460	422
10	2,083	1,786	1,562	1,389	1,250	1,041	893	781	694	625	568	520
11	2,521	2,161	1,891	1,680	1,512	1,260	1,080	945	840	756	687	630
12	3,000	2,571	2,250	2,000	1,800	1,500	1,285	1,125	1,000	900	818	750
14	4,083	3,500	3,062	2,722	2,450	2,041	1,750	1,531	1,361	1,225	1,114	1,020
16	5,333	4,571	4,000	3,555	3,200	2,667	2,285	2,000	1,778	1,600	1,455	1,333
18	6,750	5,785	5,062	4,500	4,050	3,375	2,892	2,531	2,250	2,025	1,841	1,687
20	8,333	7,143	6,250	5,555	5,000	4,167	3,571	3,125	2,778	2,500	2,273	2,083
22	10,083	8,643	7,562	6,722	6,050	5,041	4,321	3,781	3,361	3,025	2,750	2,520
24	12,000	10,286	9,000	8,000	7,200	6,000	5,143	4,500	4,000	3,600	3,270	3,000

The use of this table will much facilitate calculations. Take the previous example of a beam 4 inches broad, 9 inches deep and 10 feet long. In the table under 10 feet and opposite 9 inches we find 1012; now, as this is for a beam one inch broad, multiply the 1012 by 4 and we have 4048 as the safe strength. Had the beam been loaded only at the center we would, of course, take one-half of the 4048, viz., 2024 pounds.

Still further particulars concerning the strengths of materials will be presented in the next paper.

Diminishing the Inflammability of Wood.

An invention which, although primarily intended for another purpose, is likely to prove useful in preserving timber in mines and workshops, has been patented by Mr. G. R. McKenzie, of Glasgow. The invention may in practice be applied in different degrees in different cases, the resulting diminution of the inflammability of the wood treated being greater the stronger the solutions are that are employed, and the longer the duration of the treatment. A moderate application of the improved process, while materially diminishing the inflammability of wood, has also the important advantage, when applied to more or less green or new wood, of "seasoning," or, in other words, of effecting a change practically equivalent to that due to the ordinary process of seasoning, and the wood so treated can be subsequently turned in a lathe, or otherwise cut or shaped by means of tools such as are used for those purposes in ordinary wood. The invention consists in treating wood with soda crystals (monocarbonate of soda) in an improved manner, and in carrying it out the wood is, by preference, treated when in the sawn or cut condition, in the form of boards or joists, for example, rather than in that of thicker balks or masses.

When the object is to diminish the inflammability of the wood in a moderate degree at comparatively small expense, and yet secure the advantage of the "seasoning" effect accompanying the treatment, in the case of American ash, bay mahogany and yellow pine in boards about one-half inch thick, he boils the wood under atmospheric pressure in a tank which is by preference covered in a solution containing about 2 pounds soda crystals for each gallon of water. In arranging the boards in the tank they are "pinned" or separated by small pins or blocks, so that the liquid has free access between them, and the solution is filled in to a depth of about 6 inches above the top of the wood, or so that the wood does not become uncovered during the boiling process. The wood is held down by clamps, screws, chains, weights, or any other convenient means. The boiling should be continued for about 5 hours, and should then be discontinued for about 9 hours, after which the boiling should be renewed for about 2 hours. On the second boiling being completed the wood should be taken out of the tank as hot as it can be handled, and be "pinned" or piled with spaces between the boards or pieces, in order to be dried, and this operation is to be effected without any extra heat, but by currents of cool air, and may be expedited by means of artificial or forced currents of air when conveniently applicable. In the case of the wood being about 1 inch thick, the first boiling should be continued for about 8 hours, the interval be about 18 hours, and the second about 4 hours.

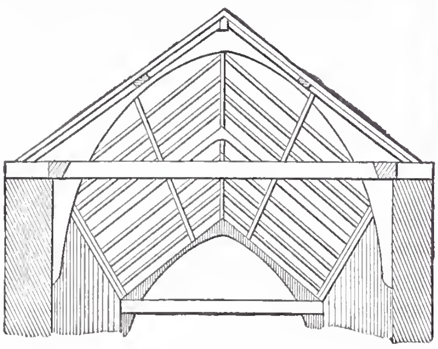
When the wood is about 2 inches thick the first boiling should be for about 10 hours, the interval about 30 hours, and the second boiling for about six hours. For white pine, pitch pine, oak, walnut, beech, elm, Spanish mahogany and similar woods, the strength of the solution should be increased to 3 pounds of soda crystals for every gallon of water, but the duration of the treatment may remain the same as hereinbefore prescribed for similar thicknesses of wood, it being, however, sometimes advantageous to soak the wood for some hours in the cold liquid before boiling. When the wood is 4 inches or more in thickness it should be boiled under pressure, and in a still stronger solution; thus, for example, a log of bay mahogany measuring about 20 feet by 3 feet by 2 feet should be boiled under a pressure of about 80 pounds per square inch in a solution of 4 pounds of soda for every gallon of water, the first boiling being for about 20 hours, the interval about 60 hours, and the second boiling for about 10 hours.

When considerable diminution of the inflammability is desired, the strength of the solution should be from 3 to 5 pounds soda for every gallon of water in the case of ½-inch white pine or 1-inch yellow pine; and the wood should be soaked for about 12 hours, boiled for about 10 hours, soaked again for about 24 hours and boiled again for about 5 hours. For similar thicknesses of oak, elm or beech the solution should contain from 4 to 6 pounds soda for every gallon of water. In the cases of 1½-inch white pine or 2¼-inch yellow pine, the wood should be soaked for about 20 hours, boiled for about 18 hours, soaked again for about 40 hours and boiled again for about 8 hours. In the case of 3-inch by 6-inch white pine, or 5-inch by 12-inch yellow pine, the wood should be soaked for about 20 hours, boiled for about 20 hours, soaked again for a week, and boiled again for about 10 hours.

Ancient Hammer Beam Roofs.

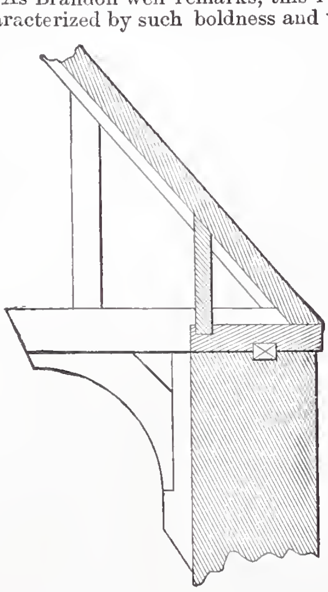
The next description of roof, after that composed of trussed rafters, is that formed with hammer beams, struts, collars and braces, of which kind there are several modifications, which may be all comprised under the general title of hammer-beam roofs.

Many writers, in treating of hammer-beam roofs, have chosen to consider them as having taken their origin from a tie-beam roof, with the tie cut away in part ; but this idea is clearly erroneous, as it is very evident that the peculiar manner in which the feet of the rafters were framed in trussed rafter roofs, on which we touched in the March number of *Carpentry and Building*, gave the



Ancient Hammer-Beam Roofs.—Fig. 1.—Roof over the Nave of the Church of St. Mary the Virgin, Pulham, Norfolk.

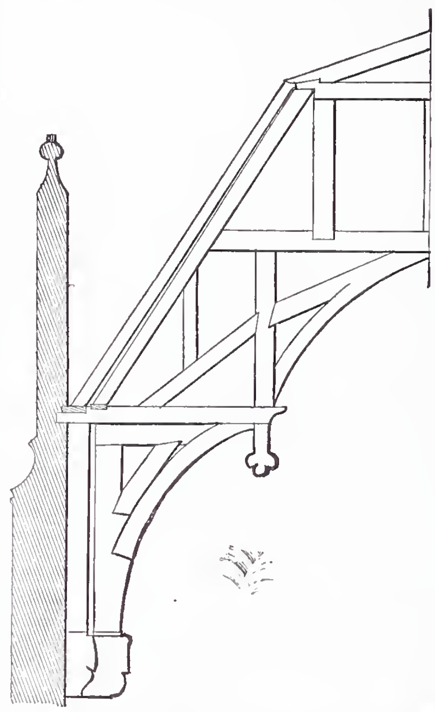
initiative of this form of construction. In fact, the only resemblance between tie-beam and hammer-beam roofs lies in the fact that they are both double-framed roofs ; that is, the common rafters in each are supported on principals, with purlins framed thereon, and further strengthened by braces, wall pieces, collars and either hammer or tie beams. Apart from this, no further connection exists between hammer and tie-beam roofs than there is between tie-beam and trussed-rafter roofs. Indeed, it may safely be said that there is still less, for tie beams were employed with the early trussed rafter roofs, as if their constructors were afraid to dispense with them as auxiliaries. Yet in no case of hammer-beam roof, even the earliest, has such aid been sought. The earliest specimen extant is the magnificent roof of Westminster Hall, of which we shall speak more at length by and by. As Brandon well remarks, this roof is "characterized by such boldness and what,



Ancient Hammer-Beam Roofs.—Fig. 2.—Comparison of the Foot of a Rafter of a Trussed-Rafter Roof, with the Foot of a Truss of a Hammer-Beam Roof.

when its span is considered, is almost sublimity of design," that "we cannot bring ourselves to believe that so exquisite an example could be the earliest roof of the kind executed. Such perfection is not to be expected in a first attempt. It is, however, the first of which we possess any record, and, though but a solitary instance, we may fairly adduce it as a satisfactory evidence of the correctness of our supposition." To illustrate still further the fact that the hammer-beam roof does not take its origin from the tie-beam roof, we give at Fig. 1 an illustration of the roof over the nave of St. Mary the Virgin, at Pulham, Norfolk. It will be seen that if the tie beams are cut away at the points of intersection with the braces, the result would be the formation of a simple arched roof ; and we find, indeed, a roof of this character at Tunstead Church, in the same county, so exactly similar to what that of St. Mary the Virgin would be without the tie, that they may be imagined to have proceeded from the hands of the same designer.

Once free from the restrictions imposed on them by the tie beam, the early roof builders seem to have perceived, with the intuition of genius, the capabilities of the new style of roof. As Brandon well says : "They saw that their favorite form, the pointed arch, could be safely employed in their roofs, without the accompaniment of the unsightly tie beam, and they at once carried to a perfection hitherto unattained



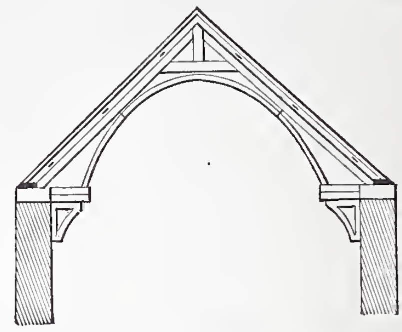
Ancient Hammer-Beam Roofs.—Fig. 3.—Roof of the Great Hall at Hampton Court, Built A. D. 1537.

those splendid roofs, in allusion to which one of the English poets so justly observes :

> 'Those forest oaks, of Druid memory,
> Shall long survive to shelter the abode
> Of genuine faith.'"

In this peculiar form of architecture England may be said to be without rivals, for, although many Continental cities possess churches of exquisite architectural beauty, there is scarcely a single building, whether ecclesiastical or civil, on the Continent of Europe, which can boast of such a timber roof as may be found in almost every English county. At Fig. 2 we give an illustration of the foot of a rafter, as framed in a trussed rafter roof (indicated by the shaded portion), and likewise the foot of a truss of a hammer-beam roof. The similarity of construction is apparent. The timbers are simply increased in scantling for the hammer-beam form, and the triangular foot widened by bringing the strut further into the building and increasing the length of the horizontal connecting piece or hammer beam, to the under side of which a wall piece is tenoned, and the strain on the hammer beam is diminished and the weight of the roof carried lower down upon the wall by means of the curved brace, which connects the wall piece and the hammer beam together. It is evident that the formation of the foot of the trussed rafter gave the idea of the hammer beam, and the latter form, once introduced, rapidly grew into favor, more especially in the eastern counties of England—to which, indeed, the further development of the double hammer-beam roof is mainly confined, the churches of St. Margaret, Ipswich, Weathersden, Grundisburgh, Rattlesden, Woolpit, Tostock and Bacton, in Suffolk, and the beautiful roof of the nave of Kimpton, in Norfolk, being the most conspicuous examples of this style.

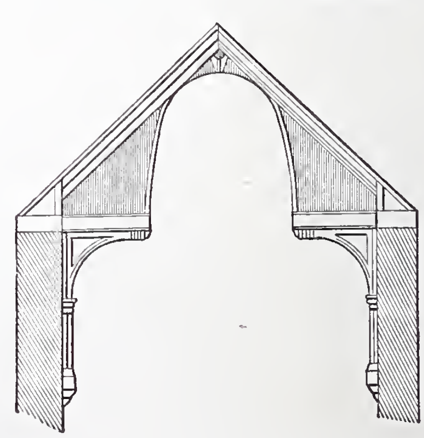
Hammer-beam roofs are, as we previously



Ancient Hammer-Beam Roofs.—Fig. 4.—Roof of Church of Chapel St Mary, Suffolk.

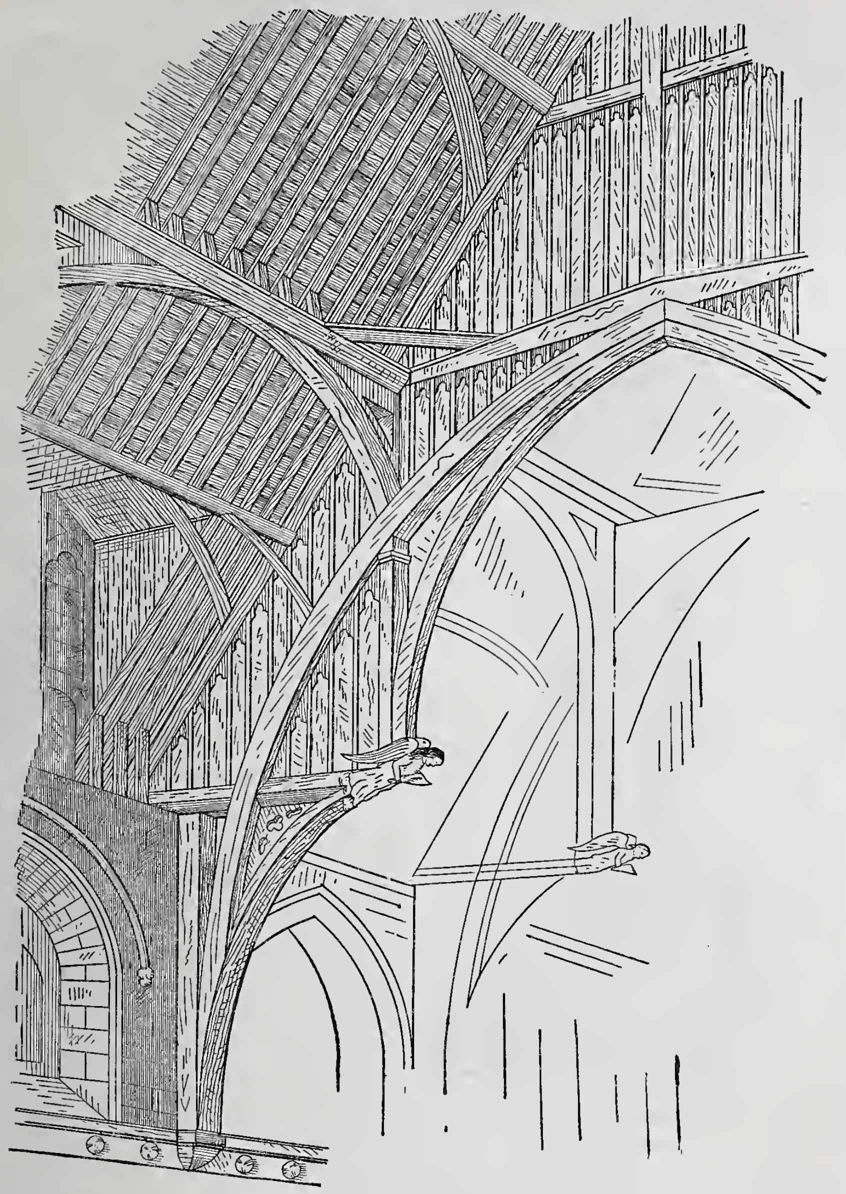
remarked, always double framed, and may be divided into several classes. Thus, there are—1. Those with collar beams and wall struts, the collars, principals, and hammer beams being connected by curved braces. 2. Those in which the collar beam is dispensed with and the curved braces carried up almost to the ridge, and framed at the top of the arch into a strut, which receives the ends of the principals also. 3. Those in which the collars and struts are omitted, curved braces alone being employed to connect and brace the truss together. In these instances the arched braces are composed of three pieces—one on each side of the roof, tenoned into the hammer beam and principal, and reaching up as far as the purlin, the center piece forming the apex of the arch being tenoned into each principal, and acting as a brace, and to a modified degree, as a collar beam. 4. Roofs having hammer beams, collars, and struts connected together by curved braces.

The church of Chapel St. Mary, Suffolk (Fig. 4), presents an example of the first kind of roof. The angle formed is 87 degrees, and it is rare to find a hammer-beam roof of steeper pitch. The span is 18 feet 3 inches; the principal rafters are 10 by 8 inches; common rafters, 6 by 3 inches; hammer beams, 10 by 8 inches ; collar beam, 10 by 8 inches; purlins, 6 by 5 inches; ridge piece, 6 by 6 inches. The trusses are 6 feet apart from center to center. Of the second kind is the roof over the nave of



Ancient Hammer-Beam Roofs.—Fig. 5.—Roof of the Nave of Trunch Church, Norfolk.

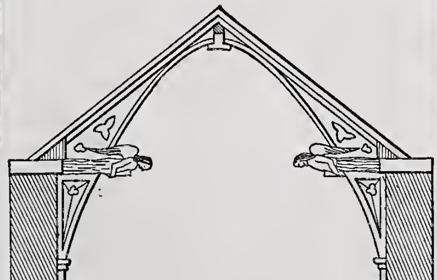
Trunch Church, Norfolk (Fig. 5). Here the intermediate trusses are the same, with the exception that, in place of the long wall piece and brace, the wall piece is stopped at the crown of the arch of the clear-story window, and a very depressed brace connects it with the hammer beam. The spandrels are filled with perforated tracery. The span is 19 feet; principal rafters, 10 by 9 inches; common rafters, 6 by 4 inches; hammer beam, 10 by 10 inches; purlins, 8 by 5 inches;



Ancient Hammer-Beam Roofs.—Fig. 6.—*Roof of Westminster Hall, built A. D.* 1397.—*Span,* 68 *Feet.—Total Length,* 238 *Feet* 8 *Inches.*

ridge piece, 10 by 10 inches. The trusses are 5 feet 6 inches apart. The nave of Wymandham Church, Norfolk (Fig. 7), is a specimen of the third description. Here the hammer beams project rather more than a quarter the width of the nave, and are carved in the form of angels holding escutcheons. Similar, but smaller, figures are also carved on the beams of the intermediate trusses. Large floral bosses, carved in bold relief, mark the intersection of the purlin and the ridge-piece. Of the fourth sort are the roofs of Westminster Hall, Hampton Court, Eltham Hall, Beddington Hall, South Wraxhall (19 feet 9 inches span) and Croydon (37 feet 9 inches). Of this kind of roof the earliest (that of Westminster Hall) is the best. Double hammer-beam roofs, forming a sort of corbeling up to the collar beam, are principally found in the churches of Norfolk and Suffolk, of which Knapton Church (Fig. 8) offers an example. It may be noticed that early roofs with curved braces differ from later ones in the thickness of their braces. In the former the braces are usually of the same thickness as the principals, but in the latter they are seldom more than 3 or 4 inches.

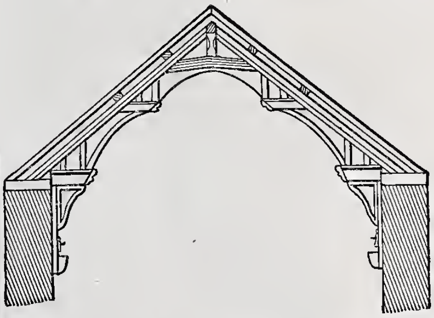
In specifying a few of the principal examples of hammer-beam roofs, that of Westminster Hall (Fig. 8) naturally takes first rank in order of time, size and beauty. The noble old hall was built by William Rufus at the close of the eleventh century; subsequently rebuilt by Richard II, and opened, with extraordinary magnificence, by the latter monarch at Christmas, 1397. The roof is, of course, of this latter date. It has a clear span of 68 feet, and a total length of 238 feet 8 inches, divided into 13 severys or bays by the trusses. The rafters are about three-quarters of the entire span, the outward thrust being of such a kind that buttresses were indispensable. "This roof," as Brandon remarks, "differs in construction from most other roofs of the kind, in the introduction of a large main arch of timber spring-



Ancient Hammer-Beam Roofs.—Fig. 7.—*Roof of the Nave of Wymandham Church, Norfolk.*

ing from the bottom of the wall pieces, and reaching to the under side of the collar beam. The hammer beam and struts run through this, and complete the form of a trefoiled arch." We may mention that the main purlins over the strut are upheld, with the collar beam, by a rafter of great strength, and Mr. S. Smirke has observed that "This roof is the common collar-beam roof, and of extremely simple construction. The whole pressure is carried by the straight lines of the principal rafter and (curved) braces above alluded to directly into the solid wall, where it ought to be." Although there have not been wanting carping critics, who have decried hammer-beam roofs in general, and this splendid specimen in particular, it has always aroused the enthusiasm of those who are interested in witnessing the grand effect of which the carpenter's handiwork is capable. Tarbuck well says, "These magnificent creations are the glory of the carpenter's art. One may look up into the mystic gloom of Westminster, and be overwhelmed by the grand genius of the men who could design such wonderful timber combinations, never before or since even approached in the union of science in the expression of sentiment;" and that eminent French authority, M. Viollet le Duc, after deploring the absence in France of any parallel example, speaks of the "beauty of the execution of that unique work of carpentry," and says that the joints and tenons are formed and cut with a rare precision and care, which, with the excellence of the timber, have preserved the roof to our own days.

Of other examples we may enumerate the roof of the Great Hall at Hampton Court (Fig. 3), which is peculiar in its flattened form, resembling somewhat a curb roof, and anticipating Mansard. This was completed about 1537, and is 106 feet in length, 40 feet high and 45 feet high in the walls. The roof consists of seven bays in length, the construction being somewhat similar to that of Westminster Hall. The principals consist of a central arch and semi-arches each, and are connected by three tiers of arches. This roof is a clever piece of construction, and the exquisitely carved panels and pendants give it a very rich effect. Eltham Hall has an internal hight of 101 feet 4 inches, is 36 feet wide, and is a specimen of the obtusely-pointed arch. The roof of Crosby Hall, Bishopsgate street, London, is another fine example. It was completed about 1470, and its internal measurement is 67 by 27 feet. The roof is ornamented by three ranges of pendants. The roof of Christ Church, Oxford, is 115 by 40 feet; Trinity College, Cambridge, 100 by 40 feet;



Ancient Hammer-Beam Roofs.—Fig. 8.—*Roof of Knapton Church, Suffolk.*

Middle Temple, London, 100 by 44 feet: Lambeth Palace, 93 by 38 feet, and that of the Guildhall, London, 153 by 48 feet.

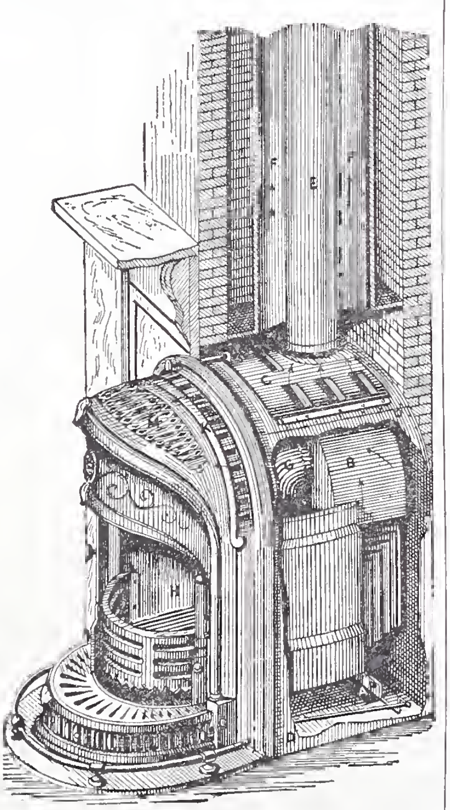
Bricklayers' Wages in Paris.—The rate of wages paid to the bricklayer in Paris is 70 centimes per hour (about 14 cents) for journey work. The hours of work are from 6 a. m. until 6 p. m. under one method, and from 6 a. m. until 5.30 p. m. under the other, there being a movement started in Paris which aims at the reduction of the hours of labor. Work is carried on on Sundays the same as on other days. The hours made during the week are 77 under the first and 73½ under the other system. The earnings of the bricklayer in Paris thus amount to 53 francs 90 centimes for a full week of 77 hours or about $10.75. For 73½ hours the sum is 51 francs 45 centimes, an amount equal to about $10.25. The building operatives are paid, as a rule, once a month, on Saturday evenings after 5.30 p. m. Weekly and fortnightly payments are also made by some builders, but not to any great extent as yet. The workmen are asking to be paid after the English fashion, namely, every week. On the Sunday following pay day the workman avails himself of a holiday if he chooses; but as the works are not closed against him, he can continue at work on that day if he wishes to do so.

The Fire on the Hearth.

The stoves and heaters commonly known as The Fire on the Hearth, have been before the public for a number of years, and in that time have made many friends. In their construction and operation they combine several desirable features of both ventilation and warming. It is claimed for them that they afford the ventilation of a fire place, the reserve force of a stove and the circulation of a furnace. The entire atmosphere of a room in which one of them is used may be replaced by a supply of invigorating out-door air, moderately warmed, in the short space of 15 or 20 minutes. The air thus furnished for breathing is pure and refreshing, not dried, parched and devitalized, as with many forms of heating apparatus in use.

The essential features of "The Fire on the Hearth" may be indicated by calling it a double stove, or, perhaps better, a double heater. The stove proper or fire-place in which the fuel is burned, and by the flues of which the products of combustion are conveyed ont of the room, constitutes one part; the space between the stove and the outer casing forms the other. This space is utilized as a warming chamber, through which the air from the outside passes before entering the room for respiration and bodily comfort. The utilization of heat by this method is very complete, there being both direct radiation from the fire into the room and a certain degree of warmth imparted to the air as it enters the room from the outside. When the apparatus is wanted for use as a double heater, the flow of warm air may be turned into a room above.

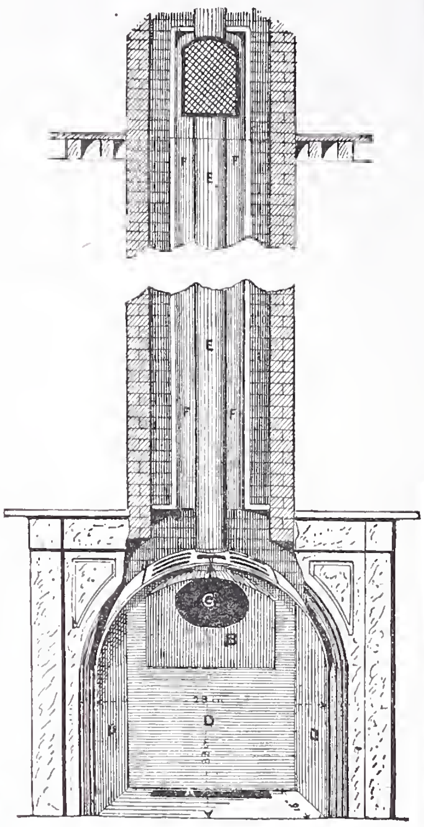
So far our description has referred to that form of heater shown in the accompanying illustrations, and which is built into the



Fire on the Hearth.—Fig. 1.—Perspective View of a Mantel Heater.

house in process of construction. The register shown in Fig. 1, on the crown of the arch below the mantel, when opened, throws the warmed fresh air into the room. By closing it and opening the register in the room above, shown in the upper part of Fig. 2, the warmed air is forced into that part of the house. Besides this form of heater, what, for lack of a better term, may be called a portable double-heating grate, is made, embodying these same general features. This form of apparatus, instead of being built in, requires no other preparation in the house itself than is necessary for an ordinary stove, save only the connection under the floor by which the outside air is supplied. A pipe carries the products of combustion as from a stove, while another pipe running from the top of the heater connects with a register in the ceiling, thus affording a means of warming the room above.

The mantel heater, which is one of the



Fire on the Hearth.—Fig. 2.—Detail of Construction of Mantel Heater.

most desirable forms of this apparatus, being constructed so as to deliver an unusually large quantity of warm air, requires more capacious flues than serve for the kinds of mantel heaters in most common use. In order to enable our readers to fully understand the mode of applying this apparatus, we will describe it somewhat in detail. In Fig. 2, D shows the outer casing of the heater with the drum B in position, already connected with the smoke-pipe E, which extends upward inside the large warm iron flue F to the register upon the floor above. In Fig. 1 is shown the heater in position, with a portion of the side casing cut away, exposing the pocket provided for the sliding door; also the neck of the fire-pot G, where it enters the drum B, and the aperture A, which serves as an inlet for fresh air. This opening, A, which is generally 4 x 21 inches in size, is controlled by the valve P, operated by means of a rod projecting at O. This valve and rod may be clearly seen by examining Fig 1. The opening underneath mantel for receiving the heater should not be less than 28 inches wide by 33 inches, and 13 inches deep. The heater frame is made large enough, however, to cover a mantel opening 33 inches wide and 34 inches high. The depth of the opening likewise may be made anywhere from 13 to 18 inches.

Several forms of this apparatus are manufactured by the Open Stove Ventilating Company, whose place of business is No. 78 Beekman street, New York city. Among others is a slight variation in form, adapting the stove to the consumption of bituminous coal. Sizes are made suitable for use in dwelling houses, also offices and public buildings, like school houses, &c.

Some builders are more fitted for the scaffold than for public speaking.

NEW PUBLICATIONS.

THE AMERICAN HOUSE CARPENTER, A TREATISE ON THE ART OF BUILDING: A manual for the practical use of architects, carpenters, stair builders and others. Eighth edition, rewritten and enlarged by R. G. Hatfield, architect. Edited by O. P. Hatfield, architect. New York: John Wiley & Sons. Price, $5.

As will be seen by the above, this is the 8th edition of a very important work, which has already had an extensive sale, and numbers many appreciative readers among builders throughout the country. The former editions of the work, although having many important additions made to them from time to time, were, nevertheless, printed substantially from the original stereotyped plates. The present edition has been extensively remodeled and expanded, and the greater portion of it rewritten. The work entire has been put into a new dress and made uniform with other works by the same author. Although it is essentially an elementary work, and intended originally for a class of minds not generally favored with opportunities for securing an extended form of education, either in the store of information acquired or in the discipline of mind which culture confers, still it has been the author's aim to embody in its pages so complete and exhaustive a treatment of the various subjects discussed, and so practical and useful a collection of data and rules governing their application, as to make it also not unworthy the attention of those who have been more highly favored in that respect.

The work is divided into two parts, which are supplemented by an appendix. In the first part of the book matters more particularly relating to buildings are treated of. In the first section of this part is given a general view of the subject of architecture, introduced in a manner which serves, by its historical reference, to excite an interest in the general subject. In the second section of part first are presented methods of erecting edifices in accordance with acknowledged principles of sound construction. The third section treats of stairs, the fourth of doors and windows, and the fifth of moldings and cornices, thus fully illustrating and explaining the several well-defined branches of house building. In the second part of the book the more useful rules and simple problems of mathematics are reduced to an easily required form and adapted to the understanding of the ordinary workman. Useful problems in geometry are described in simple language, and hints upon all subjects likely to be of interest and importance to the common mechanic, are also to be found in part second. A glossary of practical terms and many useful tables are to be found in the appendix, and the whole is followed by an index calculated to aid in referring to special subjects. A number of full plate illustrations are inserted in various parts of the work, making it attractive to the general reader, and at the same time serving as explanatory of the historical portion of the volume. The whole work is comprised in about 700 pages, and, taken all in all, is one of the most complete and most desirable hand-books for carpenters and builders at present published.

Were we to offer any criticisms upon the book in its present form, we should refer particularly to the introduction of some very poor engravings, particularly in the chapter devoted to shadows. A work which has been so carefully prepared in all its other parts, certainly should have received better treatment in this respect. Although the engravings referred to are blemishes upon its otherwise very satisfactory pages, they still serve to illustrate the subject, and do not necessarily lessen the usefulness of the book. If subsequent editions are to be brought out, we trust the publishers will improve the opportunity of bettering it in this particular.

THE CONTRACTOR'S BUILDER'S AND CARPENTER'S BUILDING TABLE AND ESTIMATE BOOK: Being a systematic, thorough and practical method by which to estimate the cost of building work and material, with full and complete instructions, together with a great variety of full bills of timber, &c., by L. E. Brown. New York: Bicknell & Comstock. Price, $2.

The general scope of this work is so thoroughly set forth in its somewhat extended title that comment is, in a measure, unnecessary. It commences with tables of balloon frames, giving the bills of timber for buildings of specified sizes. Following balloon frames are similar tables on one-half balloon frames, which in turn are followed by tables of full frames. Many practical hints upon the matter of estimating time, labor, &c., will be found in the book, together with rules for obtaining the length of hip-rafters for both square and octagon roofs.

THE HISTORY, DEVELOPMENT, ACTION, CLASSIFICATION AND COMPARISON OF SAWS OF ALL KINDS, with Appendices concerning the details of Manufacturing, Setting, Swaging, Gumming, Filing, &c. Profusely illustrated. By Robert Grimshaw, Ph. D. Philadelphia: Claxton, Remsen & Haffelfinger. $2.50.

This is an important addition to the literature of a tool which is in very general use. The works relating to the saw, considered as a tool, are very few in number, although some of them are quite elaborate. The author of this work has drawn impartially from those who have preceded him in the same field, and also upon the current literature of saws in the shape of manufacturers' catalogues, circulars, &c. Matter contained in the appendices on the subjects of setting, gumming, filing, &c., is likely to be of more interest to our readers than the body of the work, although there is not a page in it which a practical man can read without obtaining useful ideas.

CORRESPONDENCE.

The number of letters received during the past month has been very large, and we find it impossible to publish all of them in this number, or even as many as the importance of the matters treated in them would seem to make desirable. A very considerable number of letters containing sketches of tool-chests, scaffoldings and other topics suggested in last issue, reached us too late for attention this month, even had space in our columns permitted. Because we are receiving from month to month a larger number of letters than we can publish in full, we do not wish any of our readers to cease writing; nor because a correspondent fails to see his letter published in the first number reaching him after it was mailed, do we wish him to think that his effort was not appreciated. Every letter that reaches us shall have attention in some form or other, as we have repeatedly promised in numbers already published. Our correspondents must wait their turn with all possible patience.

W. K. I.'s Brace Rule.

When we went to press with the last number of *Carpentry and Building* we thought about all the correspondence which W. K. I's brace rule had stirred up had reached us, but it seems we were somewhat mistaken in that respect. Letters have continued to come in upon this subject, and while most of them are very similar to letters referred to in the last number, we think it well to acknowledge our obligations to our correspondents for the interest they are taking in the paper and which is manifested by their letters. Up to date of going to press we have received letters calling attention to the fallacy in W. K. I.'s rule from the following:

J. W., Elmo, Wis.
B. F. S., Feasterville, Pa.
W. W. G., Wakeman, Ohio.
S. B., London, Ontario.
N. O. A., Galveston, Texas.
A. M., Baltimore, Md.
H. J. B., Akron, Ohio.
W. E. H., Terre Haute, Ind.
W. D. B., Tompkinsville, S. I. (N. Y.)
J. R. L., St. Johnsbury, Vt.
J. D. H., Belle Green, Ala.
J. L., Dubuque, Iowa.

We have also received a letter from W. K. I., referring to the comments in last issue upon his former communication:

From W. K. I., *Rockland, Ind.:* The brace rule which was published in the February number of *Carpentry and Building*, over the initials of W. K. I., has been branded as false by the craft, and justly, too. The rule was given me by a carpenter who, I thought, was experienced in the "trade," and was competent to give instruction and advice. Unfortunately for myself, the rule worked in the cases in which it was tried, and I was misled. After the rule was given to *Carpentry and Building*, and before the number containing it was published, the incorrectness of the method was demonstrated, but it was then too late to prevent its appearing in the columns of *Carpentry and Building*. I shall hereafter let alone all "quick" rules.

The following letter from a correspondent who is well informed upon the subject on which he writes, as is evidenced by the letter itself, will be of interest to many of our readers. His suggestion with reference to the shingling correspondence, we will doubtless be obliged to put in practice. The letters which we present upon that topic this month are only a portion of those on hand, all of which seem to present some new feature, and therefore appear worthy of a place in this department. We commend his remarks upon the subject of "Practical Rules" to the attention of our readers:

Some Suggestions and Rules.

From C. E.—I take a number of class papers, and at different times have read many, but I have yet to see one from which the readers may so readily gain useful information as from *Carpentry and Building*. From the first it was an excellent paper in all respects, and did not have to beg its way into favor, as is usual with many class papers. The paper upon which it is printed, the printing itself, and, above all, the clear and accurate engravings, leave nothing to be desired in the publishing department. The editorial department has certainly been conducted with much skill. Only those subjects have been treated that are of importance, and that in such a way as to interest and call forth from the readers valuable remarks and criticisms.

But there is another department of the paper of which I wish more particularly to speak, and that is the correspondence. There is nothing so essential to a class paper as this department. Men may readily obtain much in the other departments of a paper in books, but such information as is contained in the correspondence of a good class paper has a newness and present interest that can nowhere else be found in print. This is chiefly the reason why no man who is ambitious of success can afford to do without a good class paper in his line. The free scope given to its correspondents in *Carpentry and Building*, and the accurate engravings of the designs of such correspondence, render the department unusually useful and interesting. But this very free scope, unless to some extent hedged in, will be abused. In this connection, in the language of Wood Butcher, I want to "humbly suggest" some considerations. 1. After a subject has been fully discussed, drop all correspondence concerning it. I think we have had enough of the "shingling business." I mean by this, the number a man can properly put on in a day. 2. When a man earnestly asks for information, however simple it may be, under your promise he has a right to it, providing your space will permit, and any remarks or replies of correspondents should be courteous; if not, I think you should throw them in the basket, or strike out such expressions as would tend to give offense among gentlemen. At the same time, when a correspondent offers a false rule, which he claims to be infallible, he should expect such good-natured ridicule as was given by McG. and Wood Butcher in the March number.

There are many rules in the trades that have no foundation in mathematics or mechanical law, and hence are false. These false rules originate chiefly in two ways: 1. In supposing that because an arbitrary rule holds good in one instance it will hold good in others. This was well illustrated by McG. in his brace rule, when the rise, run and length of brace would form a triangle similar (not necessarily equal) to a triangle having the sides 6, 8 and 10; then his rule was good, otherwise not. 2. False rules arise from a misconception of principles. This is exemplified by the common rule of finding the contents of a circular rain-water cistern that is wider at the top than at the bottom. The rule generally used is, find the area of the top and bottom, divide by two and multiply by the depth. According to this rule the contents of a cone is equal to its base by half its hight, when it is only equal to its base by one-third of its hight.

I will give simple rules to find the contents of such a cistern both in cubic yards and in gallons. They will show how simple and short rules may be made and used and yet be correct, and the rules themselves will likely be of use to some. The shape of such a cistern is what geometricians call an inverted frustum of a cone, and its contents is equal to three cones, all having their hight equal to the depth of the cistern, and their bases, respectively, equal to the upper base of the cistern, the lower base, and a mean proportional between the two. That is, to put it in algebraic language, and calling depth H, upper diameter D, and lower diameter d, we have contents:

$$= \frac{(D^2 \times .7854)}{3} H + \frac{(d^2 \times .7854)}{3} H + \frac{(D d \times .7854)}{3} H.$$

Now, this may be reduced to $= H (D^2 + d^2 + D d) \times .2618$. Divide .2618 by 27, supposing the measurements to be taken in feet, we have contents in cubic yards $= H (D^2 + d^2 + D d) \times .0097$. And multiply .2618 by 7.48, number of gallons in a cubic foot, and we have for contents in gallons, $= H (D^2 + d^2 + D d) \times 1.96$. Or, to put these algebraic formulæ in words, square the upper diameter, square the lower diameter, multiply the upper diameter by the lower diameter, add the three products together, multiply their sum by the depth; then, if you want to know the contents in cubic yards, divide by 100, or, what is the same thing, point off two decimals, and you will have the true contents within 3 per cent. If you want it very precisely, substract 3 per cent. from it. If you want the contents in gallons, instead of dividing by 100 multiply by 2, and you will have the contents within 2 per cent. If you should want it more precisely, take off the 2 per cent.

The above saves considerable work in calculation, and goes to show how rules may be made short and yet accurate. Of course, the measurements above are supposed to be taken in feet.

While the above letter is in mind, we call attention to the following, which doubtless will be found interesting reading, when taken in connection with other humorous letters published in recent numbers. "Practical Rules," so called, are not to be considered apart from the scientific principles upon which they are based. Accordingly, H. McG. improves the opportunity of poking a little fun at those who seem to attach too much importance to rules of thumb:

Easy Practical Rules.

From H. McG., *Paterson, N. J.*—Easy and practical rules are now in order. I am just about dying for that sort of thing myself. I am a little short on figures, am still shorter on algebra; in fact, so short I do not know anything about it. I am suffering, hungering (I drink too much whiskey to thirst), dying for a simple, easy rule for the calculus. Now, won't some reader of *Carpentry and Building* just give me a "hist" with a rule that will fetch old calculus every time? For such a favor I will treat, if there isn't more than two of them at "once'st." You see there isn't anything mean about me. From the careless, confident way some scientific writers sling their figures, their A, B, C's,

= ÷ ⌣ —, <, √, +, ∽, ⊏, X, Y, Z's, ∴

one has a right to suppose there is an easy way of doing it. Now, just trot it out. I long for the calculus. In an attempt to help myself in that direction some time since, I bought at auction a book "sight unseen." The "cussed" thing is filled with brick-hods upside down; pretzels, treble-twisted Bolognas, ox-yokes, back-broken Z's turned wrong side about, and all sorts of funny forms that Christians only see when they've got 'em. At first sight I said: "Hurrah! it's a correct solution of the Fifteen Puzzle." When I looked again it appeared to me to be ancient Greek.

Now, won't some reader give me an easy practical rule by which I can read and understand these crooked cusses? It must be so delightful to study architecture in the original (not Irish) Greek, just to know, you know, what kind of hair pins those old chaps were, how they did it and whether they had latch keys in the original.

The easy practical rules for rafters, stair wreaths, trusses, roofs, &c., so far published in *Carpentry and Building*, are to me N. G. (no good). The old rip I slave for wouldn't give me 10 cents a day more wages if I had a dozen bookstores full of geometry in my head, a $100 set of drawing tools in my kit and knew how to use them. He is a practical man, an old chip, to whom geometry, drawing and science generally are delusions, snares, humbugs and fizzles. But, alas! by some crooked, mean, contemptible old rule-of-thumb, he comes out right every time—that is, he hardly—scarcely ever—misses it. He lays out the work; I do it while sighing for the infinite, for the unknown, for the calculus, for the Greek, and for the easy practical rules for the same. These are what keep me awake nights. Won't some fellow help me out?

The bearing strength of timber is something in which all our readers are interested. Prof. Carpenter's article, which was published in the volume for last year, seems to be receiving considerable attention from different correspondents. We published a letter concerning it in the February number. The following communications are calculated to throw light on points not altogether plain in the original paper. We suggest to the critics, however, that possibly these writers have not covered the entire ground, and that there is more to be said in order to reduce the rules to a practical working basis. Perhaps Prof. Carpenter himself will desire to take a hand in the discussion before it is finished. We shall welcome a communication from him:

Calculating the Bearing Strength of Timber.

From F. E. K., *New York City*.—In looking over the communications in the January number, I noticed C. B. R.'s communication under the above heading, and thinking the subject of too much importance to go unanswered, I have determined to explain the difficulty if possible.

This difficulty of C. B. R.'s was to make propositions fourth and sixth of Prof. Carpenter's article, in the July number for 1879, on the "Bearing Strength of Timber," agree with each other, and to show their discrepancy he illustrated by an example.

In order that the subject may be perfectly plain, I will give the above propositions, taken from Prof. Carpenter's article, and then explain the fallacy.

"FOURTH.—To find the safe load that a horizontal pine beam, supported at both ends, will sustain. (The safe load is assumed to be one-fifth of the breaking load.)

"*Rule.*—Multiply the breadth of a beam by the square of its depth, and that product by the number 90; divide this result by the length of the beam between the supports, and the quotient will be the number of pounds that the beam will carry at the center.

"*Example.*—What will be the center safe load of a white pine beam, 4×6 inches, supported at both ends, and 12 feet long between the supports?

"*Answer.*—If the depth be 6 inches and the breadth 4 inches, the center load $= 4 \times 36 \times 90 \div 12 = 1080$ lbs.

"SIXTH.—When the dimensions of a horizontal beam that will safely carry a given load are wanted, the following rule must be used: The product of the breadth into the square of the depth equals the load at the center, divided by 90 for (white) pine, or by the number given under the fourth rule for any other material. By assuming the depth the breadth can be found.

"*Example.*—What sized pine beam 16 feet long will safely support 1000 lbs. at its center? One thousand divided by 90 equals 11.1—equals the breadth multiplied by the square of the depth. If we assume the depth to be 3 inches, its square is 9, and the breadth, 11.1, divided by $9 = 1.3$. Hence the answer is a piece 1.3×3."

Now, C. B. R. calculates, by the rule under the fourth proposition, the safe load of a white-pine beam, 16 feet between bearings and 3 inches broad by 8 inches deep, to be 1080 lbs. He then, by the sixth proposition, calculates the required size of a beam to safely sustain 1080 lbs. at the center, the distance between bearings being 16 feet, and finds the beam to be only 0.187×8 inches. Hence there must be a mistake somewhere.

The fourth proposition is undoubtedly correct, and the example under it is correctly solved. The trouble is with the rule under the sixth proposition, and this is entirely wrong, as it does not take into consideration the length of the beam. The rule should read as follows: "To find the breadth of a beam to safely sustain a given load at the center, multiply the given weight by the length, in feet, between bearings, and divide this product by the square of the depth (which must be assumed) multiplied by 90."

Now let us solve C. B. R.'s example by this rule. Multiplying the weight, 1080 lbs., by the span, 16 feet, we have 17,280, and assuming 8 inches for the depth, we divide 17,280 by 64×90, and we get 3 inches for the breadth, which gives us the dimensions we started out with.

The above rule can be safely relied on; and we would advise all those having the paper containing Prof. Carpenter's article, to make the above corrections there, for it is too dangerous a mistake to be passed over. If a load of 1000 lbs. was placed on the center of a beam of white pine 1.3×3 inches and 16 feet span, it would certainly break at once.

In thus having my attention called to the article of Prof. Carpenter, I have carefully examined it for further errors. His fifth proposition should be used only in beams of short span, and it would be better to make the safe load not more than one-sixth of the breaking load. The seventh proposition, so far as it depends on the sixth proposition, is of course wrong; but, substituting the rule I have given above for the sixth proposition, it would do very well. The ninth proposition is true only for posts where the length is not more than ten times the least thickness of the post.

The remainder of the article can be relied on. This, I trust, will give C. B. R. the explanation he desired.

From A. M., *Baltimore, Md.*—Your correspondent C. B. R., in the January number, asks to be set right in his operations for finding the bearing strength of timbers. In Prof. Carpenter's rules it is true that the sixth proposition is the reverse of the fourth, but in his example C. B. R. does not carry out the operation in full. He says: "Take a beam, for example, 3 x 8 inches and 16 feet long (pine). By proposition fourth we multiply 3 x 8 square (3 multiplied by 64) equals 192; 192 multiplied by 90 gives 17,280; this divided by the length 16 gives 1080 pounds, the safe load for a beam 3 x 8 inches in size and 16 feet long. Now, the reverse of this is, What is the size of a beam 16 feet long which will safely carry 1080 pounds at the center? Working out the rule we have the following: 17,280 divided by 90 gives 192, and 192 divided by 64 gives 3, the breadth of the beam.

I think Prof. Carpenter has made an error in his rule under the sixth proposition. It should be as follows: "The product of the breadth, by the square of the depth, equals the load at the center, multiplied by the length of the beam between the supports and divided by 90 for pine, or by the number given under the fourth rule for any other material." Applying this rule to his example of what sized timber 16 feet long will safely support 1000 pounds at its center, we have 1000 multiplied by $16 = 10,000$; 16,000 divided by $90 = 177.77 +$ which is the product of the breadth by the square of the depth. If we assume the depth to be 3 inches, and divide $177.77 +$ by 9, the square of 3, we have $19.75 +$ inches as the breadth of the beam. Reverse this operation and it will prove itself.

From J. H., *Glasgow, Ky.*—In the January number your correspondent, W. G., of Chicago, gives the method for finding the dimensions of floor joists taken from "Newland's Practical Carpentry and Joinery," which seems to take for granted that all floors require the same strength, or, in other words, have the same weight to carry. This, to my mind, is quite absurd. For instance, the floor of a grocery store or storage warehouse requires much stronger joists than that of an ordinary dwelling. I prefer the method found in Benjamin's "Elements of Architecture," which is as follows: To ascertain the load to be carried by each joist, take the depth, breadth and length of joists, and make the calculation by multiplying the square of the depth in inches by the breadth in inches, and divide the product by the length in feet. Then multiply the quotient thus obtained by the breaking weight of a piece of the same kind of wood 1 foot long and 1 inch square, which, if oak, is given at 480 pounds. By this rule the weight required to break an oak joist 2 x 12 inches in size and 18 feet long, is 7680 pounds when suspended in the center. Now, taking a quarter of that for a permanent load, we have 1920 pounds, distributed equally over its length. I find that Prof. Carpenter's stick of timber, if of the same kind of oak, 2 x 14 x 16 feet long (instead of 1 3-10 x 3) would require only 960 pounds suspended in the center to break it.

B. P.'s comments upon the letter of the English stair builder, published two or three months since, are receiving attention from some of our correspondents. The following letters show that some of the assertions he makes may be challenged. Perhaps he may have something further to say after reading the following:

Stair Building.

From S. O. E., *Evergreen, La.*—How many jours will it take to build that staircase in Detroit? H. W. C. commenced it, but spoiled the wall string by housing the wrong side. B. P. says, put it under your glue pot. I say, don't do it; it would not be honest, and, besides, it would be a bad example for the boys who are learning the trade in the shop. Send word to the foreman of the shop at Jacksonville, Fla., where B. P. works, that he had better watch B. P. very closely. You will thus save your reputation for honesty, if not for accuracy. B. P. has lost his reputation in both respects, the one by giving bad advice, and the other by spoiling his wall string before he commenced housing. He says: "The object of the easement is to make the lines exact on a level." This will not answer at all. He eased off just 7 inches too much at top of first wall strip.

From W. R., *Providence, R. I.*—As *Carpentry and Building* calls upon all those who are heavy laden to come to it, and being one of those unfortunates, I come to sit at your feet until you, or some of your intelligent readers, enlighten my darkness. In the February number B. P., of Jacksonville, writes on a subject in which, though not a stair builder, I am trying to obtain those 25 parts of brains concerning which he speaks. Now, if he will only assist me he will confer a lasting favor. I desire to know how to make the forms for front and back strings of a quarter-circle stair. I also wish to know the rule for spacing winders on line of front string. By furnishing me this information, and also explanation concerning any other points he may think I need to know about, he will be conferring a material favor upon one who is at present laboring in the dark.

From R. R., *Glenville, Conn.*—I have just one word for B. P., of Jacksonville, Fla., in the matter of stair building. Your correspondent is sound on the goose, and certainly knows whereof he writes. Please ask him to give us more of that kind of talk. It is difficult to be of service to young mechanics as well as to old. Ask him to tell them how to connect a cylinder with the string, also how to get the proper easements, also the skirting around the well-hole for, say, a plan of stairs winding one-quarter to the landing, 8-inch cylinder, three winders in cylinder and one on straight string below it. Further, request him to illustrate his letter, so that young and old may understand it equally well.

From F. G., *Canada.*—In the February number of *Carpentry and Building*, H. W. C.'s stair building gets pretty well criticised by B. P., and now I want to say something to B. P., although I shall not occupy as much space as his letter occupied.

B. P. says H. W. C.'s risers look as if they rested on the treads, and so they do; but can B. P. tell us what is the difference whether they rest on the treads or go behind down to the under side of the treads? As I am English myself, I am excused for asking such a question. In England I have always seen them made according to H. W. C.'s plan, and strongly screwed up through the tread into the riser, if it was a good job. I think the difference, if any, is in favor of the English plan, as a 6-inch riser would not shrink so much as a tread 11 or 12 inches wide. B. P. further wants to know where H. W. C. intends to put his cylinder at landing. He puts his own cylinder where a tall man wearing a plug hat would meet with considerable annoyance going up and down stairs, and perhaps get as excited as H. W. C.'s plasterer.

From A. P., *Little Rock, Ark.*—I have been somewhat amused in reading the correspondence column in the last few numbers of *Carpentry and Building*. I think B. P., of Jacksonville, Fla., is a little too severe in his criticisms of H. W. C.'s stair building, inasmuch as his own is not perfect, to wit: his easements are not graceful; there is too much humpback to the one on the first string. All easements of strings ought to be as nearly parallel with the nosings as possible. I was employed as stair builder in the largest shop in Albany, New York, for three years, and during that time had to take about 3 inches off the easements of stairs laid out as your correspondent shows. Further, B. P.'s winders are not right. All winders ought to be laid out as nearly as possible half the width of the straight steps on the line of the cut-string, in order to have the balusters the same distance apart.

Shingling.

From A. M., *Baltimore, Md.*—I suppose when R. L., of Buffalo, asked what constituted a day's work at shingling he wanted some reliable figures on which he might base an estimate, but it seems as if the correspondents of *Carpentry and Building* have used its columns as a means of blowing about how much they, themselves, have done in that line. In each succeeding number, of late, some one has tried to beat (on paper) the best time recorded in the preceding number. It looks to me as though they are apt to keep on until we have a corner in shingles.

My advice to a boss about to employ such men is to discharge them as soon as the shingling is finished, as it would be dangerous to put so much concentrated wind under such a roof as they would lay. Such information as they give is of no benefit to anyone. Readers of *Carpentrg and Building* do not care to know what amount of work any particular man can do; what we want to know is, what constitutes an average day's work at shingling.

I cannot understand how some of the correspondents crowd so many shingles into such small spaces. In this vicinity we use cypress shingles altogether; they are 6 inches wide, and we calculate 4½ shingles to the foot, or 450 to the square, and we think a man who lays 1200 of them properly, on a straight roof, is doing a fair day's work. Of course there are some who will lay more, but a great many others will not lay so many. We never drive more than one nail into a shingle, except when it is a winding one or in the last course.

From S. O. E., *Evergreen, La.*—Since so many have told how they shingle, and yet have not told all of it, I will try to tell what I know. I agree with R. L. when he says: "Take a hammer." I never go on a house to make shingles; I go there to lay them, and a hammer is the necessary tool for the purpose. I agree with C. N. C. when he says: "Shingle from right to left," but sit on the left hip, and go forward like a man and not backward like a craw-fish. While driving the nail with the right hand get from one to ten nails in the left hand; then with the nails in hand reach for the shingle; be sure to have one or more nails in hand all the time.

J. E. W. likes to climb about on a roof much better than I do, or he would throw away his straight-edge, use a line and lay three courses of shingles at a time.

From T. M. H., *Haswell, Mich.*—I would suggest, with regard to shingling, that I am glad to see the straight-edge spoken of, but if my friend who uses it would get two good hands who can lay them fast and one (a boy) to nail and try the New York plan, he will find he can do first rate on a large roof.

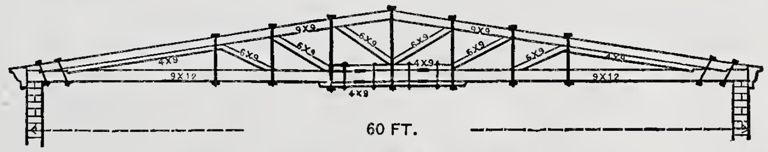
Let one take all the shingles he can carry upon his left arm and commence laying from left to right. He should wear rubbers, so as to be able to stand up and walk around with comparative safety. Let the poorest hand of the set follow and put one nail in each shingle, and let the third hand follow him and finish the nailing. Have the two best hands change off, as one of them will have very hard work. A trial of this will surprise your correspondent at the number of squares that can be laid in this manner.

From J. G., *Teheran, Ill.*—It is frequently asserted that one man's opinion is just as good as another's, and that is just what has induced me to give my own on the question of a day's work at shingling, which has been going the rounds for some time. First, I will introduce myself to my brother "carps." as a genial, good-natured sort of fellow, always willing to oblige any one by believing almost anything they may say, but since I have become acquanted with a few persons through the columns of *Carpentry and Building*, I have been compelled to go back on this habit of mine. I have worked at the trade in six different States; I have worked with a great number of men, some fine mechanics and others very poor, and think I know a thing or two about shingling.

The gentlemen who have been airing their opinions through the columns of this journal have almost invariably forgotten to mention the difference existing between varieties of shingles. It very often occurs when using No. 1 shingles that you will find a few bunches of very wide shingles—that is, there will be very few as narrow as 4 inches. Again, you will find other bunches in which there will be scarcely a shingle 6 inches wide. Now, I know, and so does every other man who has had experience, that with shingles running from 6 to 10 inches in width I can lay a great many more than when they range from 2 to 6 inches wide. I have often watched some men to see how they could accomplish so much work in such a short space of time, but I have always found the work slighted in some way—if not in one way, then in another. I once worked for a man who would lay three bunches to my two, and didn't appear to labor hard either. I soon found, however, that he used but one nail to a shingle if it was less than 10 inches wide. When I asked him about it he said it made a much better roof with one nail to a shingle, and, like your correspondent, J. V., that there was less likelihood of the shingle rotting or checking when laid in this manner. In less than a month after this circumstance he told me quite a different story. He built a new house for himself. Every shingle on that house got two nails, and all the rest of the work was done proportionately well. Quite a number of things that would have been good enough if the work was for some one else, was not good enough for him. Consequently, I am well satisfied that if some of those fellows who have been showing such big day's work were really making a house for themselves, they would not get along quite so fast. Still, I cannot doubt the truth of their statements, for they may have had the advantage of very wide shingles.

The straight-edge is much better for laying shingles than a line. A good lath hatchet is as far ahead of a 1½ Maydole or any other "dole" hammer as a hammer is ahead of a boot-jack. I never strike a nail more than one blow, and I don't shoot them half way through the shingle, either. By practice, a man gets so accustomed to his hammer that he can drive a nail just far enough with one blow.

From J. R. W., *Bloomington, Ill.*—If a mechanic lay 3000 shingles in a day he is worth more than one who can lay only 2000. Now, L. W. T. may laugh and point to his throat, but I will speak my little piece notwithstanding. I have repeatedly put on 4000 shingles in ten hours, and I have men working for me who are able to do the same. My plan is to strike two lines, and with a good hatchet trim when necessary and put one nail in each shingle close to the edge furthest from me. This fastens the shingles and gives them a chance to swell and shrink without splitting. I have followed this plan for six years, and have acquired the reputation of a good roofer. A little care in placing the bunches of shingles on the roof will obviate the necessity of moving them. I find that some workmen are worth nearly double what others are, because of their economy in time and labor in getting ready and executing the work. If young workmen will carefully consider these points they will find it greatly to their advantage in after years. My experience is that a good workman will lay 3000 shingles in ten hours and do a good job.



Design of Truss for a Flat Roof, by A. N. H.

Framing a Flat Roof.

From A. N. H., *North Adams, Mass.*—Noticing the inquiry in the March number from T. L. G. with regard to framing a flat roof, I inclose you a rough sketch which will, I think, prove a desirable plan for the correspondent's purpose. The 4 x 9 pieces shown in the sketch should be of hard wood; the bolts at the end of the truss and the rods through the truss should be 1¼ inches in diameter. The dimensions of the timbers are shown upon the drawing.

Combined Band Saw, Jig Saw, Buzz Saw and Lathe.

From E. A. W., *Cassville, N. Y.*—Answering the suggestion of W. F. R., I would say that I think he is asking altogether too much when he desires to combine band saw, jig saw, circular saw and turning lathe in one machine. I have experimented considerably with jig saws and lathes. My experience is that too many machines in one spoils the whole.

From "Simple Fact," *New York City.*—Innumerable trials in the very best manner have plainly demonstrated that a fly-wheel worked by man power will not run a circular saw satisfactorily. Again, experience has shown that, as a rule, where machines are made to perform two or more different operations, they amount to scarcely more than playthings. He is a good man who can do one thing well; it is a good machine that will do one thing well. The inquiry of your correspondent, W. F. R., for a combined machine affords a fair illustration of this fact.

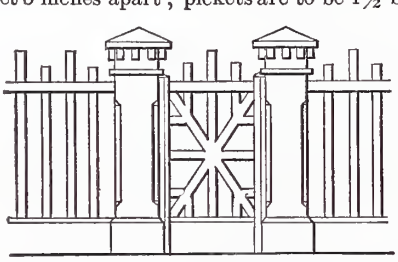
A band saw should be run at right angles with the sawyer; a circular saw should be run facing him. These requirements necessitate a change in the position of the fly-wheel when combining the two saws in one machine. Again, the speed that is necessary for a circular saw is entirely too great for a band or jig saw, and a change in the speed of the fly-wheel is a great change in the power of the machine. These facts are well illustrated in the machines manufactured by the Combined Power Company of New York, which are said to be the only satisfactory man-power saws made. These machines present a combination to do one thing—that is, produce speed. What is known as the V. M. gearing is a device by which the operator is enabled to use a lever (or wheel) three or more times the size that can be used by the old mode, to produce any given increase of speed, and a full levered crank, on which he is always able to apply power at the live or longest points of leverage, and is arranged in such a manner that he cannot apply it anywhere else.

It is plain that a thing may be theoretically true and practically as false as false can be. There are practical difficulties in combining the several machines which your correspondent named. I should add that with the circular saws named a jig saw attachment can be used. An emery wheel can also be run upon the same machine and a small lathe may be attached. A number of other devices may also be employed. The entire cost is about the price your correspondent names, but the three saws cannot be obtained in one machine.

From S. W. Foulk, *Greenville, Penn.*—I notice in the columns of *Carpentry and Building* for February the request of W. F. R. for a combined band saw, jig saw, circular saw and turning lathe. I am the inventor of just such a machine as he wants, and for the last eight years have been perfecting the device. The following is a partial list of what I can do with the machine: With the band saw I can cut timber 8 inches thick; with the jig saw, lumber 2½ inches thick, and also the same thickness by the circular saw. In eight hours, with a boy to assist, I have made 73 large brackets. My price for the machine, as above described, is from $50 to $125, according to the number of attachments.

Design of Fence and Gate.

From H. R. G., *Worcester, Mass.*—In response to the request of G. W. C., I send you a sketch for a fence and gate with posts. The rails are to be 2 by 4 inches, placed 2 feet 6 inches apart; pickets are to be 1½ by



Design of Fence and Gate, by H. R. G.

1½ inches, with 3-inch spaces between, the base 7 inches wide, with the top edge beveled; shaft of post to be 7 by 7 inches, with base corresponding to base of fence; cap to be made as shown in design, with dentals 1⅛ by 1⅛ inches; pickets are to project alternately 4 and 7 inches.

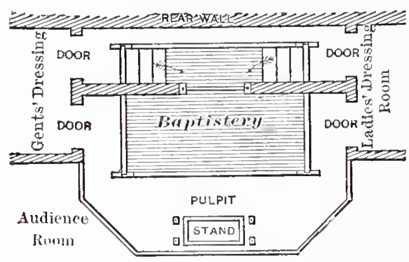
The Use of a Dictionary in Reading.

From S. L. I.—I am much pleased with *Carpentry and Building*, but being limited in education, I find it quite difficult to understand many of the terms used in its articles. I am compelled to search the dictionary for a great many words. I wish to inquire if there is not some small book or work containing the definitions of the terms commonly used in architecture. Please answer through the paper.

Answer.—There are many architectural and technical dictionaries which we might recommend to our correspondent, but, after all, none of them are quite so well suited to his wants, we think, as a copy of Webster's Dictionary (Unabridged). All the terms that he is likely to meet in this paper or in other architectural works, in case he pursues his studies further, are defined in Webster in a brief manner and in a way adapting them to common use. Of the architectural dictionaries, perhaps there is no one quite as satisfactory, the price, &c., being considered, as the "Concise Glossary of Architecture," a small book profusely illustrated, and withal quite comprehensive. Our correspondent, who is a young man, judging by the wording of a part of his letter which we have not published, should not be at all discouraged because he is compelled to look up the definition of terms. By following that plan, carefully searching out every word he meets with which he is not familiar, he will soon obtain a knowledge upon architectural and mechanical subjects superior to that of most workmen.

Plan and Construction of Baptistery.

From C. T. H., *Washington, D. C.*—In reply to the question asked by C. W. C., Berkville, Virginia, in a recent number of *Carpentry and Building*, I inclose you a sketch of the baptistery of the Fifth Baptist



Plan of Baptistery, by C. T. H.

Church in this city, with the construction of which I had something to do. The baptistery is made of white pine 2 inches thick, tongued and white leaded together, and is lined with zinc. There is a false floor placed underneath, from which a waste pipe leads, thus thoroughly protecting the plastering in the room below. The size is 6 feet 6 inches wide by 9 feet long and 3 feet deep. It is constructed in the pulpit platform, as shown by the sketch, and is entered by steps in the passage in the rear. The pastor and candidate come through a door (which is hung like a sash with weights) into view of the audience. The pulpit stand is hung with weights, and is so adjusted as to be lowered out of sight by means of a cord passing into the gentleman's dressing room. The baptistery is provided with a cover, which is removed previous to the ordinance. I think my sketch shows all the essential particulars, and I hope this hurried description may prove of some value to your correspondent and others of your readers.

Protecting Drawings against the Points of Instruments.

From M. F. J., *Middletown, Del.*—Will you please inform me how to keep the points of a pair of dividers from making a hole through the tracing cloth when one is copying?

Answer.—From any of the dealers in mathematical instruments what is called a horn center can be obtained. It is a useful device for the purpose our correspondent names. The horn center is provided with points which hold it in position, and being transparent, there is no difficulty in locating the needle of the dividers just where it is wanted. If any of our readers know of a better plan than the one we have suggested for remedying this difficulty, we shall be pleased to hear from them.

India Ink on Tracing Cloth.

From J. J. L., *Richmond, Va.*—I have read with interest the several answers to the query of your correspondent who asked about the use of india-ink on tracing cloth. For the last 10 years I have been working with the above-named articles almost daily, and so far have met with no trouble. I flatter myself I can make as neat a tracing as the next man. My plan is to use the dull side of the cloth, with a good sharp pen, and the highest priced Japanese ink, which has no odor of musk about it. It is an exploded idea that the odor of musk indicates a good quality of ink. I have discovered a very strong odor of this kind in the poorest Chinese ink that can be bought. With Japanese ink in mechanical drawings where many lines are required, I have laid on colors with the brush and the ink did not run at all. India-ink of ordinary quality would run under such circumstances. This is the best test of ink that I know of.

Facing Oil Stones.

From T. L. G., *Union Springs, Ala.*—I find *Carpentry and Building* of great service to me. I bought a lot some time since, and am making my preparations to build. I was quite undecided as to the plan of my house until I received the January number. Now I propose to use the plans of Mr. Rayside, with some few changes. Thanks to that gentleman and the journal.

I have noticed several plans for cleaning and facing oil stones given in *Carpentry and Building*, one in the January number be S. D. K., of Albia, Iowa, in particular. I think, however, I have a simpler, quicker and even less expensive plan. Take a rough board, with sand and water, and go to work with the stone, as though using a plane. You will be both surprised and pleased to see how quickly and how true your oil stone may be faced.

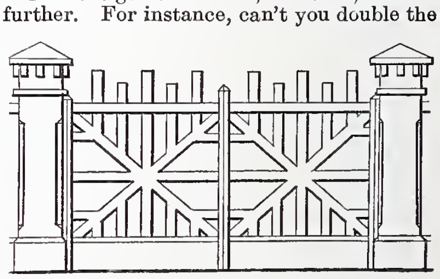
A Graduated Bevel.

From S. O. E., *Evergreen, La.*—Will some reader of *Carpentry and Building* inform me where I can obtain a bevel, with scale, showing how many degrees it is open. I have ordered from several different parties, but have failed to obtain just what I want, up to this time.

Answer.—We think our correspondent will hardly obtain what he is searching for. The idea is not practical. An instrument possessing the feature named would have to be constructed with an arc upon one side, which would seriously impair its usefulness for the ordinary purposes for which a bevel is employed.

A Larger Paper or More Frequent Issues.

From R. H. B., *Richmond, Va.*—I am well pleased with *Carpentry and Building* so far as it goes. I wish, however, it went further. For instance, can't you double the



Design of Double Gate, by H. R. G.

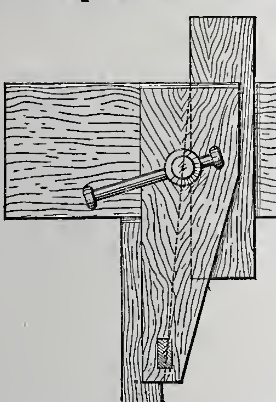
number of pages per month or issue two numbers per month of the present size, increasing the subscription price correspondingly? Even then it would be surprisingly cheap, and I think within the means of all.

Answer.—We are much obliged to our correspondent for this expression of his appreciation of *Carpentry and Building.* The time has not yet come to consider an increase in size of paper or the frequency of its visits. There are still a number of carpenters and builders throughout the country who have not enrolled themselves among its regular patrons. Whenever we have secured a majority of these, and it is the general wish of our subscribers that the paper be increased in size or issued more frequently, we shall be pleased to consider their wishes. In the meantime, we trust all our friends, as an expression of good will toward the paper, will do what they can to extend its circulation and increase its influence among the building trades.

Vise for Carpenter's Bench.

From H. D. C., *Philadelphia, Pa.*—I am convinced that there is always something to be learned. I send you herewith some drawings illustrating the use of a vise in connection with a carpenter's bench. The improved plan, it will at once be seen, is far superior to the old-fogy style, also represented in the drawings. While it may be useless to attempt to impress a new idea upon the minds of some of the old fogies, who for a lifetime have never seen anything but the old style, I will still venture to call the especial attention of our young friends to the new method, feeling convinced that if only the trial be given they will always adopt the same hereafter.

Fig. 1 represents the old style. To make the jaw requires a plank about one foot wide, the hole for the screw being put about one-third the width from the left hand edge as it faces the workman, in order to give a surplus width of the jaw on the near side of the screw, as a matter of convenience in cutting tenons in door rails, or in anything in which it is necessary to work at the end of the stuff. For such work as this, however, the old method is almost useless, for the strain is all on one side of the screw, and when you begin to draw on the screw the jaw begins to twist, taking the pressure only on one edge of the stuff; and frequently while cutting tenons in a vise of this



Carpenter's Vise.—Fig. 1.—Old Style of Vise.

character, the whole operation will give way, oftentimes tearing the fine finished edge of the rails or whatever material may be in hand in such a manner that it cannot be repaired. Fig 2 of the accompanying diagram shows the operation of a vise of this character.

Now give attention for a moment to Fig. 3, which represents the improved vise which I recommend. It is constructed of a piece of plank about 2½ inches thick and 8 or 9 inches in width. The screw hole is placed about 9 inches below the top of the bench; the nut rests against the near side of the leg. Square down a line cutting the near side of the hole, as represented in the drawing. Then take the piece, and put it in its position, in order to get length enough above the screw to reach to the top of the bench. Locate the hole for the screw in the jaw in this manner. After the screw has been put through the jaw, screw it in its place, turning it around until the left edge of the jaw strikes the line made by the square. This will give you a bevel at the bottom as well as that at the top. The slide in this case will come to the front side of the leg. Looking again at the engraving, you can easily see that, when drawing on the screw, the amount of pressure will be equal on both sides of the screw, thus avoiding any further twisting of the jaw or spoiling of good finished material. The operation of this vise is more clearly shown in Fig. 4. I am sure a trial of this construction will prove that there is no more labor, and yet less material, in the new plan than in the old, and that the new will prove much more satisfactory than the old.

Note.—We think our correspondent is in error when he calls attention to the method illustrated in Figs. 3 and 4 as being a new plan of arranging bench vises. In some sections of the country it has been used for a long time, and with very satisfactory results. We commend it for the trial of those of our readers who have not seen it.

We have added to Figs. 1 and 3 of our correspondent's sketches the dotted line shown through the center of the screw. It represents the direction of the strain, which in Fig. 1 falls altogether to one side of the piece being held by the jaw, and which in Fig. 3 falls upon the piece being held. The reason for Fig. 3 being so much more satisfactory than Fig. 1 becomes self-evident upon inspection.

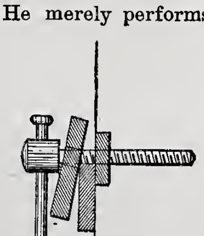
Fitting, Hanging and Trimming Doors.

From A. M., *Baltimore, Md.*—Your correspondent G. N. C. asks for an average day's work at fitting, hanging and trimming doors. I suppose there will be as wide a difference between the answers to this question as there was between the answers as to what constitutes a day's work at shingling.

In our city, to fit, hang and trim with mortice locks (carpet sills already worked) five doors 2′ 6″ x 6′ 6″ x 1⅜″ or four doors 3′ x 7′ x 1¾″ is considered an average day's work. If the doors are all hard wood it will take one-third longer time.

From J. S. B., *Fort Gratiot, Mich.*—Your correspondent H. J., of Quincy, Ill., in the February number, gives some tall door hanging. I would like to ask H. J. how many windows his man can hang of inside blinds, four sections to the window? We think we are doing well when we hang three windows per day, cut through the center and trimmed complete. I asked an old builder to-day what he called a day's work hanging doors. He says if a man hangs five doors and puts on mortise locks, he thinks he is doing well. I think H. J.'s man must have one of those Maydole hammer claws, that hawk-bill knife from Indiana, and the hedge-hook, sheep shears, and, say, 10 or 20 old suckers that L. W. T., at Upper Alton, speaks of, with which to shoot in the screws and blow on the locks and latches. I was not going to say anything about the keyholes. I think the carpenters in his vicinity ought to chip in and send him to Alaska, and let him freeze up until the next Centennial, and then fetch him out. He is altogether too fast for our day.

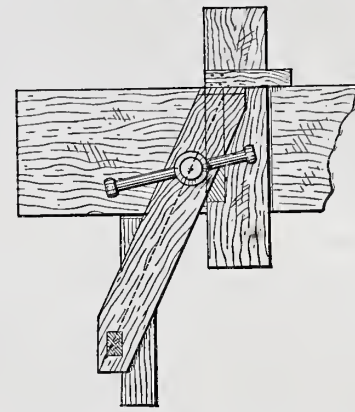
From G. H., *London, Ontario:* I have already learned, or I think I have, how many shingles a man ought to lay in one day from the "blowing" that has been done in the columns of *Carpentry and Building.* But I find there is a great deal smarter trick to be learned than shingling, *i. e.*, how to hang twenty doors in ten hours, and do the job well. Now, with your permission, I beg to ask your correspondent H. J., of Quincy, Ill., to be kind enough to tell us, through *Carpentry and Building*, the way to start out to accomplish this great feat. By the look of his letter one would suppose he does not have to fit them or do anything to them. He merely performs the work,



Carpenter's Vise.—Fig. 2.—Horizontal Section through Old Style of Vise.

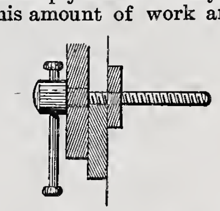
I take it, of a common executioner who has got somebody else paid to do the "slogging," as we call it here, while he is paid a little better price to come along and do the ghastly deed of hanging. According to his letter he is a most thorough hangman. For my part I am perfectly satisfied if I succeed in hanging 10 doors properly in 10 hours. I have no doubt that there are many more who are satisfied with the same amount; but, should I ever get into the notion of desiring to do more, I shall be at a loss how to proceed unless H. J. kindly comes to my rescue and tells me how it is done. Possibly he will lend me his man for a few days, so that I may yet learn something before I die.

From S. W., *Newark, Ohio.*—In reply to the inquiry of J. N. C. about hanging doors, I would say that much depends upon whether doors are of hard wood or pine, and also



Carpenter's Vise.—Fig. 3.—Style of Vise Recommended by H. D. C.

whether two pairs of butts or three are used. A door 3 feet 6 inches wide and only 6 feet 6 inches high is, according to most authorities, very much out of proportion. Take, for example, pine doors 3 x 7 feet; to fit, hang and put on mortise locks, knobs, &c., on five doors, using three pairs of butts to a door, I would consider an exceptionally good day's work. The speediest way of managing doors is, I think, to fit them first, then hinge them, finally putting on the locks. Two points, especially, are to be considered in hanging doors—first, the jams should be set straight and plum; second, the jams and doors should be just alike in size, then a few shavings taken off would give the desired space for paint or varnish. A door, when hung correctly, will allow a silver half dollar to pass all around between its edges and the jam. While mentioning this test, it occurs to me to say that I would like to try a half dollar around those 20 doors that H. J., of Quincy, Ill., claims his man can hang in one day. It is simply absurd to say a man can execute this amount of work and do it in a



Carpenter's Vise.—Fig. 4.—Horizontal Section through Vise shown in Fig. 3.

workmanlike manner. I do not say it cannot be done, but there is a vast difference between driving screws with a hammer and with a screw-driver.

From W. H. S., *Morley, New York.*—I have hung and trimmed 10 doors in 10 hours, the doors being supplied with loose-joint butts, trimmed with mortice locks, knobs, &c. I think that a fair day's work. I have hung and trimmed a single door in 40 minutes, but could not keep up that rate of speed for 10 hours consecutively.

I have also cased 10 openings on both sides for doors, with fan-lights over them, the edge of casings molded and finished with backband and moldings, making some 20 pieces to be put on each opening. This work was done under the immediate direction of an architect.

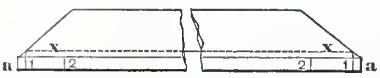
From J. W. P., *Maryland, N. Y.*—In answer to J. N. C. I would say that, in this section of country, from five to six doors of common size constitute a day's work of 10 hours for a good mechanic, the doors to be fitted, hung and trimmed with mortice locks, knobs, &c. For myself I have fitted, hung and trimmed 10 doors, measuring 2 feet 8 inches by 7 feet, in 8 hours. This was on a job I had charge of last summer, and my workmen were only averaging four and five doors a day. I took hold one day to show them what a man could do.

From J. A. B., *Orange, Texas.*—Answering J. N. C., who asks his fellow mechanics what constitutes a day's work at fitting and hanging doors, I would say that the size of the doors does not make much difference. I am a builder and practical mechanic, and experience has taught me that to fit, hang and lock a door is a neat job—that there are few men who do it as it should be done. I have heard men say that they could fit and hang ten doors a day, but I think six properly done is a very good day's work, and I do not think any man could do justice to his work and do more.

Patterns for Use in Cutting Braces.

From C. R. S., *Caldwell's Prairie, Wis.*—In response to the inquiry of L. R. C., your correspondent W. K. I., in the February number, gives a method for cutting braces which I should advise young mechanics not to follow very closely. Probably it is nearly enough correct for rough calculations when the brace is at an angle of 45 degrees, but it will not work where the rise and run are not equal.

After saying so much against W. K. I.'s rule, I suppose I ought to give my method. Well, it is simply a common square and a straight-edge. If I wish to find the length of a brace, say with runs 4 feet and 3 feet, I take such proportional part of these numbers as I can get on the square. For instance, one-third size—12 inches and 16 inches. Place the square on the straight-edge, with these figures just touching the corner; mark the points with a sharp knife and measure the distance between the marks. By this plan it will be 20 inches multiplied



Patterns for Braces.—Fig. 1.—The Pattern Cut From Thin Stuff.

by 3, or 60 inches, or 5 feet. This method will give the length correctly every time if the measurement is carefully made.

I inclose herewith a drawing of the method I use where there are a large number of braces to cut—*i. e.*, marking them by a pattern. Fig. 1 shows the two ends of the pattern. This should be cut from thin lumber; the length and bevels should be exactly those of the braces wanted. In making, cut the bevels, measuring the length on the gauge line. Square back from the bevel at end of gauge line to 1, as shown. This gauge line is for a shoulder at the toe of the braces.

To use the pattern, first mark the length of the tenon on the pattern. This is done as follows: Lay the pattern on the timber, with the long side toward you; mark where point A touches; now measure square out from bevel at any point the length you want the tenon, slide the pattern along till it touches this mark, and mark where line 1 touches the timber; now mark the distance between these points from A, as shown by 2 2 in Fig. 1.

In Fig. 2 a stick of timber is represented as though quartered diagonally, and the four faces exposed to view at one time. A is the face side. To mark this side, lay the pattern on as at 4 and mark across by the bevels; also mark the points where line 1 touches. Now move the pattern ahead and mark as before, leaving as much space between *a a* as the distance from *a* to 2 on Fig. 1. When you have marked all of the face side this way, square down from points *a a* to gauge mark 5 5; also from points 1 1 across the timber. The gauge mark is the thickness of the mortise cheek from the face. Now turn to side C, and putting point *a* where line 1 crosses side B, mark as shown. Square down on side D to gauge mark, as indicated. On side A saw only to gauge mark, but on side C saw far enough past so that part of the tenon will not split off, and follow line 1 around to mark on side A, to make the square butt at end of brace. The dotted lines on side A are the same as the lines on side C, and merely show the shape of tenon.

Fig. 3 shows the same method, applying the pattern in a case where rise and run of brace are unequal.

Note.—Before leaving this subject we beg to raise the question with C. R. S., why, when using his square for laying out braces as he describes, he uses a straight-edge and then measures the straight-edge, instead of using a rule direct? We are surprised that a man of the intelligence indicated by his letter and inclosed drawings, should overlook a simple matter of this kind. It certainly is a saving of time to use the rule direct upon the square instead of a straight-edge, afterward measuring upon the straight-edge.

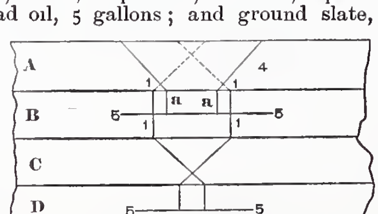
Construction of Cesspools.

From W. M. L., *Montreal.*—I notice in the February number of *Carpentry and Building* a request from G. M. N. concerning the construction of cesspools. Permit me to describe a method which I very often use, and always with satisfactory results. Excavate a pit of sufficient capacity to contain the excrement of a house for any given time, say, two or three years; line it with a 20-inch stone wall to within 4 feet of the surface and concrete the bottom; then line the whole with 4 inches of hard-burnt brick and render it with hydraulic cement. Cover the tank so formed with large, flat cedar; insert an iron pipe of sufficient diameter, cased by a wooden box, for protection. This pipe must be carried up to within about 6 inches of the surface and properly plugged to prevent the escape of gas. By this contrivance you can insert a pipe and pump out the contents when required. Cover the cedar pieces with earth to the level of the surrounding ground, and the cesspool is complete. The pipe leading from the house to the cesspool should be of tile, salt-glazed inside and out. The soil pipe should be of iron and continued through the roof, and capped with an exhaust ventilator either of the globe or cone pattern.

Recipe for Roof Paint.

From ANON.—For the benefit of brother builders I will give a recipe for roof paint, given me by a friend in the roof-painting business. It makes a very pretty roof, and I cannot see any reason why it is not a good preparation if used in the proper manner. I will not attempt to state what is the right way of using it, for it is my object to get up a discussion with reference to just such matters in the paper, which will be a benefit to all. In the course of such a discussion, if it is commenced, I shall be very glad to state my experience.

The recipe is as follows: Coal tar, 1 barrel; rosin, 10 pounds; sal-soda, 2 pounds; dead oil, 5 gallons; and ground slate, ½



Patterns for Braces.—Fig 2.—Application of the Pattern to a Stick of Timber when Rise and Run are Equal. A B C and D represent the several Sides.

bushel. Melt the rosin and add the other ingredients, putting in the coal tar last; boil all and apply hot. When a small amount is required, mix in the same proportion. This receipt is open to criticism.

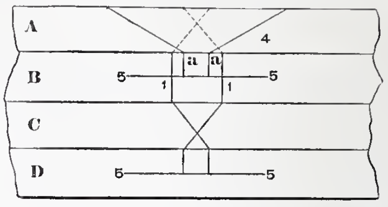
Cheaper Than Clothes Hooks.

From L. E., *Middaghs, Pa.*—Take common empty thread spools, and fasten them where wanted with a light wood screw about one-half or three-quarters of an inch longer than the spools; or, cheaper still, take eightpenny clinch nails—eightpenny cut nails have heads too small. Pegs of this kind for clothing are much easier on the collars of coats, for instance, than any hook manufactured. I have found this plan of service in my business, and think it may be useful to some other reader of *Carpentry and Building.*

The Roll on Inside Blinds.

From C. B., *Orchard, N. Y.*—I would like to learn, through *Carpentry and Building*, which is the proper way, or most common way, of hanging inside blinds, with roll next to sash or next to room?

Answer.—It would seem to us that the common-sense method would be to put the



Patterns for Braces.—Fig. 3.—Application of the Pattern to a Stick of Timber when Rise and Run are Unequal.

roll in the room, for there is where it is wanted for use. The only reason for putting it next the glass would be for the sake of appearance from the outside—a reason not justifying a change, we think.

Hand Planer.

From C. W., *Newport, Ky.*—Will you inform me if there are any small hand planers that will joint lumber, such as door and window frames, and groove and rabbet the same, and also stick small moldings? Such a machine would be very useful to carpenters who are working without steam power. If any reader of your journal knows of such a machine being manufactured, will he please give me full information concerning it?

Answer.—It is hardly worth while to refer this question to our readers, because, from the very nature of the case, such a machine cannot be made to work satisfactorily. The power required to do the work specified is altogether too much to be economically supplied by either hand or foot motion.

How to Turn a Wooden Ball.

From L. E., *Middaghs, Penn.*—A correspondent, in a recent number of *Carpentry and Building*, desires to know how to turn a wooden ball. Let him hinge a piece of board to the wall, or some other stationary support, behind the lathe, with its upper surface and axis of hinge on a level with the line between centers, and of such length as to just clear the wood that is being turned. Take a piece of sheet iron as large square as the diameter of ball to be made. With the compasses set in the middle of one edge of the iron, draw a semicircle reaching to the adjacent corners. Cut this out, and in the part left make two slots, over which put a common washer for protection, and fasten to the board with wood screws at a distance of half the diameter of the ball from its axis and parallel with it. This arrangement must be raised up out of the way while the wood is being put in to rough off; then lay it down so that it rests on the wood by its own weight. As the motion of the wood is from this edge, the friction is very trifling. Keep turning from the part of the ball on which the pattern rests and nowhere else. When it becomes of the proper size the operator will know it by the gauge dropping past. Something must be cut from the corners of the iron to clear the wood at the points, which are left until the very last. If the board be hung on a stiff, straight iron rod, it may be moved to any part of the lathe. I think this principle might be applied in duplicating other forms, both as to shape and diameter.

Foundations in Quicksand.

From G. O. S., *Atchison, Kansas.*—My method for laying foundations for a building in case I strike quicksand, is to put into the trench about a foot in depth of clay well rammed. Over that I place a layer of concrete, composed of cement, sand and broken stone, say about 10 or 12 inches thick, according to the weight to be placed upon it. Upon this I lay my footing course. For a two-story brick building I should make the clay and concrete foundations about 5 feet.

Molds for Plaster Casts.

From G. O. S., *Atchison, Kansas.*—Answering the question asked by your correspondent, G. E. F., of Buffalo, I would say that molds for plaster casts can be made by using equal parts of beeswax and rosin melted together. When making the mold, the object you wish to get the mold from should be well oiled with sweet oil; then the compound is poured on and allowed to set, after which it may be removed. The molds should be oiled every time a cast is taken. These molds become quite hard when not in use, and must be immersed in water for a few hours, heated to about 150 degrees, after which time they will become so elastic as to bend if required. For large molds raw linseed oil is used, as it is cheaper than sweet oil. For small, intricate work, the mold is made of glue and molasses, the quantity of molasses being varied according to the elasticity required in the mold. Sometimes such molds are made in three or four pieces, depending altogether upon the intricacy of the object of which a cast is desired.

Concerning Builders' Estimates.

From G. N. C., *Hancock, N. H.*—In reading the different communications upon estimating which have been published in *Carpentry and Building*, I am impressed with the fact that there is no uniform system of making estimates in use among builders, but it seems to me as though, by an exchange of ideas, we might arrive at a uniform and certainly much more reliable way than those we are now using. With this end in view I will contribute my mite, claiming nothing new, but hoping some one may be able to show me a still better way. I have never been able to fix upon a given price as a standard, as there are so many things that make difference in cost; and right here is where each builder must use his own judgment. Upon judgment depends the ability to form an accurate estimate. Matured judgment in such matters can only be the result of something of natural ability, careful study and practical experience. In making out an estimate I first write out a schedule or list of every stick of lumber for frame boards for casing, shingles, clapboards, finished lumber for inside and outside finish, doors, windows, nails, hardware, mason work, painting, in fact everything that is to be used about the building. This list I make as carefully as if ordering my stock. By the time this list is made I understand about the amount of work to be done, and I fix a price in my mind for the labor upon the whole job. I then go over the entire schedule again, estimating the time required to frame and raise and cover the building, to put on the cornice, shingle the roof, and, in fact, every item of work separately. I then compare this result with my previous figures, and in some cases revise both calculations two or three times. When I have thus settled in my mind what the job is worth, I copy the whole in a small pass-book. If I secure the job, my figures are all made by which to order my material. If I don't get the job, and find out what the building costs other parties to build, I make a note of it in the way of comparing my calculations with those of others.

Last year I made an estimate in this manner for a two-story house. Another builder made figures which were $5 more than mine. A third builder came from a neighboring town, made a great flourish with much loud talk, and took the job for $55 less than my figures. When he got done he found he had made 93 cents a day for his own labor and superintendence. I then built two houses upon which I had estimated in the manner above stated, and found only about $15 variation between actual cost and the figures of the estimate, a part of this sum being in my favor.

Stretching Paper on Drawing Boards.

From P. J. M., *Newark, Ohio.*—What is the best method of stretching paper on drawing boards so as to give a smooth and even surface to work upon?

Answer.—A very common way of fastening drawing paper to the drawing board is by pins at the corners. This plan is sufficient when no shading or coloring is to be applied, and if the sheet is not required to remain a long time on the board. It has the advantage of preserving the paper in its natural state. Another plan is by gluing the edges. For shaded or tinted drawings the paper must be dampened and glued at the edges, as the partial wetting of the paper by water colors distorts the surface when it is loose or fixed at the corners merely.

Damp stretching is done as follows: The edges of the paper are first cut straight and as nearly as possible at right angles with each other. The sheet must be so much larger than the intended drawing and its margin as to admit of being afterward cut from the board, leaving the border by which it is attached thereto by glue or paste. The paper is first thoroughly and equally damped with a sponge and clean water on the opposite side from that on which the drawing is to be made. When the paper has absorbed the water, which may be seen by the wetted side becoming dim as its surface is viewed slantwise against the light, it is to be laid on the drawing board with the wet side downward, and placed so that its edges may be nearly parallel with those of the board, otherwise, in using a T-square, an inconvenience may be experienced. When this is done, lay a straight-edge or flat ruler on the paper, with its edge parallel to and about half an inch from the margin of the paper at one side. The ruler must be held firm. The projecting half-inch of paper is then turned up along its edge. Next, a piece of solid or mouth glue, having its edge partly dissolved by holding it in boiling or warm water for a few seconds, must be passed once or twice along the turned-up edge of the paper, after which, by sliding the ruler over the glued border, it will again be laid flat, and, the ruler being pressed down upon it, the edge of the paper will adhere to the board if sufficient glue has been applied. The ruler may be removed directly, and the edge finally rubbed down with an ivory book knife, or with the butt of a common key, by rubbing on a slip of paper placed on the drawing paper so that the surface of the latter will not be spoiled. By this means the paper will be firmly fastened to the board. This done another, but an adjoining, edge of the paper is to be acted upon in like manner, and then the remaining edges in succession. We say the adjoining edges, because it sometimes occurs that, when the opposite and parallel edges have been laid down first without continuing the progress progressively around the board, a greater degree of accuracy is required to prevent undulations in the paper as it dries. Sometimes a strong paste is used instead of glue, but as this takes a longer time to set, it is usual to wet the paper also on the upper surface to within an inch of the paste, great care being taken not to rub or injure the surface in the process. The wetting of the paper in either case is done for the purpose of expanding it, and the edges being fixed to the board in its enlarged state, they act as stretchers upon the paper while it continues drying, which it should be allowed to do gradually. All creases or undulations by these means disappear from the surface, and it forms a smooth place to receive the drawing.

House Finishing.

From G. N. C., *Hancock, N. H.*—Answering the inquiry of A. B. C., in the February number, I would say I have frequently used O. G. band molding under the stool-cap for inside finish, but I do not like it for outside finish.

I place butts on common doors 6 inches from top of door to top of butt, and 10 inches from bottom of door to bottom of lower butt, increasing to 7 and 11 inches, respectively, if the doors are 7 feet high. I put the knob about 2 feet 10 inches from the floor, varying a little if needed to suit my customers.

From E. A. W., *Cassville, N. Y.*—I am much interested in the column of questions and answers, and in order to call out others I will reply to the queries of A. B. C., of Little Falls, N. Y. As I do not think it good taste to use O. G. band mold under the window stool on the outside, neither do I think it proper to place it under the stool on the inside. Second, my rule is to place the bottom of the lower butt on a line with the top of the bottom rail, and the top butt 7 inches from top of door. When three butts are used, I put the middle butt at the top of lock rail. The position of the lock rail governs the knob. I place the lock in the top of the lock rail, so as to get the knob below the top line of the rail. This necessitates taking out one tenon from the door. I do not think this weakens the door more than mortising through the stile above the rail.

As regards the size of newels in the hall, that depends somewhat on the style and finish of the hall stairs. I very generally use 8-inch newels, and I have used 6 and 7-inch for narrow halls and as large as 13-inch in wide halls. I hope to see the opinions of brother chips in regard to these matters.

REFERRED TO OUR READERS.

Drafting Tables.

From C. V. M. D., *Hannibal, Mo.*—I desire to ask readers of *Carpentry and Building* to suggest some cheap and convenient plan of construction for drafting tables, such as would be suitable to use at home during leisure hours.

Design for Well House.

From T. J. L., *Stockbridge, Mass.*—I have a well over which I would like to build some sort of fancy cover in summer-house style. Will some reader of *Carpentry and Building* furnish me a design, with directions for construction?

Question in Roof Framing.

From J. P. R., *Worcester, Mass.*—I have taken great interest in the letters concerning the art of joining hip roof to a main house. I desire to ask both A. J. H. and A. H. F. how they can set the bottom end of the valley rafter right over the angle of wing and main building, and have the cornice on both the same width?

Wood Carving and Scroll Sawing.

From J. H. K., *Huntington, West Va.*—Will some of the practical readers of *Carpentry and Building* furnish some lessons in wood carving and scroll sawing? I think communications upon these subjects would prove of general interest to your readers.

Designs for Picture Frames.

From A. D. H., *Rochester, N. Y.*—Will some of the readers of *Carpentry and Building* furnish a few designs of picture frames, suitable for construction without machine work? I desire something to make in hard wood that will finish in oil.

Stain for Pine.

From A. D. H., *Rochester, N. Y.*—Will some reader of *Carpentry and Building* please inform me how to stain pipe so that it will appear like oak, ash or cherry? I wish to finish it in oil, if that can be done. If so, a recipe for each style of finish will greatly oblige. I desire also to know how much of the materials will be required to cover a given surface.

Local Customs in Measuring Stone Work.

From M. P. E., *Middlesex, N. Y.*—I have been much benefited by the questions and answers in the correspondence department of *Carpentry and Building.* I now wish to ask a favor for myself. How many cubic feet make a cord of stone, measured after laid in a cellar wall, and how should the wall be measured, not for the mason, but for the parties who furnished stone? Are there any local regulations differing from what we learned at school?

Note.—We take it that our correspondent does not require to be informed upon the simple arithmetical rule, since he refers to what he learned at school, but rather desires to know what is the custom in different sections of the country. Accordingly, we refer this question to our readers for such discussion as they may see fit to give it.

Practical Questions for Shinglers to Discuss.

From Anon.—Much having been said in recent numbers of *Carpentry and Building* about the manner of laying shingles and how much constitutes a day's work at shingling, I think it will be for the good of the trade to have a little chat about the durability of different kinds of shingles, how to nail and prepare them so as to get the most service from them and have them at all times present a good appearance.

To bring out ideas on this subject, I will suggest a few questions which I trust will be properly discussed through the columns of the paper.

If shingles are used as sawn, what kind will last the longest time and make the best covering for a roof? Which is the second best?

If the shingles are to be painted either before or after nailed, and kept painted, is one kind any better than another, and, if so, wherein is the difference? I will remark, in connection with this last question, that the kind of shingles I have in mind are cedar, white pine, chestnut, spruce and fir.

How much of a shingle ought to be laid to the weather on different kinds of houses, and how many nails should be employed in each shingle, taking shingles as they run, from 4 to 8 inches in width?

If shingles are to be painted, should it be done after they are laid or when they are being laid, in order to have the under side of each course laid in paint? Is it advisable simply to paint the butts after the shingles are laid, or is it a better way than all to dip each shingle in paint before laying?

Should boarding under shingles be close, or open so that air can come in contact with the under side of the shingles?

It seems to me a discussion of these questions upon the part of practical men will be of great benefit to the readers of *Carpentry and Building*.

Note.—We heartily second our correspondent's suggestions, and refer these questions to our readers, hoping that practical roofers generally will take them up and give us the benefit of their ideas, together with statements of experience upon each of the points raised.

Book Case and Secretary.

From F. S. H., *McConnellsville, N. Y.*—Will some of the readers of *Carpentry and Building* furnish a design, with details, for a book case and secretary combined? It should be of some late style and of good finish.

Prices of Building Materials in New York, March 20, 1880.

Blinds.—OUTSIDE.

Per lineal, up to 2.10 wide....$ .... @ 0.24
Per lineal, up to 3.1 wide..... .... @ 0.28
Per lineal, up to 3.4 wide...... .... @ 0.31
Per lineal, paint'd and trim'd 0.45 @ 0.55

INSIDE.

Per lineal, 4 folds, Pine....... .... @ .56
Per lineal, 4 folds, ash or chstnut.................... .... @ .90
Per lin'l, 4 folds, cherry or butternut.................. .... @ 1.30
Per lineal, 4 folds, bl'k wal't. .... @ 1.30

Bricks.—(Afloat.)

Pale.................℘ M. $7.00 @ 7.50
Jersey............... 8.00 @ .....
Long Island......... " 9.00 @ .....
Up-River............ " 9.00 @ .....
Havers'aw Bay, 2ds. " 9.50 @ .....
Havers'aw Bay, 1sts. " 10 00 @ .....

FRONTS.

Croton—Brown........℘ M. .... @ $10.00
Croton—Dark.......... " .... @ 11.00
Croton—Red........... " .... @ 11.00
Philadelphia........... " 18.00 @ 20.00
Trenton................ " 17.00 @ 19.00
Baltimore.. .... " 34.00 @ 38.00

Yard prices 50c. ℘ M higher, or, with delivery added, $1.50 per M for Hard and $2.50 per M for front Brick.

FIRE BRICK. (yard prices).

Red Welsh...................$35.00 @ ....
Scotch...................... 30.00 @ ....
English..................... 30.00 @ 35.00
Silica....................... 40.00 @ 50.00
Stourbridge................. 50.00 @ 55.00
American.................... 40.00 @ 50.00
Afloat. 500 ℘ M less

Cement.—(Cargo rate, nominal.)

Rosendale, ℘ bbl............ $ @ 1.25
Portland Saylor's American, ℘ bbl.................. 2.65 @ 3.00
Portland (imported) ℘ bbl.. 3.00 @ ....
Roman............. " .. 2.85 @ 3.00
Keene's coarse..... " .. 6.00 @ 6.25
Keene's fine........ " .. 9.75 @ 10.00
Add 25 cts. to above rates for yard prices.

Doors.—Net to 10 % dis.

RAISED PANELS, TWO SIDES.

2.0 x 6.0	1¼ in.	$1.10	....
2.6 x 6 6	1¼ in.	1.53	....
2.6 x 6 8	1¼ in.	1.58	....
2.8 x 6 8	1¼ in.	1.67	....
2.10 x 6.0	1¼ in.	1.90	...
3.0 x 7.0	1¼ in.	2.00	....

MOULDED.

Size.	1¼ in.	1½ in.	1¾ in
2.0 x 6 0	$1.81	....	....
2.6 x 6 6	2.33	2.68	....
2.6 x 6.8	2.28	2.72	....
2.6 x 6.10	2.32	2.80	....
2.6 x 7.0	2.39	2.91	....
2.8 x 6 8	2.37	2.92	3.56
2.8 x 7 0	2.49	3.03	3.75
2.10 x 6.10	2.61	3.16	3.96
3.0 x 7.0	2.73	3.41	4 20

2nd quality 15 cts. less.

Drain and Sewer Pipe.

Discount 50 to 60 per cent. according to quality and size of order.

Pipe, per foot.		Bends & Elbows, Each.	Branches— Sing.	—Branches D'bl. & V.		Traps, Each.
2 in.	$ .13	$ .40	$ .48	$ ...	Longer than 1 ft., charged as pipe.	$1.00
3 "	.16	.50	.61	...		1.25
4 "	.20	.65	.75	1.30		1.75
5 "	.25	.85	.90	1.55		2.50
6 "	.30	1.15	1.05	1.80		3.50
7 "	.35	1.50	1.20	2.05		5.00
8 "	.45	2.00	1.45	2.45		6.00
9 "	.55	2.50	1.70	2.85		7.00
10 "	.70	3.00	2.00	3.30		8.00
12 "	.80	3.75	2.52	4.24		10.00
15 "	1.25	5.00				
18 "	1.60	7.50				

House Branches pr. lin. ft.		Sewer Branches pr. lin. ft.,	
15x6	$1.75	15 in.	$2.25
18x6	2.50	18 "	3.00

Glass.—(American.)

Prices current per box of 50 feet.

Sizes.	1st.	2d.	3d.	4th.
SINGLE.				
6x 8—10x15	$7.50	$6.75	$6.25	$5.75
11x14—16x24	8.50	7.75	7.25	6.50
18x22—20x30	10.75	9.75	8.75	7.75
15x36—24x30	12.25	10.75	9.00	8.50
26x28—24x36	13.00	11.50	9.75	9.00
26x36—26x44	14.50	13.25	10.75	9.50
26x46—30x50	15.00	14.00	11.25	10.50
30x52—30x54	16.00	14.50	12.00	...
30x56—34x56	17.25	15.50	13.50	....
34x58—34x60	18.25	17.25	15.00	....
36x60—40x60	20.75	18.75	17.25	....
DOUBLE.				
6x 8—10x15	$12.00	$11.00	$10.00	$9.25
11x14—16x24	13.75	12.50	11.75	10.50
18x22—20x30	17.25	15.75	14.00	....
15x36—24x30	19.75	17.25	14.50	....
26x28—24x36	21.00	18.50	15.75	....
26x36—26x44	23.25	21.25	17.25	....
26x46—30x50	24.00	22.50	18.00	....
30x52—30x54	25.75	23.25	19.25	....
x56—34x56	27.75	25.00	21.75	....
34x58—34x60	29.25	27.75	24.00	....
36x60—40x60	33.25	30.00	27.75	....

Sizes above—$10 per box extra for every five inches.

An additional 10 per cent. will be charged for all glass more than 40 inches wide. All sizes above 52 inches in length, and not making more than 81 inches, will be charged in the 84 united inches' bracket. Discounts: Single, 50 @ 5%; Double, 50 & 15

French

WINDOW, PICTURE AND CAR GLASS.

Prices current per box of 50 feet.

Sizes.	1st.	2d.	3d.	4th.
SINGLE.				
6x 8—10x15	$8.00	$6.75	$6.25	$5.75
11x14—16x24	8.75	8.00	7.50	7.00
18x22—20x30	11.25	10.50	9.75	8.75
15x36—24x30	12.75	11.50	10.00	. .
26x28—24x36	13 50	12.25	11.25	. .
26x36—26x44	14 75	13.75	11.75	..
26x46—30x50	16.25	15.00	13.00	....
30x52—30x54	17.25	16.00	13.50	...
30x56—34x56	18.75	16.75	15 00	...
34x58—34x60	19.50	18.00	16.00	....
36x60—40x60	21.00	19.50	18.00	.. .
DOUBLE.				
6x 8—10x15	$12.00	$11.00	$10.00	$9.25
11x14—16x24	14.75	13.75	12.75	11.75
18x22—20x30	19.00	17.75	16.00	....
15x36—24x30	21.50	19.25	16.50	....
26x28—24x36	23.00	20.75	18.25	....
26x36—26x44	25.00	23.00	19.25	....
26x46—30x50	27.00	25.00	21.25	....
30x52—30x54	28.50	26.00	22.25	....
30x56—34x56	30.00	27.75	24.75	....
34x58x34x60	31.75	30.00	27.00	....
36x60—40x60	35.50	32.50	30.25	....

Sizes above—$10 per box extra for every five inches.

An additional 10 per cent. will be charged for all glass more than 40 inches wide. All sizes above 52 inches in length, and not making more than 81 united inches, will be charged in the 84 united inches' bracket.

Discounts: Single, 40 & 10; Double, 60%

GREENHOUSE, SKYLIGHT AND FLOOR GLASS

Per square foot, net cash.

⅛ Fluted plate,	case 10c;	cut to size	14c.
3-16 Fluted plate	" 13c.	" "	16c.
¼ Fluted plate	" 16c.	" "	18c.
¼ Rough plate	" 16c.	" "	18c.
⅜ Rough plate	" 21c.	" "	27c.
½ Rough plate	" 28c.	" "	33c.
¾ Rough plate	" 45c.	" "	55c.
1 Rough plate	" 55c.	" "	65c.

Hair.

Cattle..............℘ bushel..$ .... @ 0.17
Goat............... " .... @ 0.20

Lath.

Cargo rate............ ℘ M $ 2.35 @ 2.50

Lime.

Glen's Falls, or Keenan's common, cargo rate ℘ bbl................. 1 00 @ ....
Glen's Falls, or Keenan's finishing Jointa....................... 1.20 @ 1.25
Rockland, common........... 1.00 @ 1.05
Rockland, finishing........... 1.25 @ 1.30
Add 25c. to above figures for yard rates.

Lumber.—(Yard prices.)

Market firm with upward tendency.

Pine, very choice and ex.. dry, ℘ M. ft. thick........$65 00 @ $70.00
Pine, clear.................. 60.00 @ 65.00
Pine, selects................ 45.00 @ 50.00
Pine, selected, box......... 20.00 @ 22.00
Pine, common box.......... 18.00 @ 20.00
Pine, common box, ⅝...... 15 00 @ 16.00
Pine, 1¼x10, 13 ft., matched, each................ .40 @ .43
Pine, 1¼x10, 13 ft.. culls.... .28 @ .30
Pine, 1x10, 13 ft., good matched, each........... ... @ .30
Pine, 1x10, 13 ft., common, matched, each........... .23 @ .25
Pine, 1x4½, clear, match'd, each.................... .23 @ .25
Pine, 1x4½, merchantable, matched, each........... .17 @ .18
Pine, 1¼x4½, cl'r, match'd, each.................... ... @ .35
ine, 1¼x4½, merchant-Mable, matched, each....... .28 @ .30
Spruce, 1x9, 13 ft., rough... .18 @ .20
Spruce, 1x9, 13 ft. matched, each...................... .20 @ .22
Spruce, 1¼x9, 13 ft., rough. .21 @ .22
Spruce, 1¼x9, 13 ft., matched, each.................. .23 @ .25
Spruce, 2x9, 13 ft., rough.. .36 @ 40
Spruce, 2x9, 13 ft., match'd, each...................... .40 @ .42
Spruce, 2x4, 13 ft.... .... .13 @ .14
Spruce timber, flat, ℘ M ft 20.00 @ 22.00
Spruce timber, square, ℘ M ft.................. 22.00 @ 25.00
Hemlock, 1x10, 13 ft., each. .. @ .17
Hemlock, 2½x4, 13 ft.,each. .14 @ .15
Hemlock, 3x4, 13 ft., each.. .. @ .16
Hemlock, 4x6, 13 ft., each.. .40 @ .43
Ash, good, ℘ M ft........... 45.00 @ 55.00
Oak......................... 45.00 @ 55.00
Oak, quartered ... . 70.00 @ 90.00
Maple, common............ 25.00 @ 35.00
Maple, good to 2 in......... 40.00 @ 45.00
Maple good thick........... 45.00 @ 55.00
Maple white................ 55.00 @ 60.00
Chestnut.................... 45.00 @ 60.00
Bl'k walnut, good to choice 85.00 @ 100.00
Black Walnut 2d........... 55.00 @ 65.00
Black walnut, ⅝........... 75.00 @ 85.00
Black walnut, selected and seasoned................ 100.00 @ 120.00
Bl'k walnut counters, ℘ ft. .12½ @ .20
Cherry, wide, ℘ M ft....... 85.00 @ 100.00
Cherry, ordinary........... 60.00 @ 80.00
Whitewood, or Poplar 1 to 1½ inch.................. 40.00 @ 50.00
Whitewood, or Poplar ⅝ in. 30.00 @ 35.00
Whitewood, or Poplar ⅝ panels.................... 35.00 @ 45.00
Shingles, extra sawed pine, 18 in., ... 5.00 @ 6.00
Shingles, clear sawed pine, 18 in., 2 nd................ 4.00 @ 5.00
Shingles, cypress, 7x24..... 14.00 @ 18.00
Shingles, cypress, 6x20..... 12.00 @ 14.00
Shingles, Cedar, 6x24, No. 1 — @ 22.00
Shingles, Cedar, 6x24, A's.. — @ 16.00
Shingles, Cedar, 6x20, No. 1 — @ 12.50
Shingles, Cedar, 6x20, A's.. — @ 10.00
Shingles, Cedar Eastern... — @ 3.50
Shingles, Pine............. — @ 3.75
Shingles, Spruce........... — @ 3.50
Yellow pine dressed flooring, wide, ℘ M ft......... 29.00 @ 24.00
Narrow ditto............. 30.00 @ 35.00
Yellow pine timber........ 30.00 @ 45.00
Locust posts, 8 ft., ℘ in..... .18 @ .20
Locust posts, 10 ft.,.......... .24 @ .25
Locust posts, 12 ft........... .25 @ .30
Chestnut posts, ℘ ft... .... .3 @ .3½
Mahogany, ¼ in. ℘ ft....... .5 @ .7
Mahogany, ⅜ in. ℘ ft....... .8 @ .10
Mahogany, ½ in. ℘ ft....... .10 @ .12
Mahogany, ⅝ in. ℘ ft....... .12 @ .14
Mahogany, ¾ in. ℘ ft....... .14 @ .16
Mahogany 1 in. ℘ ft........ .16 @ .18
Rosewood, ⅛ in. ℘ ft....... .11 @ .15
Rosewood, ¼ in. ℘ ft....... .16 @ .20
Rosewood, ⅜ in. ℘ ft....... .24 @ .28
Rosewood, ⅝ in. ℘ ft....... .40 @ .45
Rosewood, 1 in. ℘ ft........ .60 @ .75
Satin wood, ½ in. ℘ ft...... .25 @ .35
Satin wood, 1 in. ℘ ft........ .35 @ .50
White holley ¼-inch........ .10 @ .12
White holley ⅜-inch........ .15 @ .18
Cedar (Cuban and Mexican) ℘ ft.................... .10 @ .14
Cedar (Florida)............... @
Less than 1 inch.......... .10 @ .24
1 inch and over ... . .25 @ .30

Moldings.

60c. to 80c. per inch per 100 feet, according to quality.

Paper.

Rope, waterproof building, ℘ ℔ .16 @ .17
Rosin Sized Sheating, ℘ ℔. .4 @ .5
Dry Sheating ℘ ℔.......... .3 @ 3½
Tarred Felt. ℘ ℔........... .... @ .3

Plaster.

Calcined City........Mill rate..$1.05 @ 1.10

Sash.—Net to 10 % dis.

GLAZED.

Dimensions of windows.	12 Lights. 1¼ pl.	12 Lights. 1¼ c.	12 Lights. 1½ c.	8 L's. 1½ c.	4 Lights. 1¼ c.	4 Lights. 1½ c.
2.1x3.6	$1.12	1.20	....	....	....	....
2.4x3.10	1.28	1.36	....	....	1.52	....
2.7x4.6	1.59	1.67	....	....	1.90	2 00
2.7x4.10	1.68	1.75	....	....	2.20	2.30
2.7x5.2	....	1.85	....	....	2.28	2.40
2.7x5.6	....	.. .	....	2.49	2.45	2.60
2.7x5.10	....	....	....	2.54	2.60	2.75
2.10x4.6	1.71	1.81	1.92	....	....	....
2.10x5.2	1.91	2.00	2.16	2.51	2.50	2.65
2.10x5.6	2.05	2.16	2.35	2.56	2.64	2.83
2.10x5.10	2.35	2.45	2.65	2.69	....	3.05

c. means counted checked—plowed and bored for weights.

Hot bed sash, glazed..................$2.35

HEAD LIGHT.

Two or three Lights, Glazed.

Size.	1¼	1½	Size.	1¼	1½
2.6x1.0	65	75	2.10x1.0	65	80
2.6x1.6	75	85	2.10x1.6	80	90
2.8x1.0	65	75	3 0x1.0	70	85
2.8x1.6	75	90	3.0x1.6	95	1.05

Slate.

By car load, delivered in New York.

Purple roofing slate, ℘ sq're.$5.50 @ $6.00
Green slate.................... 5.50 @ 6.00
Red slate...................... .... @ 10.00
Black slate, Pennsylvania... .... @ 4.00
Tiles, 1¼ in. rubbed, ℘ sq. ft. .25 @ .28

℘ sup. ft.

Steps and platforms, 1 in. thick........30c
" " 1½ " 40c
" " 2 " 55c
Risers, 1 inch thick....................35c
Coping, 1½ " 35c
" 2 " 49c

Lineal ft.

Window sills, 4x7.........................55c
" 3x7.........................45c
Window caps, 4x10, plain...............80c
" 4x8, " 60c
" 3x10, " 55c
" 3x8, " 50c

Stair Material.

BALUSTERS.

Black Walnut.	1½ in.	1¾ in.	2 in.	2½ in
Fancy Turned	7c	9c	10c	16c
Neck Turned	9c	10c	12c	19c
Fluted or Octagon	12c	14c	17c	25c

OCTAGON PANELED NEWELS.

Panels Veneered with French Walnut.

8-inch Newels, with Cap............ $6.12
9 " " " 6.88
10 " " " 7.60

SOLID NEWELS, WITH CAPS.

Black Walnut.	5 in.	6 in.	7 in.	8 in.
Fancy Turned	$1.60	$1.90	$2.50	$3.40
Octagon	2.10	2.40	3.00	3.90

STAIR RAIL.

Worked out and finished ready to put up. Easements and cylinders counted double. Price per foot (Newels and Balusters not included).

Black Walnut.	3 in.	3½ in.	4 in.	4½ in.
Molded	40c	45c	50c	53c
Toad Back	45c	50c	63c	68c

STAIR RAIL, UNFINISHED.

Price per foot.

Black Walnut.	3 in.	3½ in.	4 in.	4½ in
Molded	11c	13c	15c	17c
Toad Back	12c	14c	16c	18c

Stone.

Cargo rates, delivered at New York.

Amherst freestone, in rough, ℘ C ft.......................$0.85 @ $0.90
Berlin freestone, in rough... 0.85 @ 0.90
Berea freestone, in rough.... .... @ .80
Brown stone, Portland, Ct... 1.25 @ 1.50
Brown stone, Belleville, N. J. 1.00 @ 1.50
Granite rough................. .50 @ 1.00
Dorchester, N. B., stone, rough................℘ foot. .... @ 1.00

BLUE STONE.

Rubbed hearth, 10 ft. or under........ 25c
Rubbed hearth, 20 ft. or under........ 35c
Rubbed hearth, 30 ft. or under........ 45c
Rubbed hearth, 40 ft. or under........ 50c
Rubbed sills............................ 30c
Sawed & Planed......................... 40c
Sills and lintels........ .... @ 18c
Sills and lintels, fine quarry cut sills......................... .... @ 35c
Coping, 11 to 18 in. wide.......... 20c @ 34c
Coping, 20 to 28 in. wide.......... 38c @ 60c
Coping, 30 to 36 in. wide.......... 65c @ 80c
Steps, 8 in.......................... .... @ 60c
Steps, 7 in.......................... .... @ 55c
Steps, 6 in.......................... .... @ 35c
Steps, door. per in. wide........ .... @ 3c
Platforms, promiscuous, 4 in... .... @ 32c

Vault Lights.—Nominal.

Platform, sq ft.................... ....$3.50
Step and risers, sq. ft.................. 3.50
Floor light, sq. ft....................... 2.50
Roof light, sq. ft........................ 2.50
Platform, 2d quality, sq. ft........... 2.60

COVERS.

Diameter.	Round.	Hexagon.
14 inch	$3.00	$0.00
16 "	3.75	4.00
18 "	5.50	6.00
20 "	8.00	8.50
24 "	14.00	15.0
26 "	16.00	17.0
30 "	23.50	25.0
36 "	31.00	33.0

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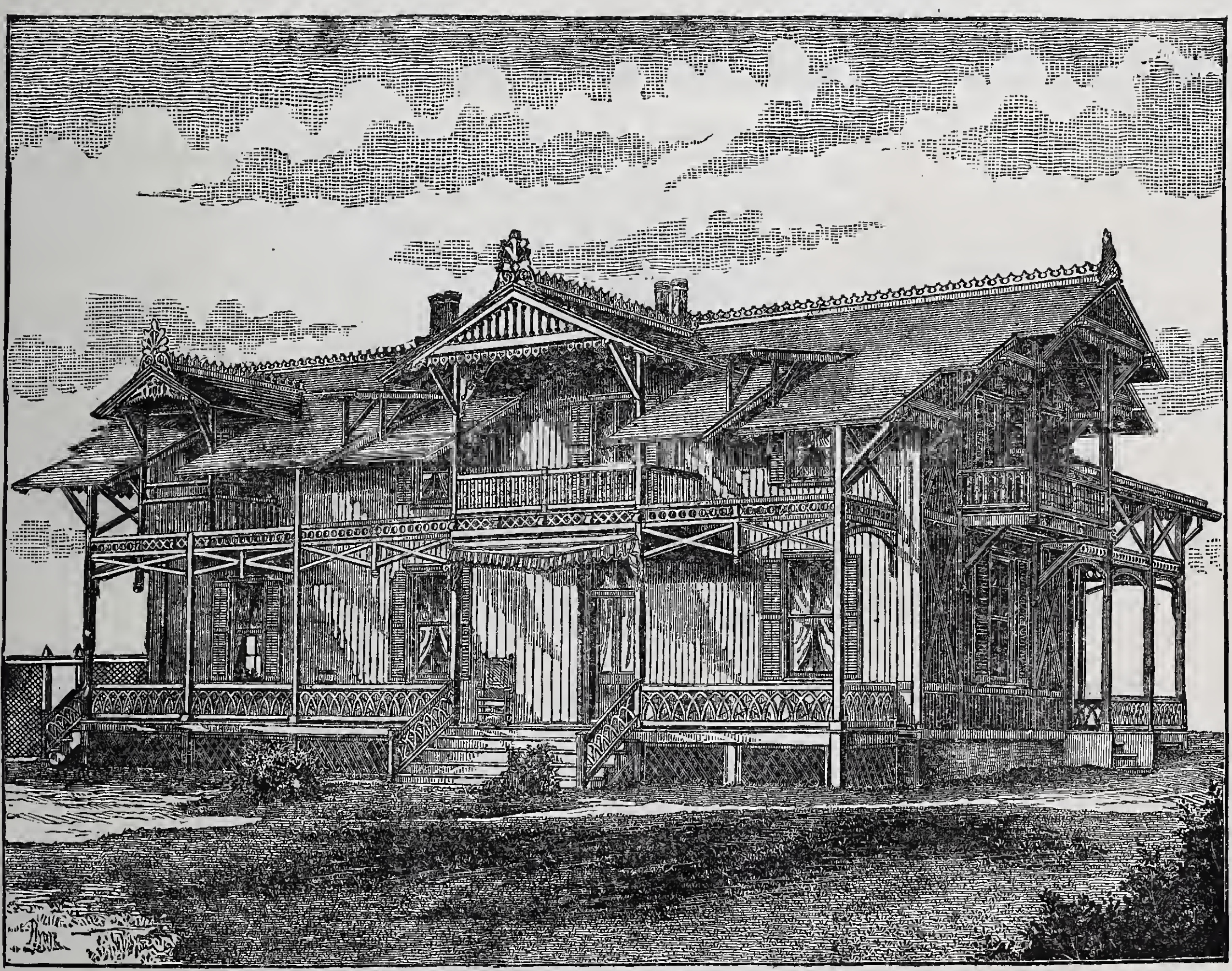
Summer Cities.

Every one is familiar with the term watering place or summer resort. A large hotel either at the seaside, or among the mountains, or near some famous lake, with broad piazzas filled with crowds of elegantly dressed people, of fine equipages, of accommodations for boating, fishing, and even more expensive amusements, of ball rooms and club rooms, and all that goes to make up the gay life of fashionable society, is the picture presented to the mind by the term. So inseparable has become the idea of fashion and expense with the names of summer resort and watering place, that there are many people who do not know that fresh air can be had away from home at any less cost than the price paid for it by fashion's votaries. There are, however, scattered all over the country, what may be termed summer cities, which are managed upon entirely different principles from those controlling such summer resorts as we have just described. In some cases, these summer cities are to be found in groves near our inland towns, sometimes they are located in the mountains, again near picturesque lakes, and in some instances upon islands, while a great many of them are scattered along the sea coast.

As scientific knowledge has advanced, and men have become better acquainted with the laws governing correct living, it has become evident that a great many of the old Hebrew regulations, usually supposed to be strictly religious in character, were founded upon a deep knowledge of the physical necessities of the human race. One of these customs, which is usually considered as having a strictly religious bearing, was the Feast of Tabernacles, in which the Hebrew population left their houses and for eight days dwelt in booths or tents in the open air. The revival of the open-air feast in the form of a religious service among the Methodists, gave rise to what we have called our summer cities. The camp meeting, which was at first simply a meeting extending over a week, or perhaps a little longer space of time, and which was conducted in a grove on account of convenience, and where, for like reason, those who attended dwelt in tents, proved itself of such practical character and so valuable in results not only to the moral, but also to the physical needs of the people, that in time the practice of holding religious meetings in groves spread to other denominations. As cheap houses began to take the place of tents, people who had little sympathy with camp meetings in their religious character, were induced to spend their vacations in some one of the summer cities. An outdoor life for a few weeks in the warm season proves to be absolutely necessary to the best health of town-bred people.

The wants of these summer cities, whether in the mountains or on the seashore, in the East or in the West, have created a style of architecture peculiar to themselves. The houses are entirely different from anything found elsewhere. The number of such houses which have been constructed within the past few years is almost beyond calculation. Besides the regular camp grounds and summer cities which have sprung up around them, such as Martha's Vineyard, Eastham, Northport, Round Lake, Old Orchard, Chautauqua, Ocean Grove, Sea Cliff and others, there are hundreds of places resembling them in character, but which do not have a special religious interest. A large proportion of the residences between Long Branch and Sandy Hook, and down the Jersey Coast, as at Cape May and Atlantic City, resemble very much in character those of the camp grounds proper. A consideration of the architecture peculiar to our summer cities would not be complete if these were excepted.

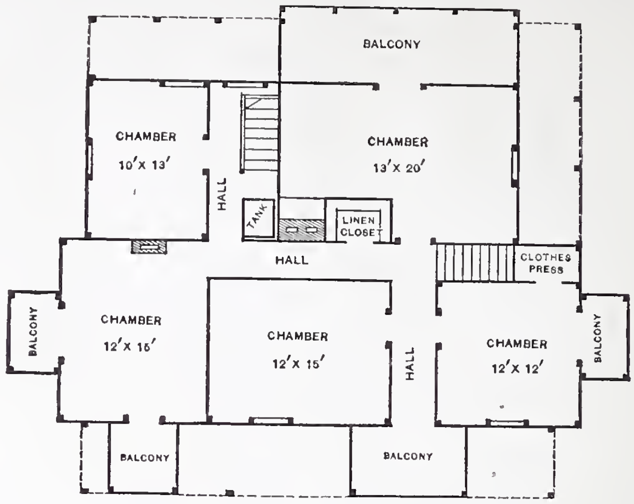


Summer Cities.—Fig. 1.—House at Seabright.—Briggs & Comen, Architects, Newark, N. J.—Built in 1873.—Cost, $4700.

The primary idea was a tent. When it became convenient, boards replaced the boughs with which the early tents were floored. Following the floors came a light framework, often put together with screws or hooks, upon which the tent was stretched. Board roofs above canvas sides followed, the use of canvas obviating the need of windows. Sliding frames, covered with canvas, formed the doors. In this transition period small board out-houses were used for kitchens, and from these the next step was light unfinished houses, built almost without framework. The more pretentious structures of a later day, and to which we have alluded, were apparently developed in a sort of mongrel fashion. They took picturesque features from the villas of fashionable summer resorts, and combined them with the cheap and open construction of the light cottages which replaced the tents of the camp meeting.

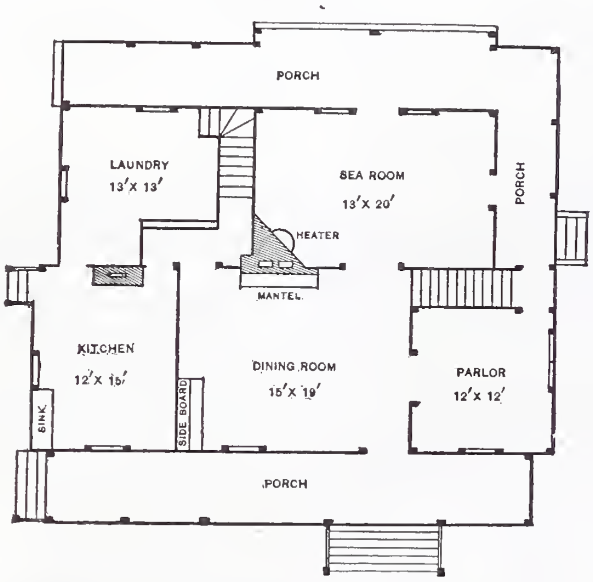
Perhaps it would not be improper to classify the structures peculiar to our summer cities under two general heads, viz.—those which take the place of tents and are called "cottages," and those which take the place of villas. Of the latter, the most characteristic feature is the external form and decoration, for the interior is frequently finished quite plainly. It is luxurious only in its furnishing and the number of its rooms. The "cottage," in a vast majority of cases, still holds what might be called the position of a wooden tent—it is fit for occupancy only in the summer. At first there was no finish of the interior of the cottages. The walls consisted of one thickness of matched boards, and whatever timber work was employed was exposed upon the inside. This construction, however, has been found objectionable, and a large proportion of the cottages now erected are finished with lath and plaster; but the structure is as light and the woodwork as cheap as before. Ornamentation of the exterior has received considerable attention, and brackets and scroll-sawed work are freely employed. Being intended for use only during the warm months, a certain somber appearance is given to many of the buildings by the use of verandas and balconies. A cottage is scarcely comfortable in the summer without them. They usually afford shade during the greater part of the day, and at the same time give the occupants a comfortable lounging place out of doors.

The illustrations presented herewith show the two classes of buildings to which we have alluded. The house represented in Fig. 1 is an example of the mongrel structures we have described, and is a fair specimen of those buildings that combine the features of both tent and villa. The balconies of this building are more in appearance than reality, there being three small ones, although from the appearance of the front it would seem that a single veranda extended all the way around the house. On the lower floor there is abundant room for lounging, and at the same time there is ample shade. Though houses of this kind are usually located in cool and sheltered situations, yet, as they are occupied during the hottest months of the year, special protection from the heat, as well as room for outdoor lounging, is a necessity. The windows in this building are well protected from the sun, while, at the same time, they afford pleasant views, thus enlivening the house. This is very necessary, because a dull day in a summer cottage is the dullest of all imaginable things. Houses not being furnished for anything beyond sleeping and eating, and recreation coming exclusively from outdoors, it is very essential to have the outlook as pleasant as possible. It is only what can be seen from the windows that affords diversion to one confined within doors.



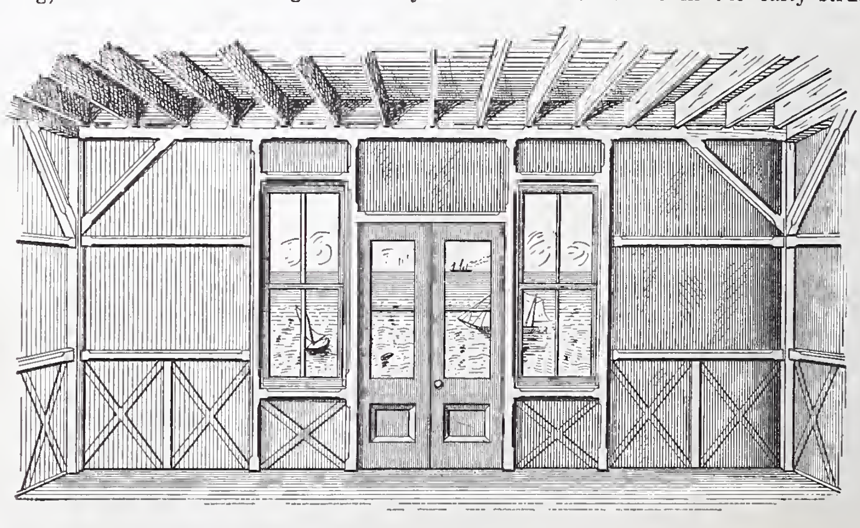
Summer Cities.—Fig. 3.—Second Floor Plan of House at Seabright.—Scale, 1-16 Inch to the Foot.

The character of the finish in buildings of this sort is entirely dependent upon the artistic ability of the architect or designer, or carpenter who erects the building. As the amount of money to be expended is very commonly limited, the work must be of the simplest character, and effects must be produced by the most legitimate of means. The two interior views (Figs. 4 and 5) show very fairly the type of finish adopted in not only the poorest, but in the best, houses of these classes. Plain timber work, with chamfered edges, single thickness of boarded walls, and exposed floor joist, are the principal members for finish by which to produce relief and make the general aspect pleasing. In the cheapest houses the whole inside is allowed to yellow with time. An improvement upon this, and a little more expensive, is a shellac finish, with painted ceilings and skirtings, the timbers painted in light, delicate tints, and chamfered corners in bright colors. In Fig. 4 is shown large double doors and windows side by side, which open the whole room to a view of the sea. As will be noticed by the caption, and also by reference to the floor plan (Fig. 2), it is appropriately denominated the "Sea Room." Such large openings are common in houses of this character, and in a measure decorate one side of the room.



Summer Cities.—Fig. 2.—First Floor Plan of House at Seabright.—Scale, 1-16 Inch to the Foot.

In Fig. 5 we have a sketch of a stairway occurring in another house of the same general kind, showing a rather luxurious fitting up of windows and doors with curtains. In this connection it may be well to state that the steady tendency in furnishing these houses is toward greater luxury and more comfort. While in the early structures, and in more simple times, the plainest furniture and the least in quantity was considered sufficient, now reclining chairs



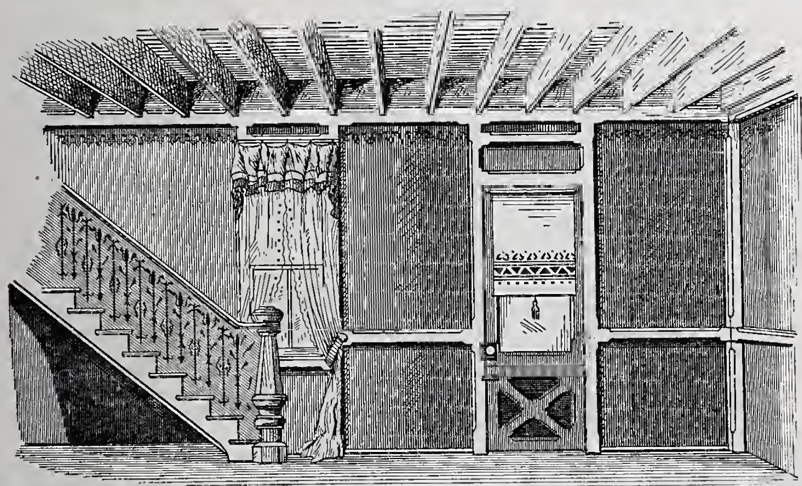
Summer Cities.—Fig. 4.—" Sea Room " in House at Seabright.

lounges, cane furniture, and everything which renders life comfortable in hot weather are freely used.

Fig. 6 represents a house which may be described as the first remove from the wooden tent. It is two stories in hight, and contains as many sleeping rooms as can possibly be got into the upper part. On the first floor, according to common practice, there are two rooms. One is used as a dining room, and the other, which is open upon all occasions, is a sitting room, reception room or parlor, and at night is very likely to be used as a bedroom. Behind the building is the simplest form of a kitchen. In front of this house there is a veranda with a balcony above, and, as is common in the cheaper forms of buildings, the balcony is without shelter. The cost of making the roof project enough to shade not only the walls, but also the front and rear of the building, is so small that in many cases the roof is carried forward so as to cover the balcony and back far enough to shelter the rear part of the house.

The house shown in Fig. 7, although rather large, and containing more rooms than the typical house of its kind, shows the direction of development, and may be taken as a type of a large number of buildings It is somewhat more pretentious in its character than the one just described. The veranda extends around two sides, and very frequently, in houses of its class, is carried around three sides. The projection in the roof covers the balcony in front and measurably protects it at the sides. The supports to the projecting roof and the balustrade are converted into decorative features, which contrast pleasantly with the background against which the house is seen.

Summer Cities.—Fig. 6.—A Cottage at Ocean Grove.



Summer Cities.—Fig. 5.—View in House at Monmouth Beach.

The painting of houses in the summer cities is a matter of considerable importance, and one upon which taste should be exercised. The outside of the house shown upon our first page is painted as follows: The wall surfaces, buff; the exposed timber work, a light brown; the open work of front and balustrades of verandas is painted a buff, the same as the walls of the house; chamfered corners of posts, &c., vermilion; cresting, and finials of roof, buff, same as walls; the window shutters are a light tan color, and the roof is a light reddish brown. The whole effect is good.

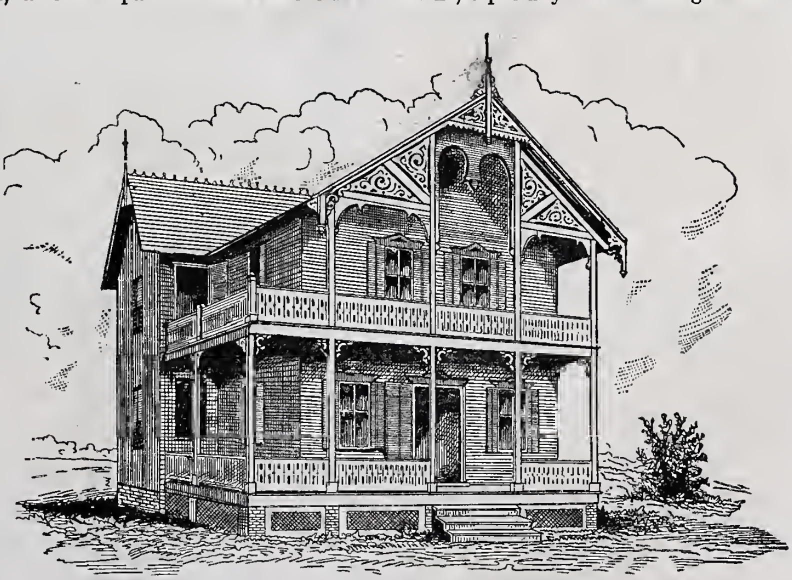
We might extend our description of houses to be found in summer cities much further with both interest and profit; but enough has now been said to give our readers an intelligent conception of the needs of houses for these places, together with some idea of the manner of erecting and finishing them commonly employed. Perhaps we shall resume the subject at another time, calling attention more especially to particular features embodied in summer cottages, and their simplicity in both construction and decoration. The floor plans shown in Figs. 2 and 3, belonging to the house upon the first page, besides indicating the arrangement of rooms in this particular building, illustrate features of construction to which we have alluded above. It will be seen that all the timber work is exposed upon the inside, and that the walls are of single thickness of boards.

Oak Made to Look Like Ebony.—Oak may be so dyed as to resemble ebony. Soak it for 48 hours in a hot solution of alum, and then paint it with a decoction of one part of campeachy wood in 11 parts water. This decoction should be first filtered and slowly boiled down to one-half its volume, when 10 to 15 drops of neutral indigo should be added for every quart it contains. After the application of this the wood should be rubbed with a saturated solution of verdigris in acetic acid until the desired tint is obtained.

Bird's-Eye Maple.

This beautiful wood is found both in Europe and America, but it is with the American that the present article deals, as being best known in England, so says a London paper. Mottled maple is also a native of the latter Continent, and is principally used for picture frames. The grain of the bird's-eye maple varies as the saw divides the eyes transversely or longitudinally, and pieces cut out in circular sweeps, such as chair backs, sometimes exhibit both the bird's-eye and the mottle at different parts. The occurrence of eyes, zones, spots and small curls in the wood gives rise to figures of great beauty. Of the wood so marked, bird's-eye maple, amboyna wood, the roots or butt of the common yew, and the common maple, are, perhaps, the most beautiful. The knobby tubercles that form in the root and trunk of the common elm from the repeated stripping off of the side branches, as is the general practice around London, afford, occasionally, very fine specimens, which are known by the name of "curled elm."

The maple was highly prized by the Romans, especially that which grew in Istria and Bœotia, and was distinguished by its curled peacock-tail veins. Pliny says it ex-



Summer Cities.—Fig. 7.—Another Cottage at Ocean Grove.

ceeded even the *citrus* in value, but could be obtained only in small pieces, for writing desks and similar articles. The bird's-eye maple shows, in finished work, the peculiar appearance of small dots or ridges, or of little conical projections, with a small hollow in the center, but without any resem blance to knots, the apparent cause of ornament in woods of similar character, as the burrs of the yew, and kiaboca and the Russian maple (or birch tree), and this led Mr. Holtzapffel to seek a different cause for its formation. He states that, on examination, he found the stem of the bird's-eye maple of America, when stripped of its bark, presented little pits or hollows, as if made with a conical punch, others ill-defined and flattened, like the impression of a hob-nail. Suspecting these indentations to arise from internal spines or points in the bark, a piece of the latter was stripped from another block, when the surmise was verified from its appearance. The layers of wood being molded upon these spines, each of their fibers is abruptly curved at the respective places, and when cut through, they give, in the tangential slice, the appearance of projections, the same as some rose-engine patterns, and the more recent medallic engravings, in which the closer approximation of the lines at their curvatures causes these parts to be more black (or shaded), and produces upon the plate-surfaces the appearance of waves and ridges, or of the subjects of the medal.

Friction.

The amount of power wasted by needless friction is something beyond belief when we examine into the quantity actually needed for any given operation. In some mechanical operations a certain amount of friction is really needed, and it would be inconvenient to have the work go on too easily. In general, however, we find friction is a waste, often costly and usually a great source of wear and tear.

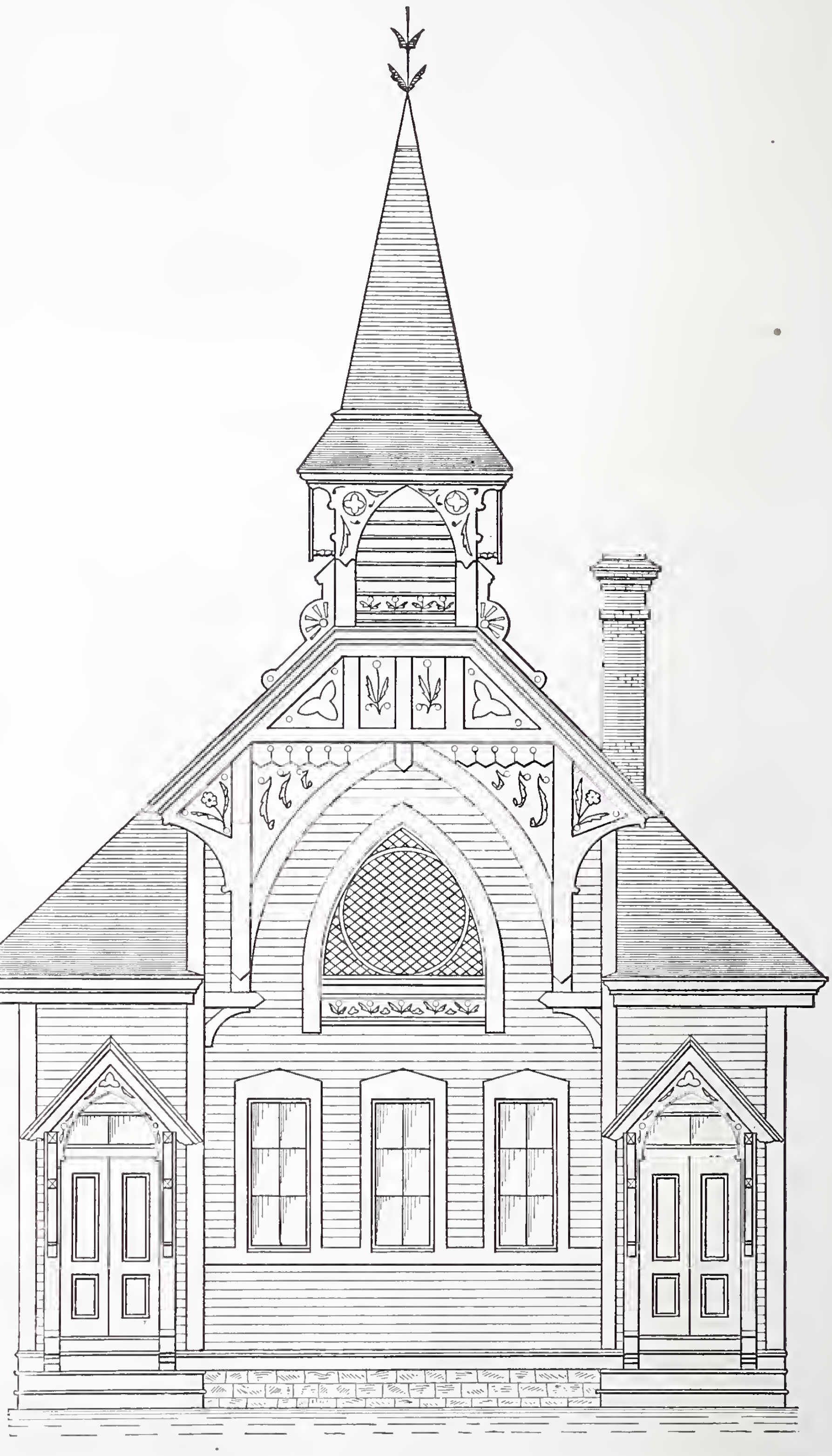
The quantity of friction, if we may use the word in this connection, depends entirely upon the weight. If a block of metal is made to slide upon a metal surface, the force required to move the block will depend entirely upon the weight, and not the size, of the block. If the sides and edges of a brick-shaped block are equally smooth, this may be demonstrated by pulling the block across the surface by means of a pulley and weight. The weight which will move it upon its edge will also move it when lying upon its broadside. Ignorance of this fact among builders or designers of machinery are increase of friction and a great and rapid wear of tools and machines. The common idea is that by making the surface as small as possible the friction will be proportionally diminished. It is easy, however, by diminishing the size of a bearing or rubbing surface to make it so small that the pressure makes the surfaces "cut." That is, the pressure forces the particles into such close contact that they interlock and are stripped off when one surface is moved upon the other.

Different substances and different surfaces vary in the amount of force needed to move them under the same pressure. A rough surface needs more power to drag it across another rough surface, than would be needed to move smooth surfaces of the same substance loaded with the same amount of weights. It was discovered early in the history of the mechanical arts that as rubbing surfaces became polished friction decreased; and the better the polish the less the friction—at least that is the rule with most substances, and the exceptions are always due to other causes which cannot be considered here.

A Day's Work for a French Bricklayer.—A French bricklayer, according to the statement of a correspondent of the English building journals, will execute about two meters cube of brickwork in a day. That would be equal to laying 990 brick in 11 hours. This number is some 300 or 400 less than a day's work of an Englishman upon similar work, while comparing it with the work of American mechanics the difference is still greater.

Design for a Cheap Frame Church.

The accompanying engravings represent a cheap frame church, contributed by Mr. John A. Bayliss, of Providence, R. I. The design is one suitable for erection in a small village, and coming from a practical man, possesses some features likely to prove of especial interest to our readers. The building is so completely shown by the elevations, plan, section and details, that an extended description is unnecessary. The author of the design, in a letter accompanying the plans, says: "I must apologize somewhat for the execution of the drawings, since I never attended a drawing school in my life. I have long expected to get up something for *Carpentry and Building*, but each time when I got my task finished, it was of a character not satisfactory to me, and therefore was not sent. The features of the accompanying drawings are such that any good mechanic can execute the design from the plans without trouble. The cellar is provided both for ventilation under the floor and to accommodate a furnace, in case that method of heating is desired. As to the finish of the inside of the building, the ceiling may be formed on the line of the lower edge of trusses, thus hiding all the framework, or the framework may be exposed being finished properly for this purpose.'

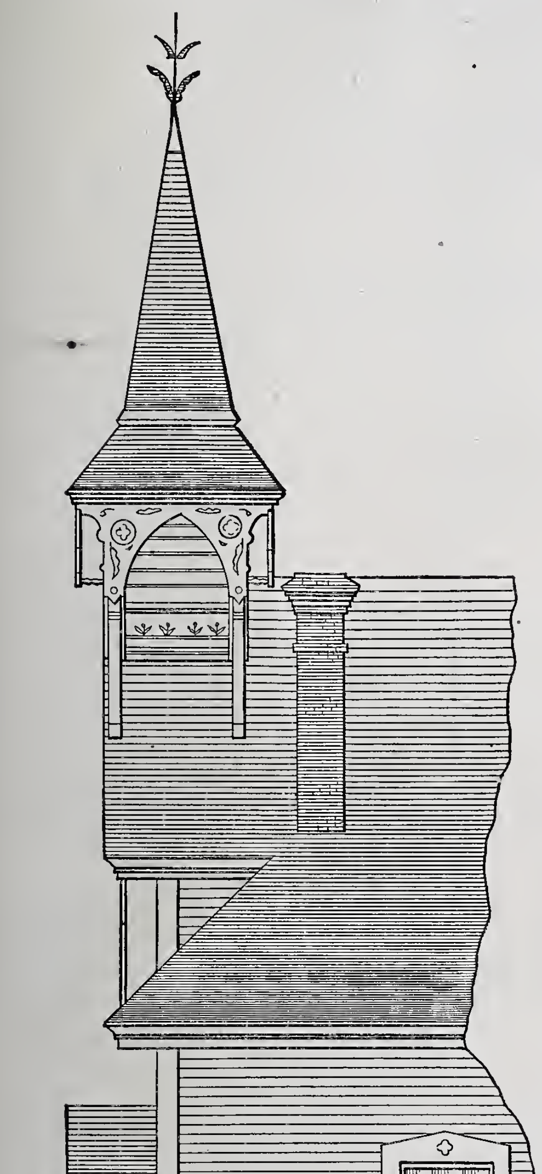


Frame Church.—Fig. 1.—Front Elevation.—Scale, ⅛ Inch to the Foot.—John A. Bayliss, Providence, R. I., Architect.

Mr. Bayliss does not accompany his plans by any estimate, and, considering the condition of the markets at this time, we shall not venture to make one ourselves. The building is very simple in all its parts, and is of a character upon which any mechanic can readily figure. The most casual inspection of the front and side elevation reveals many features of a pleasing character, and yet the work employed is of a kind not necessarily expensive. We believe the design thus furnished will meet the requirements of several correspondents who have recently written for plans of an inexpensive frame church.

Natural Qualifications of Mechanics.

It is remarkable that the desire of a young man to become a finished workman or adept in any business is not always a criterion of his natural fitness for the work. Everyone must have noticed that, after all, the desire



Frame Church.—Fig. 2.—Side Elevation.—Scale, ⅛ Inch to the Foot.

to excel in any particular line has little to do with the qualifications of the enthusiast. It seems more than probable, also, that one reason why there are so many indifferent mechanics and uninterested workmen is because desire or circumstances drifted them into mechanical eddies, where they keep sailing around and around, without purpose or effect, of less account than the chips that keep in the current and float seaward unattracted. There are thousands of admirers of his work to one Meissonier. There were thousands of visitors to Mechanic Hall, Philadelphia, who admired the products of mechanical skill, but the true mechanic was as one to 50. Young men who wish to become good mechanics have an honorable ambition. But there are certain natural qualifications that all the instruction of an apprenticeship cannot supersede.

Mechanics understand what is meant by a "mechanical eye." Without cultivation and practice, the mechanical eye can never reach the point of excellence that enables its possessor to form a good judgment on relations of lines, sizes, proportions and adaptedness. But the mechanical eye, even without technical practice, is offended with a picture hung awry; objects to disproportion, as enormous wooden moldings to support a light roof; sees incongruity between heavy running gear and a single seated carriage; detectsthe fault in an imperfect circle, and can tell at a glance if two lines are parallel, convergent or divergent. When cultivated, this faculty is wonderfully exact in its observations. The possessor will select from a pile of bars of iron all the sizes without the use of a rule or caliper gauge, detect the slightest throw out from the center of a rotating shaft or pulley, and in nine cases out of ten make a prick punch center in the end of a bar where it should be. Such a man will not waste metal in useless shapes. He will give the proper proportions to every part of the machine, and, if a draftsman, will never err in making cumbrousness do duty for strength, nor try to imitate flexible grace in rigid metal.

There ought to be preliminary tests for the would-be apprentice. Recently our railroad companies have instituted a series of experiments to determine the capacity of their employees to distinguish colors. It would be well if mechanics' apprentices were subjected to tests before they have been labored with and instructed half through a novitiate. If a candidate for apprenticeship cannot tell when a round bar on centers runs out, nor determine a taper from a parallel, he will never learn. The boys should have known these things; the apprentice is too far advanced to be taught them. After once showing, the apprentice ought to be able to comprehend the why of certain manipulations. He should be able to see that a certain tool is for a certain work, and he should know why it is so adapted.

A willingness to learn is also a natural qualification. There are boys who never find out their ignorance until it is too late to remedy it. If they knew at 50 all they thought they knew at 20, they could be the progenitors of a race of wiseacres. A "knowing" boy is poor material for a mechanic's apprentice. The apprentice who is impatient of instruction and who knows more about a job than his master, has learned all of his trade he can ever be taught, and the slop shop is his proper place. Impatience in work and ignorance of the qualities of metals and other materials are great sources of annoyance to one who is trying to teach the apprentice. A young and inexperienced steam engineer had occasion to remove the piston from an engine—a horizontal stationary machine. He never inquired what sort of packing the piston might have, and so he mauled away on the connecting rod end when the piston was almost at the open end of the cylinder, and finally broke off a piece of the cylinder, from the port out, necessitating a new casting and its fitting up. The piston rings were steam packing, and they fell into the port and held the piston. He knew the piston had been put into the cylinder and he was determined to get it out. He did, and put himself out of a place.

The would-be mechanic should have a natural aptness at comparisons—comparisons of dimensions, directions of lines and proportions of parts. He should know the difference between the rotation of a circle and the throw of an eccentric. He should be ready to see why a tool was used for a certain purpose. He should understand the qualities of materials enough to see that they required differing tools for working. He should be willing to learn and not take offense at being taught. He should have consideration for the stubbornness of inanimate matter and not offset it by his own, and he should feel an interest in his work.

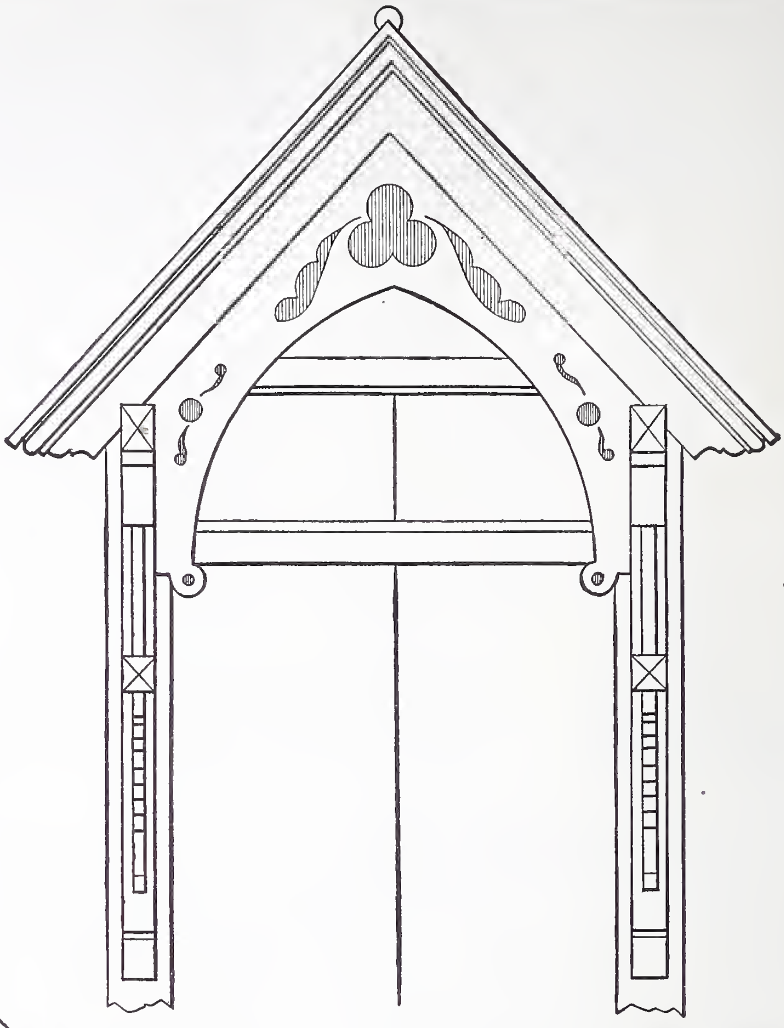
Frame Church.—Fig. 3.—Plan.—Scale, 1-16 Inch to the Foot.

NEW PUBLICATIONS.

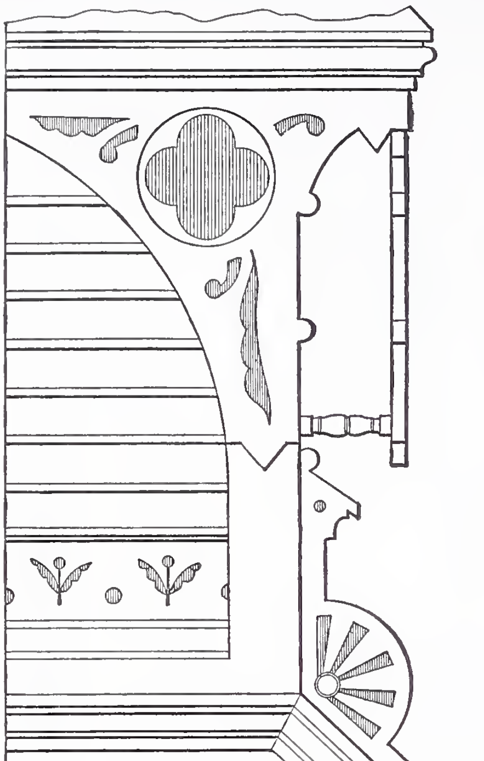
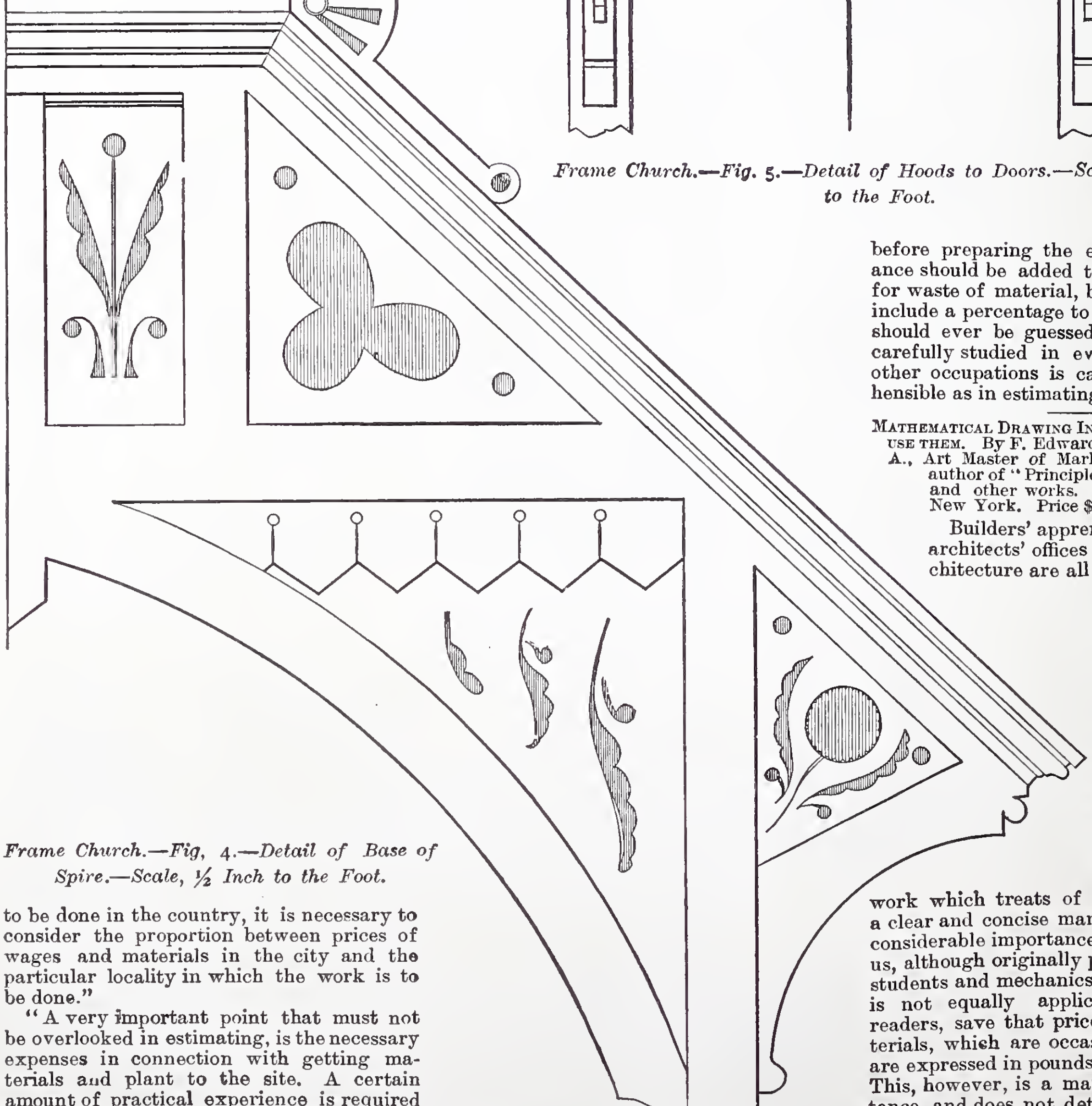
BEVIS' BUILDERS' PRICE BOOK AND GUIDE FOR ESTIMATES. Third Edition. Bevis & Co., London.

We noticed the midsummer edition of this work some time since. The volume before us is the same revised and brought down to the present date. In the former notice of the work we took occasion to compare the condition of the building trades in England, which admit of the use of such a work, and those of our own country, which seem to forbid the introduction of a book of this kind. There are many things in this work which American builders will do well to examine. The skill which has been exercised in systematizing the cost prices of the various items entering into the construction of buildings, when examined must excite admiration, and cannot fail to have its proper effect upon the minds of our own builders. Mr. Bevis prefaces his work with some remarks upon estimating, from which we take pleasure in making the following extracts:

"The great importance of accuracy in preparing estimates needs little comment, as all who are associated with any of the various operations in connection with building or engineering will readily admit the difficulties that have to be overcome. The alterations that are taking place from time to time in the prices of materials as well as labor, render the greatest vigilance and foresight necessary in the preparation of estimates. In preparing estimates for new work, it is requisite to measure up separately the items in each trade before proceeding to carry out prices. In estimating work



Frame Church.—Fig. 5.—Detail of Hoods to Doors.—Scale, ½ Inch to the Foot.

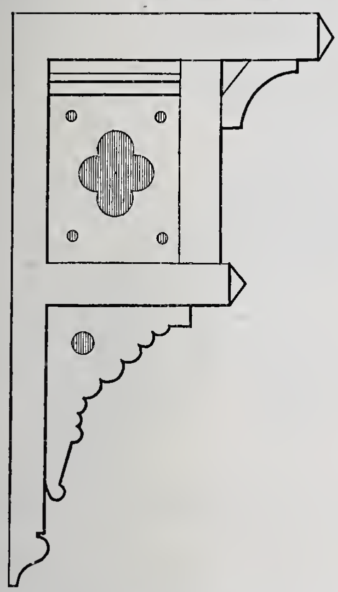
Frame Church.—Fig, 4.—Detail of Base of Spire.—Scale, ½ Inch to the Foot.

to be done in the country, it is necessary to consider the proportion between prices of wages and materials in the city and the particular locality in which the work is to be done."

"A very important point that must not be overlooked in estimating, is the necessary expenses in connection with getting materials and plant to the site. A certain amount of practical experience is required in estimating, as in everything else, but this, united with patience and perseverence, will overcome all obstacles. Any one who has not had opportunity of becoming practically acquainted with the working of a builder's business, must not rely too much upon his own judgment when preparing an estimate, but should obtain special prices for some of the items from merchants and manufacturers. It is always advisable to carefully examine the site of any proposed building before preparing the estimate. No allowance should be added to any measurement for waste of material, but the prices should include a percentage to cover it. No prices should ever be guessed or jumped at, but carefully studied in every detail. In few other occupations is carelessness so reprehensible as in estimating."

Mathematical Drawing Instruments and How to use them. By F. Edward Hulme, F. L. S., F. S. A., Art Master of Marlborough College, and author of "Principles of Ornamental Art" and other works. Bicknell & Comstock, New York. Price $1.50.

Builders' apprentices, draftsmen in architects' offices and students of architecture are all interested in drawing instruments. In short, the use of mathematical instruments enters so largely into various mechanical and professional pursuits, that there are few among our readers who are not interested in one way or another in the subject indicated by the title of the book above named. A work which treats of the uses of tools in a clear and concise manner is a matter of considerable importance. The book before us, although originally prepared for English students and mechanics, has little in it that is not equally applicable to American readers, save that prices of tools and materials, which are occasionally introduced, are expressed in pounds, shillings and pence. This, however, is a matter of small importance, and does not detract from the general excellence of the work. For the purposes of description, instruments are treated in three classes—those used in the projection of straight lines, those employed in making various kinds of curved lines, and those more especially employed for the measurement of lines and angles. These divisions are introduced only as a matter of convenience and aid to systematic description, and are not so rigidly observed as to make the descriptive matter strained or awkward. Some instruments belong to each of two classes, while others in common use hardly belong to either of the divisions specified. Each tool is taken up and carefully described. Rules for making and testing are introduced; directions for the management of paper, the preparation of ink, the sharpening of pencils and the use of colors, are all given in proper connection, the whole forming one of the best descriptions of



Frame Church.—Fig. 6.—Detail of Brackets to Door Hoods.—Scale, ½ Inch to the Foot.

drawing tools it has ever been our pleasure to examine. Typographically speaking, the book is very handsome; the paper is of good quality, the type of fair size and the printing excellent.

The Age of Forest Trees.

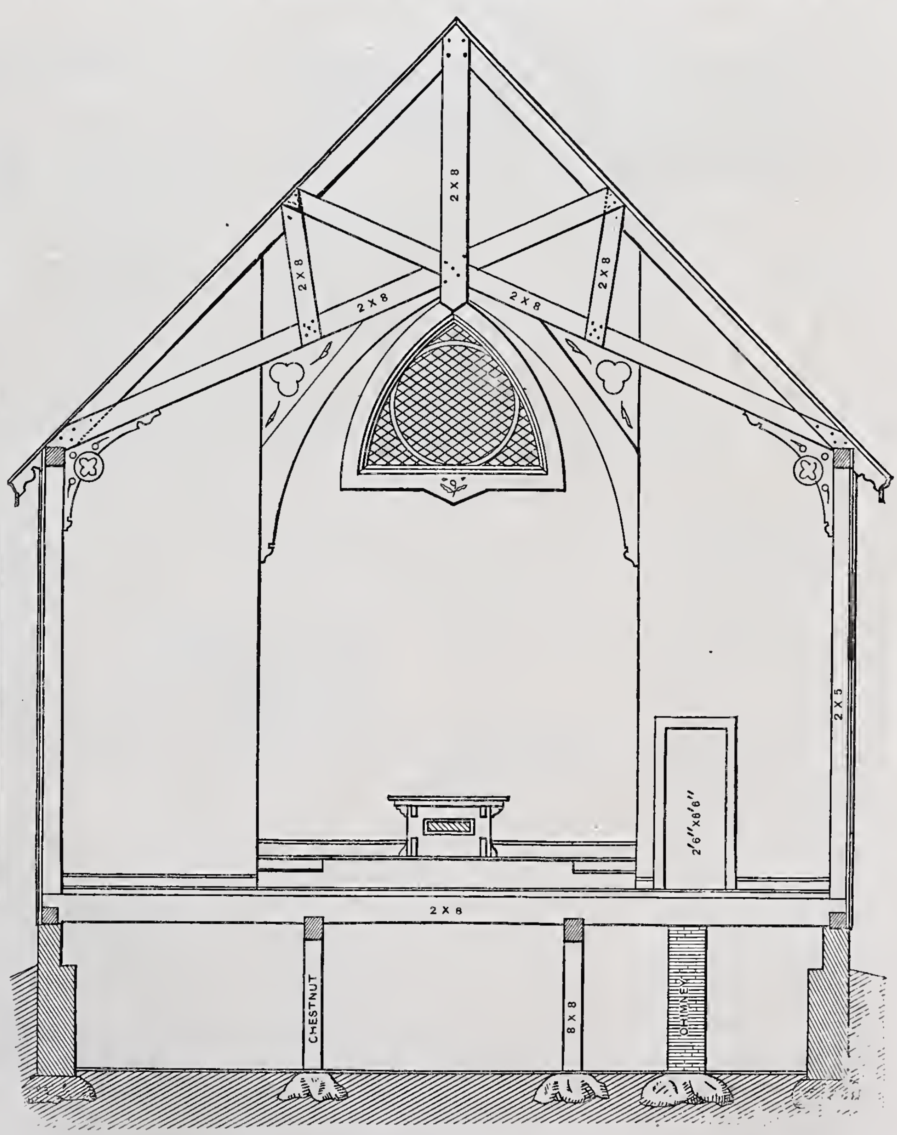
An English paper says that oaks and yews, the most venerable of our trees, are in several instances so old that it is difficult to form an estimate of the time which has passed since they were planted. Several oaks felled in Sherwood Forest about a quarter of a century ago exposed, on being sawn up, the date 1212, and the mark or cipher of King John; and it has been calculated that these trees must have been several centuries old at the time the marks were made. It is well known that the oak which is said to have proved fatal

> "To the Red King, who, while of yore,
> Thro' Boldre wood the chase he led,
> By his loved huntsman's arrow bled,"

was standing not long since in the New Forest, in Hampshire. They who think this tree insufficient to record a fact of so ancient a date, should be reminded that Sir Thomas Dick Lauder says: "Seven hundred years make no extraordinary period in the existence of an oak. Some oaks blown down in Donnington Park were supposed by the interior rings to have been nearly 800 years old, and it is supposed on good authority that there still exist in England oaks which were in existence at the commencement of the Christian era. A venerable oak stood not long since at Tormond Wood, in Stirlingshire, under which, tradition says, William Wallace convened his followers. There are vestiges of the ancient Druids in the neighborhood of this tree, which was 22 feet in circumference. There is another famous Scotch oak, called the Wallace oak, at Ellerslie, near the place where Wallace was born. There are other oaks in Great Britain which are probably more than 1000 years old. The most useful age of this tree, for building and other purposes, is from about 50 to 70 years. When we consider the slow growth of the yew, and the large size to which some yews still in existence have grown, it seems probable that their age is not less than that of some of the famous British oaks. Many have been recorded of the circumference of 26 feet, and there are some even larger than this. In Fotheringale churchyard, in Perthshire, is an old yew, much shattered and nearly dead, the trunk of which measures 56 feet 6 inches in circumference.

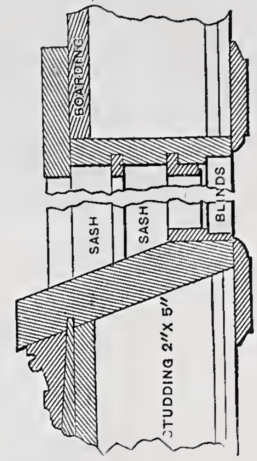
Sawdust Made Valuable.—A United States patent was granted March 25th, 1880, to W. Grossman, of Petersburg, Va., for making railroad ties, fence posts, paving and building blocks, &c., out of sawdust. This artificial wood, it is claimed, can be made fire and water proof, and is of such a character that no insects will attack it. It is claimed that it will take a high polish and stand a higher pressure than ordinary wood. Also, that it can be cut and sawed and that nails may be driven into it. As the process of making it is declared to be very simple and cheap, it is possible that it is destined to bring a revolution in the saw mill business; at least it promises to relieve the saw mill men of much trouble concerning the accumulation of sawdust. We shall await the particulars of a practical test with interest.

The Oak Tree.—A characteristic of the oak, of which Virgil takes notice, is the stoutness of its limbs, its *fortes ramos.* We know no tree, except, perhaps, the cedar of Lebanon, so remarkable in this respect. The limbs of most trees spring from the



Frame Church.—Fig. 7.—Transverse Section through Audience Room.—Scale, ⅛ Inch to the Foot.

trunk. In the oak they may be rather said to divide from it, for they generally carry with them a great share of the substance of the stem. You often scarcely know which is stem and which is branch; and, toward the top, the stem is entirely lost in the branches. This gives particular propriety to the epithet *fortes* in characterizing the branches of the oak; and hence its sinewy elbows are of such peculiar use in shipbuilding. Whoever,



Frame Church.—Fig. 8.—Vertical Section through Windows.—Scale, ½ Inch to the Foot.

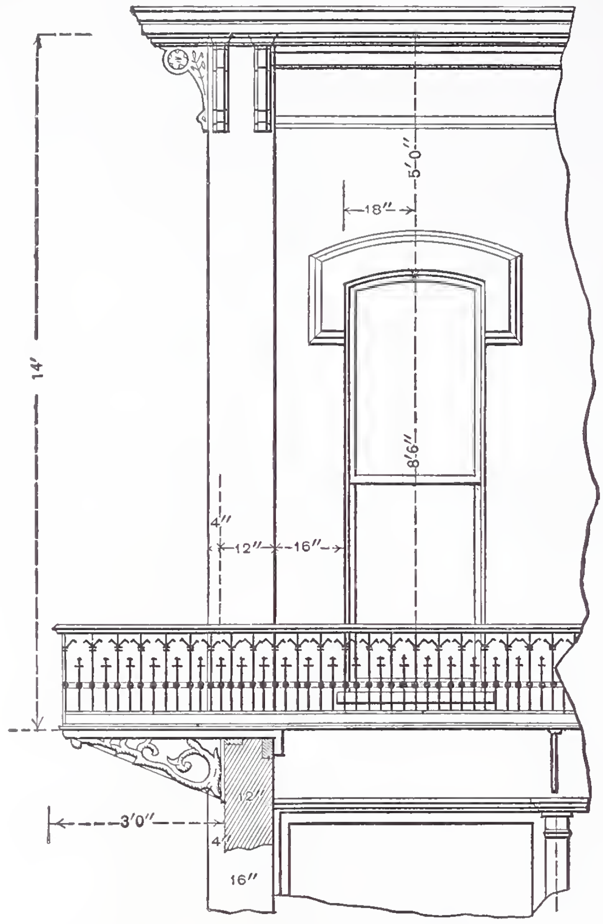
therefore, does not mark the *fortes ramos* of the oak might as well, in painting a Hercules, omit his muscles.

A new hand, on being set to work in a cabinet shop, is told to dress up some veneered panels that are given him; he sharpens his jack plane and dresses off the veneers completely from the pine body and smooths it down. Going to the foreman he says: "Well, boss, I've got the bark off of that piece; what's next?"

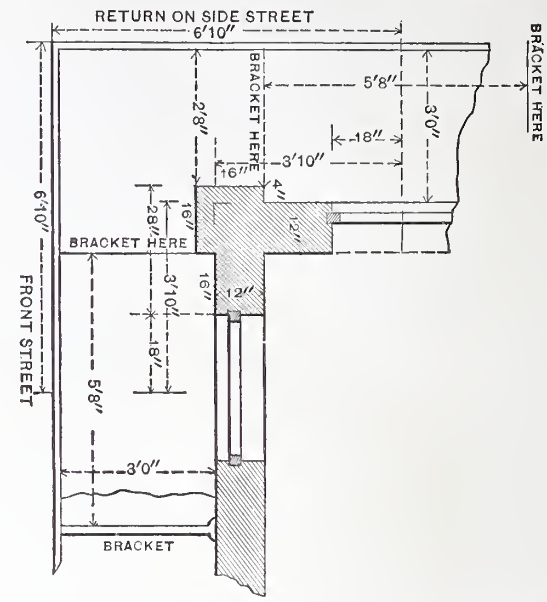
The Mechanics of Bracket Balconies.

BY ALEXANDER BLACK.

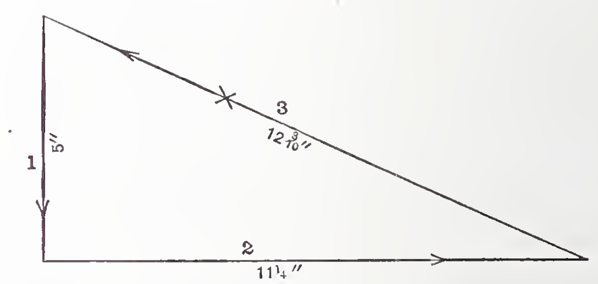
Very frequently balconies supported by brackets are constructed in some of our small Western towns by rule-of-thumb, computations of their strength by carpenters and architects not versed in mechanical science being somewhat difficult. It may be interesting, therefore, to such persons to have a safe, simple and quickly applied method of computing strength for general use. Safety should be a prime element in the construction of articles of this character, and without intelligent calculations there is no method of determining strength in advance of actual trial. Very frequently, balconies are the resort of crowds of people, as, for instance, on show days, and the risks attending defective construction are very great.



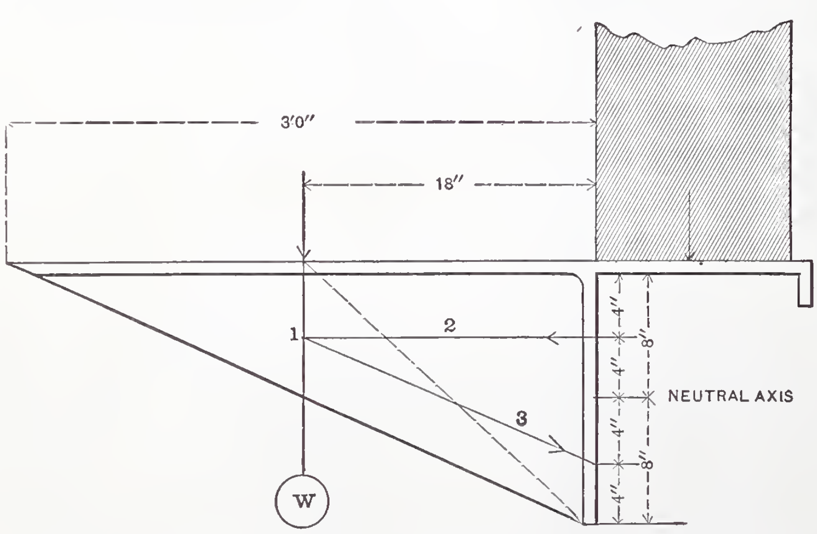
The Mechanics of Bracket Balconies.—Fig. 1.—Elevation of Corner of Second Story of Store Building.—Scale, ¼ Inch to the Foot.



The Mechanics of Bracket Balconies.—Fig. 3.—Plan of Balcony and Corner of Building.—Scale, ¼ in. to Foot.



The Mechanics of Bracket Balconies.—Fig. 4.—Diagram of Strains.—Scale, 1 Inch to 1000 pounds.



The Mechanics of Bracket Balconies.—Fig. 2.—Diagram of Opposing Forces, showing position of Concentrated Load, location of Neutral Axis, &c.—Scale, 1 Inch to the Foot.

The accompanying elevation and plan, Figures 1 and 3, represent the corner of the second story of a store building, situated on a corner lot. We will assume the balcony to be 3 feet wide from wall line. Its outside length on front, from mid-distance between the corner bracket to the adjacent one, is 6 feet 10 inches; its inside length is 3 feet 10 inches. From these dimensions a calculation shows that there are 32 square feet of balcony floor. This must be multiplied by the allowance for probable load imposed by a romping crowd of spectators, say 150 pounds per square foot, including the weight of balcony. This gives 4800 pounds, or, say, in round numbers, 2½ tons for the balcony to support. This load is assumed to be concentrated at its center of pressure of leverage, which is one-half of the width from wall line; that is, 1½ feet out from the wall. Through this point, as shown in Fig. 2, draw a vertical line (1) to indicate the position and direction of the action of concentrated load. Assuming that the back of wall plate of bracket is 16 inches deep, as indicated by the figures in the diagram, the neutral axis (that is, the point at which the opposite forces which tend to draw out the top of the bracket-anchor and to press inward the foot of the bracket, change direction or are neutral) is midway between top and toe of bracket wall plate. In other words, it is 8 inches up from toe, as indicated in Fig. 2. To facilitate computations, each of these opposite forces is assumed to be concentrated in their resultant, at the middle point of both the upper and the lower halves of the wall plate, or at 4 inches from its top and 4 inches from its toe. Now, if a horizontal line (2) be drawn through upper resultant point intersecting the vertical line (1) representing position of concentrated load (W), and another line (3) be drawn obliquely from this point of intersection to middle or resultant point of lower half, a diagram of the opposing forces will be consructed. In Fig. 4, which may be called a stress diagram, a vertical line (1) is drawn to scale, say 1 inch, representing 1000 pounds, or a half ton. To represent 2½ tons, therefore, the line must be made 5 inches long. From its lower extremity draw a horizontal line (2) toward the right hand indefinitely. From the upper extremity of the vertical line draw an oblique line (3) parallel to or of the same inclination as 3 on bracket diagram of Fig. 2, which continue until it meets the horizontal line (2). The lines in Fig. 4 are now numbered in the order of the forces in passing around the triangle, as indicated by the arrows. The forces are all in tension except those indicated by 3, which is marked by an X to indicate compression.

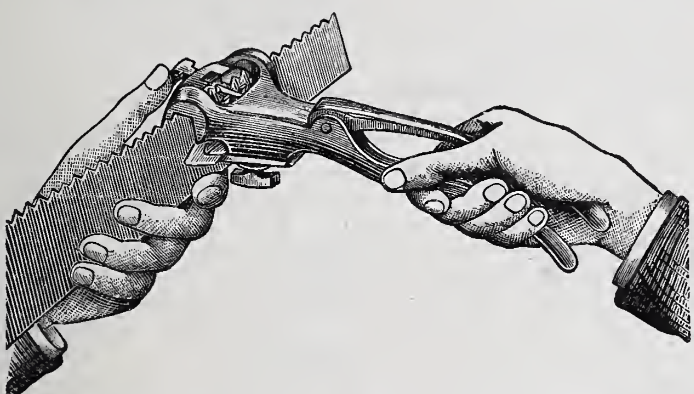
According to the science of mechanics, the quantity of the forces is proportional to the length of the sides of the triangle to which their direction is parallel. By measuring the horizontal line by the scale we have indicated, it will be found to be 11½ inches, which at one-half ton per inch gives 5⅝ tons, which is required to counterbalance the moment of a concentrated quiescent load. In order to allow for dynamic effects of sudden shocks and impulses, an adequate margin of safety must be allowed over this. Hence, in the calculation the superincumbent weight on the bracket-anchors should not be taken less than twice this amount.

To obtain the weight of piers, &c., refer to plan, Fig. 3. The area of the corner pier, including front and return pilasters (which are added to increase the weight there), is one-half of 2 feet 4 inches outside face, added to 1 foot 4 inches inside face of 12-inch wall, and 1 foot 2 inches of 4 inch pilaster, all of which is taken twice for front and side, making a total of 4 4 9 square feet, which is to be multiplied by the hight from top of bracket to top of wall, say, 14 feet, which gives as the result, 62 2-9 cubic feet. Again, the half spandrel over front window is 18 inches of 12-inch wall, and there is the same over the side window, which together make 3 feet. This multiplied by 5 feet, the hight above windows, gives 15 cubic feet, or a grand total of 77 2-9 cubic feet of brickwork above the balcony. An ordinary class of common brickwork should not be estimated to weigh more than 110 pounds per cubic foot, say in round numbers 100 pounds. The amount of brick above specified, therefore, would weigh 7900 pounds, or, in round numbers, say, 4 tons, which shows a very decided deficiency in stability. It is, therefore, necessary that the walls should be made thicker and higher, and that stone bond blocks should be used in the pilasters, and that a stone cornice and blocking course above it be added. Or, it is necessary that the width of the balcony be reduced until a sufficient surplus of insistent weight upon the bracket is obtained to render it safe. For stone cornice, &c., allow, if of sandstone, 130 to 140 pounds per cubic foot, according to density; if of limestone, 145 to 160 pounds. The cornice shown on elevation is supposed to be of wood, the usual construction of buildings of the character described. There ought to be heavy wrought-iron plates under the outside bearing of balcony brackets, and also between the hook and the back of the wall, to distribute pressure. The wall plate of bracket should be wide for the same reason.

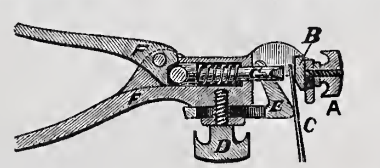
It may be proper to observe in this connection that it would be culpable imprudence to risk an unsafe balcony to the chance of its never being crowded. On occasions its safety or unsafety may not be thought of by eager crowds of spectators, as, for instance, on a show day and in the temporary absence of a careful occupant. In fact, there are so many exigencies of circumstances which baffle all well-meant intentions of careful supervision, as to render a weak structure a constant source of probable mishap. Besides what we have mentioned, there are other structural points to be considered in the matter of adequacy for their purpose. For instance, it must be seen that the bricks are sufficiently hard, so that they are not liable to crush under or at back of brackets, and that those parts of the wall are sufficiently solid and homogeneous; that the anchor hooks of brackets are sufficiently strong against shearing or bending strains; that the anchors have sufficient tensile strength; that the raking or oblique parts of brackets are of sufficient section to resist bending or crushing strains. The above and other details, however, as well as different forms of brackets, are reserved for a future article, if interest in the subject should seem to warrant it.

Morrill's Saw Set.

The accompanying illustrations represent a little tool quite recently put upon the market, which, we judge, has more than usual interest for our readers. It is a saw set, working upon principles radically different from those in common use. Fig. 1 shows the manner of using the set, while Fig. 2 shows the construction and operation of the parts. It will be seen that, in its general features, the set resembles a large pair of pliers, save that the handle, instead of operating a jaw, as in pliers, works a punch. The blade of the saw is passed in front of the punch, as shown at C in Fig. 2. By depressing the lever, or handle, F, the punch is driven forward, striking the tooth of the saw, as indicated at B, thus imparting to it whatever set is desired. The amount of set is regulated by the movable guard E, which is held in place wherever it is required by the screw D. The die B is regulated by the screw A in the forward end of the set, in such a manner as to control the angle upon the die. By this means the tool is adapted to use both with fine and coarse saws. It is claimed by the manufacturer, Mr. Asa Farr, whose office is at No. 136 Chambers street, New York, that this set has been tested, and is in constant use by more than 1000 leading mechanics in this city and vicinity. The inventor offers this tool as the result of over 30 years' practical experience in the use of saws and saw sets. He contends, with great reason, that there is no saw which does not require setting, however scientifically it may be made. Saws, by constant use, wear on the side of the teeth at the points, thus causing friction, which is only overcome by frequent filing. This consumes time and files and causes a constant wear on the saw, producing the liability of rucking. He claims that with the proper use of the set represented in the accompanying engravings, saws need not be filed more than once where they are ordinarily filed three times. Saw teeth should be set or pressed into line wherever they bind, and this set corrects the faults of too much set in places, and also imparts a uniform set to new saws. By giving careful attention to the matter of set, &c., the mechanic is able to do his work better, with more ease, and with greater rapidity than otherwise. Besides this there is a saving of files, and a reduction in the wear and tear of his saw. The set as manufactured is adapted to all kinds of saws in general use, including band and scroll saws, and, as will be readily seen by examining the illustrations, can be made to operate with the accuracy and precision of a die. The opening at the top permits the operator to observe the action of the punch on each tooth, and to determine when the tool is in correct position.



Morrill's Saw Set.—Fig. 1.—Manner of Using the Set.



Morrill's Saw Set.—Fig. 2.—Construction of the Tool.

Grindstones.

What can disable a shop more effectually than to destroy the grindstone? Unless the loss were supplied by the modern substitute, the emery grinder, to destroy the grindstone would be to wreck the shop. A thorough study of the subject will develop more requirements than many think, and much ingenuity of skill in designing might be displayed in working out the problem. It should be strong, simple and clean; the trough expanded to catch as much as possible of the drip water and grit; a movable shield securely hinged to keep the water from splashing, and yet permit the stone to be used from either side; rests provided upon which to rest tools and the rod for turning the stone, these rests being arranged to move toward the center as the stone wears smaller. The bearings should be generous in size, proper provisions being made for oiling without washing the grit into the bearings with the oil, and the ends of the bearings being protected by some device which effectually prevents the entrance of the grit. The stone should be secured to the shaft by nuts and washers, and the washers fixed so that they cannot turn with the nuts as they are screwed up or unscrewed. In hanging the stone great care should be taken to hang it true sidewise, not only for convenience in using, but because a stone that is not true sidewise can never be kept true edgewise.

Suppose a stone to run one-fourth of an inch out of true sidewise, and while in motion draw a line around it within three-eigths of an inch from the edge on an average. From this line there would be but one-fourth of an inch of stone on one side and one-half on the other. If you had a stone only this in thickness—that is, a stone one-fourth of an inch thick on one side and one-half of an inch thick on the other, would not the one-fourth-inch side wear away faster than the other? That is exactly what it does on that side of the thick stone, only the thicker the stone and the less it is out of true the less it wears.

Groining.—After such works as King's College Chapel, Bath Abbey, St. George's Chapel, Windsor and the Lady Chapel at Peterborough, there remained but one advance more to be made in the construction of groining, and that is one to be wondered at rather than admired. It was impossible to push constructional science further than it had been carried in the regular fan-vault. It only remained to exaggerate science in a *tour de force*. The roof of Henry VII's Chapel shows us this last wonderful effort of constructive daring. Imagine a building vaulted like King's College Chapel; add to it aisles as lofty as the main vault, separated from the nave by soaring pillars and similarly groined; then sweep away all the pillars, throwing nave and aisles into one vast span, and leave the vault resting apparently upon nothing, and exhibiting, where the pillars once stood, only a series of great pendants floating in mid-air. Such is the conception of this truly wonderful roof. The problem of providing that support which pillars would naturally have afforded, but without pillars, was solved by the introduction of flying arches passing through the pendants. The pendants are long suspended bars of stone, upon the bases of which the groining is built up. This most daring work fitly closes the history of of the Gothic style. Hardly was it completed before the Italian Torregiano, in the sumptuous tomb of the founder below, inaugurated that new classic style which was to supplant it. In this wonderful chapel the style had said its last word, and, both as regards constructive ability and power of artistic effect, this great work forms a noble climax to a wonderful history.

Wooden Roof and Bridge Trusses—Strengths of Materials (Continued).

BY GASTON M. ALVES.

In the last paper the beams were considered horizontal. When a loaded beam is inclined, as in the case of a common rafter, we take its horizontal length; that is, the horizontal or level distance from its foot to a plumb line dropped from its upper end. Example: Required the safe strength of a beam 3 inches broad, 6 inches deep and 10 feet long, the beam uniformly loaded and one end 6 feet higher than the other. In this case the horizontal length of the beam is 8 feet. Hence, in our calculations we consider its length as 8 feet, and find its strength accordingly, which will be 1686 pounds.

When a horizontal beam, supported at each end, has a weight applied at any point of its length, to find its strength find the strength of the beam loaded at the center; multiply this by the square of half the length of the beam, and divide the product by the product of the two segments into which the weight divides the beam. Example: Required the safe strength of a beam 2 inches broad, 6 inches deep and 12 feet long, the weight being applied 4 feet from one end, and the beam supported at each end. If the weight was applied in the center of the beam, its safe strength would be 375 pounds; 375 multiplied by the square of half of 12, which is 36, equals 13,500; and this, divided by the product of the two segments, which is 4 times 8 equals 32, gives 422 pounds for its safe strength.

The *stiffness* of beams obeys quite different laws from the strength of beams. Tredgold says a beam should not bend more than 1 inch in 40 feet, and this is generally taken as the limit. The consideration of the stiffness of beams is of very great importance; but where trusses are well designed the beams will generally be made so short, or supported at short intervals, that in giving the safe transverse strength they will of necessity generally have the required stiffness. However, it is at times necessary to employ beams of such a length that, while they may be amply strong, they will be too flexible, if proportioned only by the rules for strength. To meet this requirement the following table is prepared. The figures to the right and above the heavy lines in the table are the greatest weights in pounds, uniformly loaded along the whole length, that wooden beams 1 inch broad and of the depths and lengths given, will bear without bending more than the rate of 1 inch in 40 feet. The figures to the left and below the heavy lines are the safe transverse strengths as in the preceding table. Had they been calculated by the formula for stiffness, like those on the other side of the heavy lines, while they would have given beams of sufficient stiffness, they would not have given sufficient strength.

COMBINED TABLE OF THE SAFE STRENGTH AND STIFFNESS OF BEAMS ONE INCH BROAD, AND FOR DEPTHS AND LENGTHS GIVEN THEREIN.

*Beams Supported at the Ends and Uniformly Loaded along their Length. Safe Strength (to the Left and Below the Heavy Lines) taken at 125 pounds for a Beam 1 Inch Square and 1 Foot Long. Stiffness (to the Right and Above the Heavy Lines) to be such that it will Bend only 1 Inch in 40 Feet.**

Depth in Inches.	Length in Feet.														
	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24
4	492	315	219	161	123	97	79	65	55	40	......	......	......	......	......
5	760	615	427	314	240	189	154	127	106	78	60	47	......	......	......
6	1,124	900	738	543	415	328	265	220	184	135	104	82	66	55	46
7	1,532	1,224	1,021	862	660	521	422	349	293	215	165	130	106	87	73
8	2,000	1,600	1,333	1,143	985	778	630	521	438	322	246	194	158	131	109
9	2,532	2,024	1,687	1,446	1,266	1,108	897	742	623	458	351	277	224	185	155
10	3,124	2,500	2,083	1,786	1.562	1,389	1,231	1,017	855	628	481	380	308	254	214
11	3,782	3,024	2,521	2,161	1,891	1,680	1,512	1,354	1 138	836	640	506	410	338	284
12	4,500	3,600	3,000	2,571	2,250	2,000	1,800	1,636	1,477	1,085	831	657	532	439	369
14	6,124	4,900	4,083	3,500	3,062	2,722	2,450	2,228	2,041	1,723	1,319	1,043	844	698	586
16	8,000	6,400	5,333	4,571	4,000	3,555	3,200	2,910	2,667	2,285	1,969	1,557	1,260	1,041	875
18	10,124	8,100	6,750	5,785	5,062	4,500	4,050	3,682	3,375	2,892	2,531	2,216	1,795	1,483	1,246
20	12,500	10,000	8,333	7,143	6,250	5,555	5,000	4,546	4,167	3,571	3,125	2,778	2,462	2,035	1,710
22	15,124	12,100	10,083	8,643	7,562	6,722	6,050	5,500	5,041	4,321	3,781	3,361	3,025	2,731	2,276
24	18,000	14,400	12,000	10,286	9,000	8,000	7,200	6,540	6,000	5,143	4,500	4,000	3,600	3,270	2,959

* The stiffness is calculated for white pine, and will answer for other soft building woods, but where white oak is used, when it is desired to calculate the stiffness, the dimensions being given, add 44 per cent. to the amounts in the table. When the load is given and the dimensions for stiffness required take only 70 per cent. of the load, and then find the dimensions from the table. The weights in the table are in pounds.

Hence, we see that a long beam may be strong enough, and yet not stiff enough, and that a short beam may be stiff enough, and yet not strong enough. The formula from which that part of the table to the right of and above the heavy lines is calculated is, $1.6\left(\frac{B \times D^3}{.013 \times L^2}\right) = W$, which put into words is as follows: Multiply the breadth in inches by the cube of the depth in inches; divide the product by decimal .013 times the square of the length in feet, and finally multiply the quotient by 1.6. The result will be the weight in pounds. Where the weight is known the formula for the depth is $1.6\left(\frac{W \times L^2 \times .013}{B}\right) = D^3$, which put into words, is as follows: Multiply the weight by the square of the length in feet, and by the decimal .013; divide the product by the breadth in inches; multiply the quotient by 1.6, and finally extract the cube root of the product so obtained, and the result will be the depth in inches of the beam. When the beam is not uniformly loaded, but the load is applied in the center, omit the multiplier 1.6 in all of the above. The decimal .013 is for pine; when oak is used substitute in lieu of it decimal .009.

The use of this table will much facilitate calculations. By the rules it would be necessary to calculate the strength of a beam, and then if there was any doubt of its stiffness, we would also have to calculate the stiffness; but by the use of the table a simple inspection will give a beam not only strong enough, but also stiff enough. It will readily be understood that the weights taken to the right and above the heavy lines are less than is required for safe strengths, although under the loads the beams will be no stiffer than necessary, and that the weights taken to the left and below the heavy lines are less than need be for stiffness, but under the loads the beams will be no stronger than necessary.

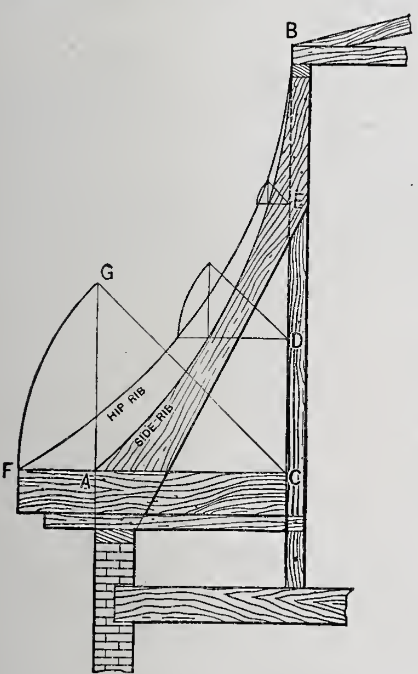
In practice the load, length of span, and either the breadth or depth of the beam is usually given. Let us solve a problem in each case by means of the table. Required, the breadth of a beam 10 feet long, 8 inches deep, and supported at each end, uniformly loaded with 1260 pounds. Beam to have the safe strength and stiffness heretofore required. In the table under the 10 feet column, and opposite the depth 8 inches, is found 630 pounds, but as this is for a beam 1 inch broad, we divide the required load, 1260 pounds, by 630, which gives us 2 inches as the required breadth. Now, to find the depth of a beam. Required, the depth of a beam under the same conditions, 12 feet long 4 inches broad, to bear a load of 3420 pounds. Divide the load, 3420, by the breadth, 4 inches, and we have 855 as the proportionate load for a beam 1 inch broad. Now, in the 12 feet column we find 855 pounds opposite the depth 10 inches; hence, 10 inches is the required depth of the beam. It will usually happen that the exact loads will not be found in the table, in which case take the depth for the next greatest load given in the column, unless the required load is near the next lesser load in the same column, in which case take the depth corresponding to the latter. If the required load is midway, or very near midway, between the next greater and next lesser loads, a depth may be taken which will be an arithmetic mean to the corresponding depth of the next greater and next lesser loads. This, however, will usually give odd sizes for the depths. Thus, suppose the weight in the above example to have been 4000 pounds; 4000 divided by the 4 inches in breadth would give 1000 pounds, and 1000 pounds is very nearly an arithmetic mean between the next greater, 1138, and the next lesser, 855; hence, the required depth would approximately be a mean to their corresponding depths, which would be 10½ inches.

In the next paper the consideration of the strengths of materials will be concluded, after which the application of the results and principles of this and the foregoing papers will be made to the designing of trusses.

CORRESPONDENCE.

It is hardly necessary to state that the interest in our correspondence department continues unabated. The appearance of the following pages, both in the variety of subjects discussed and in the number of letters which occur under each heading, sufficiently attests that fact. There are several leading topics this month which, by their very importance, have crowded out letters whose claims for publication were almost imperative, but these will be considered in due season. In the meantime we ask, as before, the patience and kind indulgence of our friends whose favors are thus obliged to stand over. Do not let any one fail to write us upon any subject of general interest to our readers on account of other letters being unpublished. It is hard to convey an idea of the encouragement letters from our readers afford us. To be unable to print them all promptly, is, of course, something to be regretted, but we do not want to be deprived of the kind offices of our friends on that account. So send along your letters anyhow. Each number of the paper will contain a careful selection from whatever we have on hand when it is made up. Every communication sent us shall have attention in some form sooner or later.

We have taken great interest in our correspondents' letters concerning the matter of hip rafters for mansard roofs, called out by an inquiry in a recent number. The letters



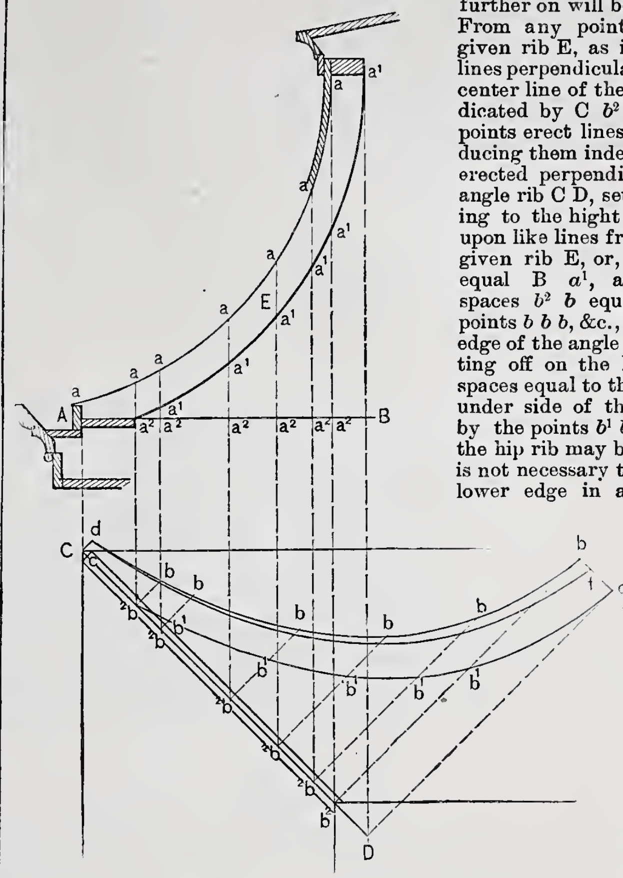
Hip Rafters for Mansard Roofs—Fig. 1.—Method Recommended by G. H. H.

following give the subject a pretty thorough discussion, and illustrate in how many different ways a single mathematical principle may be viewed.

Hip Rafters for Curved Mansard Roofs.

From G. H. H., *Philadelphia.*—Draw an elevation, say an inch and a half to the foot, of the side rib, perpendicular stud and outlooker. Strike the concave of the side rib, as shown by A B in the accompanying sketch. (Fig. 1.)

Divide the line of perpendicular stud B C into any number of equal spaces—in this case three, as indicated by E D C. From each of the points thus obtained and at right angles to B C, draw lines indefinitely, as shown by C F, cutting B A as indicated. From the point of intersection of each of these lines erect a perpendicular, as shown by A G, making A G equal to A C. Connect G and C; then from C as center, with C G as radius, describe arcs as indicated by G, just intersecting C F in the point F; then F will be the point in the curve of the hip rib on the line F C. In like manner obtain other points upon the several division lines set off from B C. Then a line traced through the points thus obtained, as indicated by B F, will be the curve of the hip



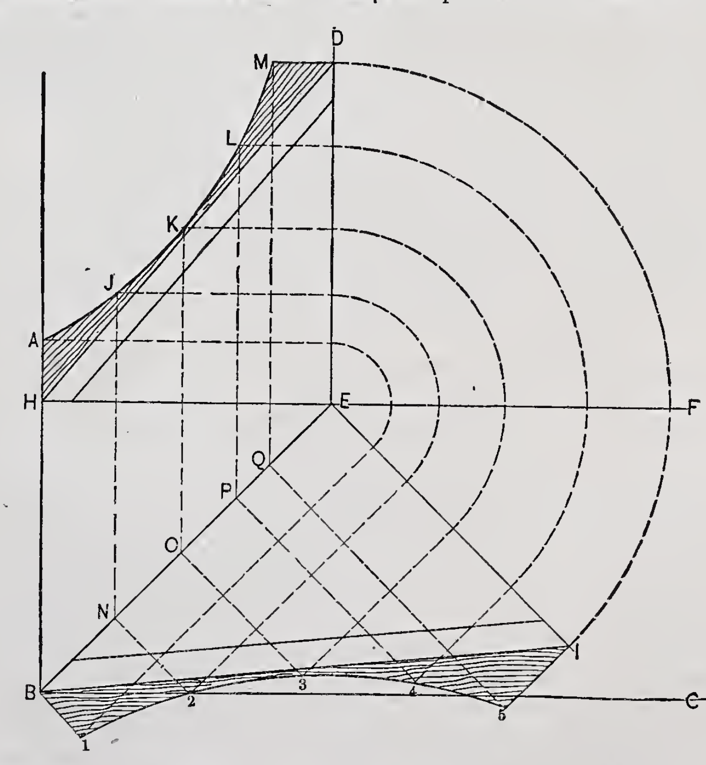
Hip Rafters for Mansard Roofs.—Fig. 2.—Method Recommended by A. M.

rib. In conclusion, I would remark that the line G C represents the line perpendicularly under the hip line, or, in other words, the seat of the hip rafter.

From A. M., *Baltimore, Md.*—One of your correspondents asks for information with regard to the method of laying off hip rafters for curved mansard roofs. Possibly he can obtain what he desires from the inclosed sketch. (Fig. 2.) Let A B be the seat of the given rib E, standing square with the building. Let C D in the plan be the seat of the angle rib. By laying off the thickness of the angle rib on the plan, as shown by the lines parallel to C D, operations to be explained further on will be more clearly understood. From any points on the top edge of the given rib E, as indicated by *a a*, &c., draw lines perpendicular to A B, intersecting the center line of the seat of the angle rib, as indicated by C b^2 b^2 b^2 and D, from which points erect lines perpendicular to C D, producing them indefinitely. Upon these lines, erected perpendicularly to the seat of the angle rib C D, set off distances corresponding to the hight of similar points measured upon like lines from A B to the edge of the given rib E, or, in other words, make D *e* equal B a^1, and each of the several spaces b^2 *b* equal to a^2 *a*. Through the points *b b b*, &c., trace the form of the upper edge of the angle rib in like manner. By setting off on the lines perpendicular to C D spaces equal to the distance from A B to the under side of the given rib E, as indicated by the points b^1 b^1 b^1, &c., the under line of the hip rib may be developed. Of course, it is not necessary to be so particular about the lower edge in a case of this kind, but the two edges may be obtained in one operation if desired.

To back the angle rib, slide one rib on top of the other from C to *c* at the foot, and from *b* to *f* at the top, making the space from *b* to *f* equal to C *c*, and mark the line *a f*. Reverse the ribs, and mark the other side in the same manner; then trace each side from the lines thus obtained to the center line on the edge of the rib; this will give the required backing. The best way to trace the form of the rib is to drive a nail into each point of intersection, then bend a thin strip until it touches every nail, and mark along its edge with a pencil or scribe.

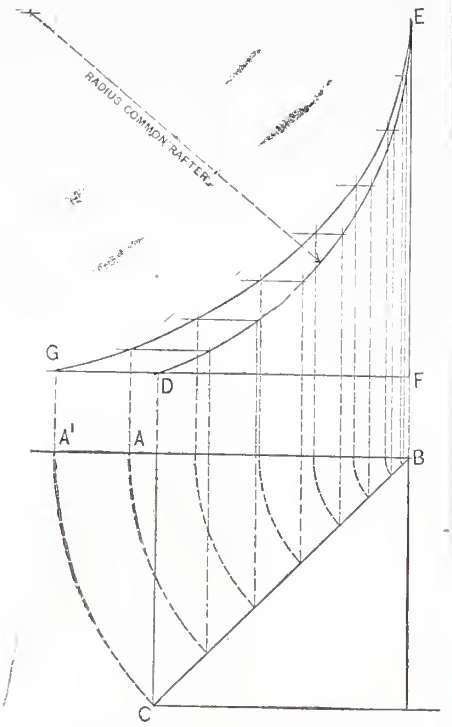
From G. W. D., *Oxford, Iowa.*—A correspondent, in a recent number of *Carpentry and Building*, requests a method for finding the hip rafter of a French roof. Inclosed



Hip Rafters for Mansard Roofs.—Fig. 3.—Method Recommended by G. W. D.

please find a sketch (Fig. 3), which I believe contains the desired information.

Let A B C and D E F represent the plates in their position on the plan. Extend F E to H. Make E D equal to the rise of roof, and join D H, which gives the lengths and cuts of common rafters, upon which place the hip having the desired curve, as indicated by A M. Join E B, which represents the seat of the desired hip. From E as center and with E D as radius, describe the arc D F I. At E, perpendicular to E B, draw E I, producing it until it intersects the arc D F I in the point I. Join I B; then I B represents the length and cuts of the hip rafter if the same were to be made straight. To find the



Hip Rafters for Mansard Roofs.—Fig. 4.—Method Recommended by C. O.

curve proceed as follows: Divide the normal rafter A M into any number of equal spaces. In this case four are indicated by the points A J K L and M. From J draw a line parallel to the plate, intersecting B E, as shown at the point N; from K, in like manner, draw K O, likewise L P and M Q. From the same points A J K L and M, draw a line perpendicular to and intersecting E D. From the points thus obtained in E D, from E as center, describe the arcs, as shown by the dotted lines cutting E I. From the points thus obtained in E I, draw lines perpendicular to E I independently. From the points N O P Q, in the line B E, draw lines perpendicular to B E, producing them until they meet the lines drawn from E I in the points 1 2 3 4 and 5, as shown. Then a line traced through these points will be the curve of the hip rafter. To trace a line through the points 1 2 3 4 and 5 a thin strip may be bent, along which the curve is marked.

From C. O., *Canton, Miss.*—The way I should go to work to shape hip rafters for a French roof is indicated by the inclosed sketch (Fig. 4), which shows the corner of a building with common rafter A B in plan, and also hip rafter B C in plan. Directly above the plan is drawn an elevation, in which D E represents the common rafter, and E F the rise of the roof. Divide the common rafter D E into any convenient number of equal parts, and from the points thus obtained drop lines intersecting the plan of hip rafter C B, as shown. From these same points carry lines at right angles to E F indefinitely. From B as center, with radii corresponding to the several points in B C, describe curves cutting the base line A B, from which line extend them upward until they intersect horizontal lines drawn from the elevation already described. Then a curve traced through the points thus obtained, as indicated by G E, will be the shape of the hip rafter.

From F. E. B., *Los Angeles, Cal.*—In the March number of *Carpentry and Building* I saw referred to readers questions in regard to hip rafters for mansard roofs. I am a constant reader of the paper, although I am a tinner instead of a carpenter. I am much interested in it, and obtain from it a great deal of information applicable to my trade, and, therefore, I recommend it to others of my craft. I inclose you a drawing of the method of obtaining the shape of a hip rafter in a mansard roof. I will not try to describe the solution, as I think it so simple that you will readily see through it, and be able to give the proper explanation if you think the drawing merits it. This rule will give the shape of any hip rafter either convex or concave, O G or straight; also at any miter, providing the plan is correctly drawn. In conclusion, I beg to say that I am thirsting after mechanical knowledge, and I seem to find just what I want in *Carpentry and Building*. Every copy is worth the full year's subscription to me.

Note.—We have not thought it necessary to engrave the diagram sent in by this correspondent, as it coincides in all essential particulars with one of those above given. The only difference to be found is in the introduction of a duplicate miter line—points being carried across between the two lines for the purpose of avoiding confusion of lines where the shape of the hip is to be delineated. This plan, doubtless, has some advantages, but it also has its disadvantages. We are glad to know that tinners are taking an interest in the paper. This problem of mansard roofs, by the way, is one in which tinners, and more particularly cornice makers, are interested. The several rules here presented will no doubt prove of value to them.

In addition to the foregoing solutions to the problem proposed by our correspondent in the March number, we have received diagrams from T. A. B., of Philadelphia, and T. V. D., of Rural Grove, N. Y., neither of which is correct. T. A. B. uses the line in the plan representing the seat of rafter as a base line, from which to measure in obtaining points through which to draw curve of hip rafter. This is manifestly incorrect, and we think was an over sight in our correspondent's work, rather than a failure to understand principles. We suggest that he look over the problem again, and apply to it the same test which he proposed in connection with the solution sent in. T. V. D. makes use of at least one dimension for which he gives no method of ascertaining. His rule, although it appears (using his own language) quite simple, would, we fear, fall far short of producing satisfactory results if applied in practical work. If this correspondent will carefully study the letters and diagrams given herewith, he will no doubt see wherein he has made a mistake.

Before leaving this subject, it may be well to call attention to the principles involved, upon which the various methods set forth by our correspondents are based.

Inasmuch as the projection of the base—in other words, the length of the seat of the hip rafter—is greater than the seat of the common rafter, the vertical hight of both being the same, it follows that the projection of each point in the hip rafter is greater than the corresponding point in hight of the common rafter in the same proportion. This principle may be reduced to a rule stated as follows:

Divide the profile of the common rafter into any convenient number of equal spaces, and from each point drop vertical lines, cutting the line which represents the seat or rafter in the plan, or as shown by D E of Fig. 5. Also from each point in the common rafter C B, draw horizontal lines to the left, as shown, and cut them with a vertical line G F, corresponding to A B of the common rafter. Now, with the dividers, take the projection of the several points in D E and set off like distances upon corresponding lines drawn from F G. In other words, make G H equal to D 8^1; make K L equal to D 7^1; make M N equal to D 6^1, and so on. Then a line traced through these points, as shown by H F, will represent the curve of the hip rafter.

Kind of Drawings Required for Our Illustrations.

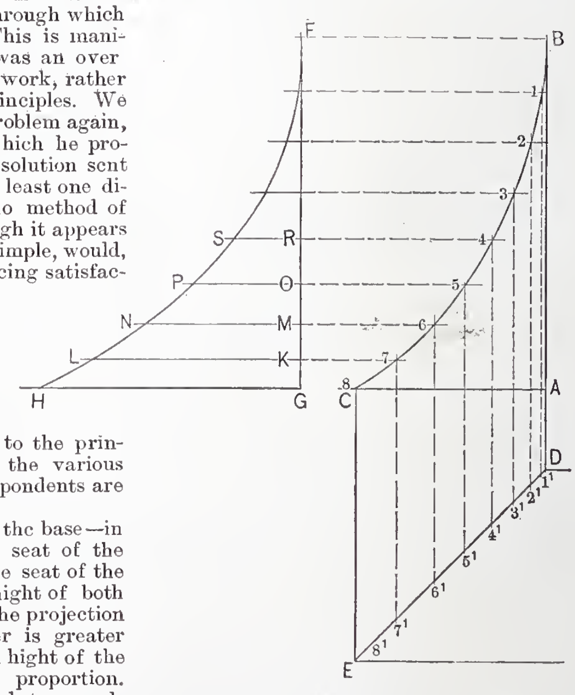
From E. H. C., *Rochester, N. Y.*—I do not pretend to know much about writing for the press, but as I shall want to ask a question now and then through the columns of "our paper," I will do the best I can to contribute my part in the way of return. I send some notes herewith, which you are at liberty to use as you see fit. Please inform me how much of a drawing you can use in *Carpentry and Building?* Can you copy from full size? I have some plans which I would like to send.

Answer.—By the peculiar processes used in engraving for the illustrations published in *Carpentry and Building*, we can use almost anything which our correspondents see fit to send us. We can reduce from full sized drawings; we can use free-hand pencil sketches; in short, anything which has sufficient finish and accuracy to convey the author's idea to us. All things being equal, we prefer, of course, drawings in ink, on white paper, of the size they are to be engraved for the paper. We do not stipulate this, however, but give our correspondents the widest possible range in preparing their favors. In this particular *Carpentry and Building* occupies a position among the architectural and building papers of the country peculiar to itself. We trust our readers will make a note of it, and be all the more ready to send along whatever they have which they think will be of interest to our subscribers.

What is an Ellipse?

From W. W. G., *Wakeman, Ohio.*—Will you please define an ellipse through the columns of *Carpentry and Building*. Is it any circle but a true circle?

Answer.—We do not know what sort of a figure a circle would be that is not a true circle, much less can we define an ellipse in the manner our correspondent suggests. An ellipse may be variously described. One

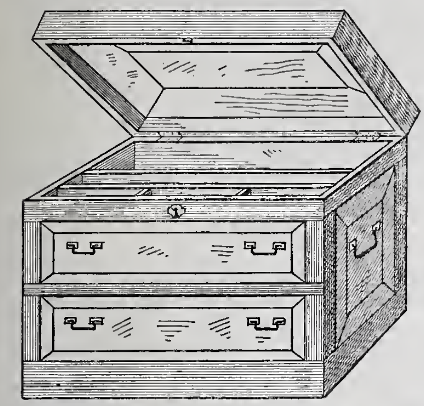


Hip Rafters for Mansard Roofs.—Fig. 5.—Diagram Illustrating Principles.

definition is as follows: "It is an oval or oblong figure, bounded by a regular curve, which corresponds to an oblique projection of a circle, or an oblique section of a cone through its opposite sides." Another definition, and one quite frequently given of this figure, is that it is "a figure bounded by a regular curve generated from two foci." Still other definitions are sometimes given of the ellipse, but the above probably cover all the points necessary for our correspondent. On page 14, January number of *Carpentry and Building* for 1879, he will find an extended description of the ellipse, together with some seven or eight different methods of drawing it, to which we refer him for further information.

Tool Chests.

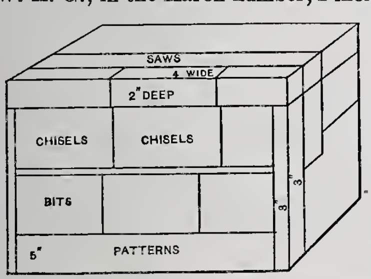
Discussion of the tool-chest question is opened in this number by the following very intersting letters and diagrams. The topic is by no means exhausted by what has so far reached us. We have no doubt, however, that what



Tool Chests.—Fig. 1.—*Elevation of Chest used by L. S.*

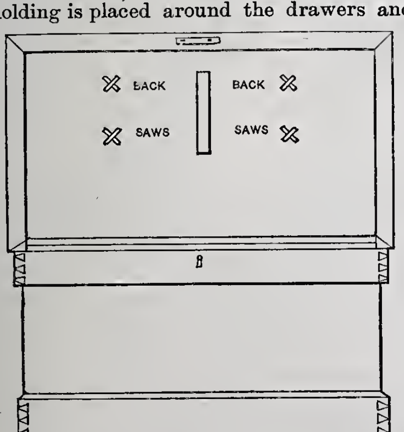
here appears will stimulate others of our readers to contribute their ideas upon the same subject. In addition to these letters we have received the catalogue of tool chests issued by the American Tool Co., whose office is No. 116 Chambers street, New York City. This book contains considerable information, as well as a large number of cuts of amateurs' and carpenters' tool chests, and is a work which we have no doubt a large number of our readers will be anxious to see. We understand it is mailed free to all applicants.

From L. S., *St. Paris, Ohio.*—In answer to W. A. G., in the March number, I inclose



Tool Chests.—Fig. 2.—*Compartments in Chest used by L. S.*

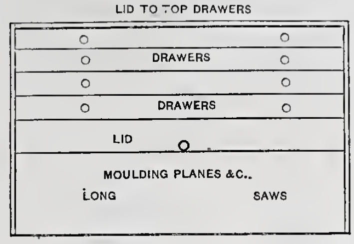
you my plan for constructing a tool chest. The length of the chest is 3 feet; width, 22 inches; hight, 19 inches; the drawers in front are 2½ feet long, 5 inches wide, 5 inches deep. The tray is 4 inches wide and 9 inches deep. The corner post is made of 2 x 3 black walnut, with chamfered corners. The balance of the chest is constructed with ⅞-inch ash lumber. A small molding is placed around the drawers and



Tool Chests.—Fig. 3.—*Elevation of Chest used by L. R. H.*

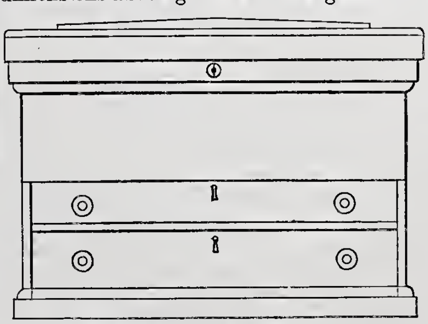
ends of the chest. Fig. 1 shows the chest open and Fig. 2 shows the inside arrangement.

From L. R. H.—Inclosed find sketches of ool chest (Figs. 3 and 4), which is convenient both in size and interior arrangement. I am not a draftsman, and therefore am unable to present as complete plans and details as I would like. Of course W. A. G. will have to use his judgment in constructing a chest and in designing apartments to accommodate his tools. The chest should be about 22 inches high, 3 feet long and 2 feet wide, inside measurement, and width of drawers should be 8 inches, the depth to accommodate the



Tool Chests.—Fig. 4.—*Drawers in Chest used by L. R. H.*

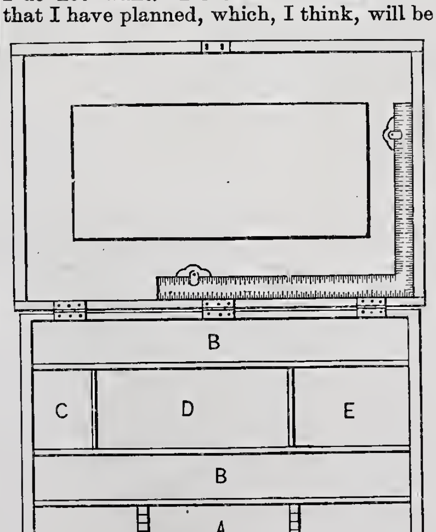
various tools. Four drawers of suitable depth will leave ample room for a division expressly for saws, place for framing tools and large tools in general. In the back part a division can be made for molding, bead and other planes to stand on end, the whole under division in front of drawers to be inclosed, with the lid to swing up against drawers. Squares can be hung against the front, with a slot in the lid below for the tongue to go through. On this lid can be packed bench planes, &c. A chest of the dimensions above given and the general ar-



Tool Chests.—Fig. 5.—*Elevation of Chest used by J. W. P.*

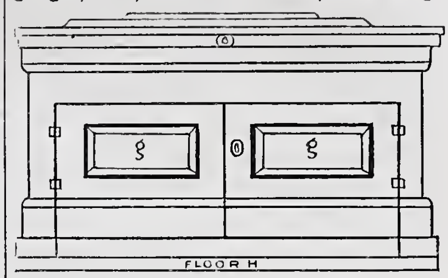
rangement indicated, will hold all the tools that two men will care to lift, and all that a journeyman carpenter or joiner needs for use. Black walnut and cherry are desirable materials out of which to construct a handsome and durable chest.

From J. W. P., *Maryland, N. Y.*—I have a very nice tool chest, but I would like a better one—one in which I can get at all the tools without handling over those which I do not want. I inclose sketches of one that I have planned, which, I think, will be



Tool Chests.—Fig. 6.—*Top View of Chest with Lid thrown back* (*J. W. P.*)

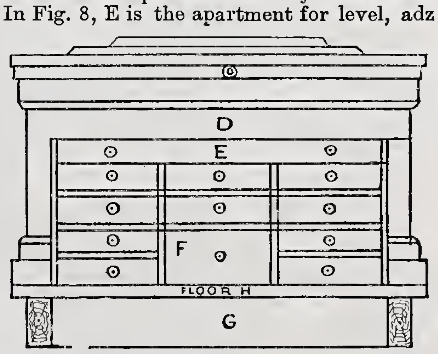
very handy, and I respectfully submit it to the readers of *Carpentry and Building*, requesting their opinions. Fig. 5 is a front view of chest, showing two drawers for bench planes, and whatever a carpenter wishes to put in them. Fig. 6 is a top view of the chest. A is a saw-rack, B and B are for molding planes; C D is for oil stone, gauges, &c.; E for bits. Now, this design



Tool Chests.—Fig. 7.—*Front Elevation of Chest by L. R. C.*

is open for criticism, and I want to obtain all the information concerning it which is possible. I am about to construct a chest, and I want to build the best.

From L. R. C., *Tribe's Hill, N. Y.*—In the March number, your correspondent W. A. G. asks for plans of tool chest which does not require handling of the greater part of the kit whenever it is necessary to find some particular article. Inclosed I hand you some sketches which possibly may meet his requirements. Fig. 7 represents a front elevation of the chest. Fig. 8 shows the chest with front doors removed, and Fig. 9 shows the end of the chest, the inside arrangement being indicated by the dotted lines. Referring to the latter figure, the space marked A is for molding planes, B for bench planes, C for saws and D represents the body of the chest. In Fig. 8, E is the apartment for level, adz

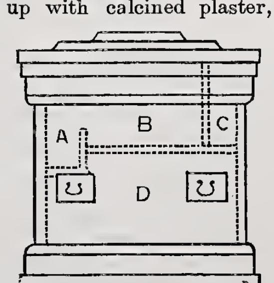


Tool Chests.—Fig. 8.—*Interior Arrangement of L. R. C.'s Chest.*

handle and other long articles; F is for plow, &c.; G represents blocks 6 inches high, forming the base upon which the chest rests. In Fig. 7, H is the floor of chest; *g g* are paneled doors. Should doors be any objection on account of folding, they can be made in one piece and the drawer E omitted, letting door slide in the space.

Covering Cracks in a Plaster Ceiling.

From L. G. C., *Taftsville, Vt.*—Before kalsomining a ceiling the cracks should be patched up with calcined plaster, mixed



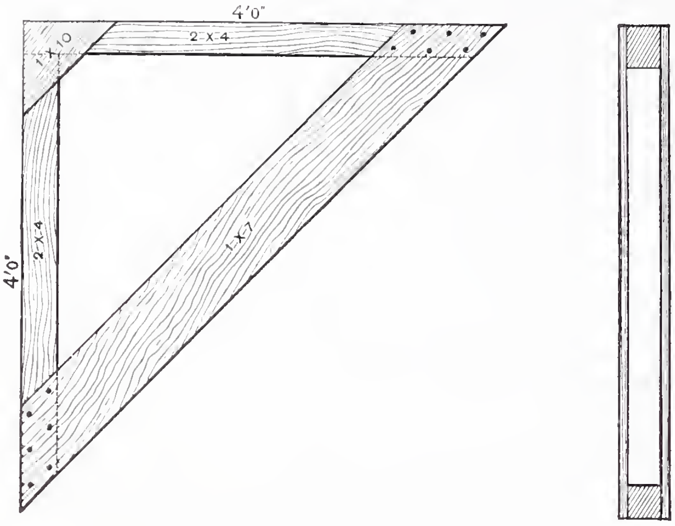
Tool Chests.—Fig. 9.—*Sectional View of L. R. C.'s Chest.*

with water and a slight dash of vinegar. The vinegar prevents the plaster from setting too quickly. Calcined plaster (plaster-of-Paris) in glue size makes a good patch for some purposes. After carefully stopping up crevices and all imperfections, proceed to kalsomine in the regular way. My advice is, never paper a ceiling, or, in fact, any other plastered surface. Paper soon becomes unhealthy and unsightly. It is more expensive than kalsomine, or even plain oil painting. A room can be painted and decorated at about the cost of fine paper hangings, and would look neater when done than if papered. I refer, of course, to rooms of private dwellings where it has been the custom to paper. Large public rooms are invariably painted in water or oil, and are generally decorated.

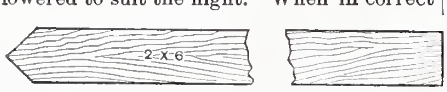
Note.—The objections which our correspondent makes to paper do not hold good if, after the paper is properly applied, it is sized and varnished, as it should be in all cases. In regard to the relative cost of paper and painting we think he is mistaken, for the finer grades of paper afford a decoration at comparatively small expense, while painted work of equally good character would cost more than the most wealthy people could well afford.

Construction of Scaffolds.

From A. C. H., *Rochester.*—I noticed an inquiry from a correspondent for a safe way of building scaffolding for common use. The plan we have been using for scaffolds in this neighborhood for the past two years is illustrated by the accompanying sketches. Take two pieces of 2 x 4 scantling, about 4 feet long, and halve two ends together the 2-inch way and thoroughly nail. Then take an inch piece, 10 inches wide, and nail across the ends one piece on each side, all as shown in Fig. 1. Next take a 2 x 6 piece and cut one end so that it will fit in the corner of the bracket, as shown in Fig. 2, and raise it up against the building, as shown in Fig. 3. The scaffolding can be raised or lowered to suit the hight. When in correct position, put on two braces, one on each side of the 2 x 6 to the ground, also as shown in Fig. 3.



Scaffolds.—Fig. 1.—Construction of Brackets by A. C. H.



Scaffolds.—Fig. 2.—Ground Brace for Holding Brackets in Place (A. C. H.)

I think this is about the cheapest and safest way of building scaffolds that I know of. There is no waste in lumber, and the scaffolding, once built, may be laid away ready for use whenever required. In using this scaffold, I have employed 2 x 12-inch plank above the brackets, on which I work from two to three men. I consider that a good weight. I have never met with any accident. For the gables of buildings we have always spiked two pieces, 2 x 6, together to lengthen out the standards.

We are also indebted to W. A. W., of Oregon, Ill., and S. S., of St. Paris, Ohio, for drawings representing the same idea, and for letters of explanation.

We do not think the subject of scaffolding is by any means exhausted yet. In fact, only one feature has been described so far; accordingly, we would remind our readers that the question is still open. Let us have as complete a discussion of this subject as of some others which have been treated in this department.

An Old Shingle Roof.

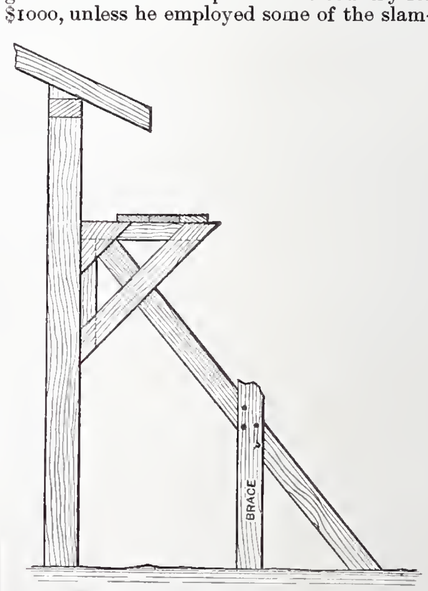
From E. H. P., *Farmington, Conn.*—I this day send you by mail, a specimen of shingle removed from a little church in this place in the course of repairs during the fall of 1879. The church was built in 1771, and has not been reshingled during that period. I think the roof was repaired on one side in 1864, simply by tucking a few shingles. Last fall a more thorough overhauling was required, consuming about 7000 shingles. The whole roof would require about 64,000 shingles. The roof is in such excellent repair now that the carpenter has warranted it to last for 15 years to come, in consideration of $1 per year. Now the question arises, Was there any preparation used for the preservation of the shingles or were the shingles themselves of a superior quality? Why can't such shingles be found at the present day?

Shingles which will wear 25 years are cheaper than slate—*i. e.*, so far as my experience goes. During the summers of 1864–5 I resided in the city of Washington, and from the room in which I lodged I could see a three-story building having a slate roof, one side of which faced the south. During storms I have seen slate upon that building slack and crack like lime. After returning to this place, I helped in the erection of slate-roofed houses. One next door to my own I think has required from $5 to $15 per year in the way of repairs ever since its erection. The trouble is with the valleys and hips, and particularly where the main eaves overhangs. In another case, where a square or hip roof is used, having a rise of 12 inches to the foot, the gutter being located in the cornice, we had nothing to keep the snow from sliding off. A number of slates are found in the gutters every spring. The two cases last mentioned above employed what was supposed to be the best quality of slate in this vicinity. I know of at least a dozen slated buildings, mostly barns, where slate may be seen hanging by one nail, and more frequently lying on the ground, rendering them quite picturesque, but not at all beautiful. On account of facts of this kind, I can see no reason why slates are to be preferred to shingles, save only in cities where fire is to be more dreaded than ice and water.

Note.—The shingle our correspondent sends us is a very interesting specimen, and we have examined it quite carefully. Originally it was fully one-half inch thick at the point where it was lapped by the course above it, and about three-quarters of an inch at the butt. In length it is 18 inches, and in width 4½ inches. It was laid 6 inches to the weather. The exposed part has been reduced by weather-beating to about one-half of its original thickness. There is little evidence of decay about the shingle in any portion. In material the shingle is pine, and a careful examination of it reveals no indication of its having been submitted to any treatment before being laid on the roof. The shingle, when in place, was held by a single nail, which, by its characteristics, being a hand-made rose-head wrought nail, bears testimony of the time it was made. The durability of the shingle is at least in part explained by the unusual thickness, the amount having been worn away by the weather being considerably in excess of the thickness of the modern-made shingles, and it would take at least three layers of modern-made shingles to give an equal amount of wear and keep the roof tight during the whole of the period.

A Challenge to "Wood Butcher."

From G. H. H., *Philadelphia.*—I have read the correspondence in *Carpentry and Building* for March with double interest. I had noticed the mistake in W. K. I.'s brace rule, and was waiting to see if it would be observed by others. I am glad so many detected the error. E. P. M., in the December number, says if short runs are required use 4 inches to the foot, then every quarter inch will be equal to one foot. Now my rule says that a 4-inch scale has 4-12 or ⅓ of an inch to the foot. Next I have a word for "Wood Butcher." He says, "brand such rules as that of G. H. H." I would be glad to see the brand mark to put on it. If he is able to brand it he most assuredly knows what is wrong with it. Will he please expose the fallacy, and explain the mystery that surrounds the rule for backing hip rafter. G. H. H. is very docile, and is willing to drop bad for good at any time. It occurs to me that "Wood Butcher" likes to be heard from, and no questions asked. Now, let us see if he is as good at solving questions as was our Editor. The answers to those I asked about problems in framing were perfectly satisfactory. It may be the Editor thinks I have been a long while in saying so. "Wood Butcher" says, speaking of the first prize design, that a good and tasty builder would erect such a house to the plans and make it look even better than the design. It strikes me it would taste kind of bitter before he got it finished in this part of the country for $1000, unless he employed some of the slam-bangers we have heard so much of through *Carpentry and Building.* "Wood Butcher," I doubt not, holds to himself what will soon be of no use to him. Let him, then, show some of his generosity by telling us how to cut the shakes, knots and rotten places, and let him give us sound timber to put in place of them. If it had not been for certain black spots, we should never have heard of the wonderful W. B. Strength of materials and proportion of parts, in a letter in the November number, by G. H. H., is open to W. B. Will you please call his attention to it?

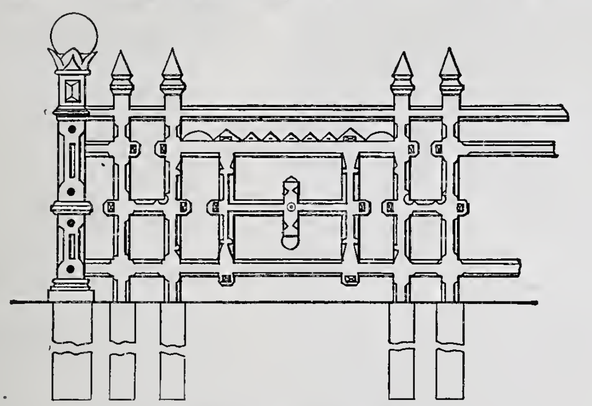


Scaffolds.—Fig. 3.—The Scaffold in Position as Described by A. C. H.

Design for Fence.

From A. M., *Baltimore.*—I send you herewith a design for a gate and fence. The gate is framed together out of 2-inch and 2½ x 4-inch white pine. The panels and sawed work over the top rail are of 1⅜-inch stuff. The posts are worked out solid. The rails of the fences are 2½ x 4 inches, and the pickets are 1¾ inches square.

From R. J., *Toronto, Canada.*—Hearing that the pages of *Carpentry and Building* are still open for designs of fences, I send you



Design for Fence.—Contributed by R. J.

a sketch which I trust will be considered worthy a place along with other communications. The drawing shows the construction of the gate and fence so well that explanation seems unnecessary. In the design published in the March number, I think the gate is the best part. The scrollwork on the posts it strikes me is very poor, and not at all in keeping with the gate.

Saw Filing.

From D. P. P., *Portsmouth, N. H.*—I will try and give my way of filing. In the first place, take the saw and true the edge. For this purpose use a flat file; set it in a block midway—a block about 4 inches long, and 2 inches square. Next saw a slot from one end to the other, and you have something by which you can true your saw without any trouble. Next set the saw, using for the purpose either a hammer set or lever set. If doing the work in a shop, I should prefer a hammer set; if required to be done outside, I should use a lever set. In filing, always run the point of the file toward the point of the saw; that will give the edge on the leading side of the teeth; if you run the point of your file toward the handle of your saw, it gives the cutting edge on the back of the teeth. To file splitting saws, run the file as square across the saw as possible, always filing the side from you. In so doing it is necessary to reverse the saw end for end. I have carefully read the directions given by various correspondents, and do not fully agree with any of them. Experience has given me full confidence in the plan above set forth.

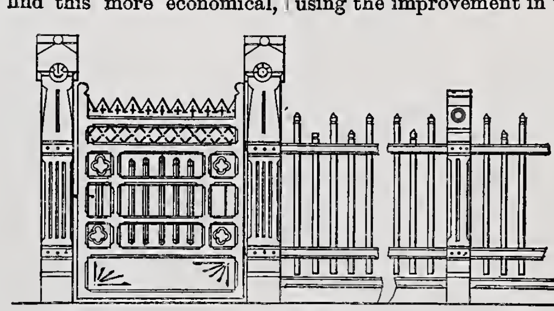
From E. H. C., *East Rochester, N. H.*—I have read the directions for filing saws, as given by three correspondents in the March number of *Carpentry and Building.* Two of the correspondents, one of them claiming to be an old filer, advises us to file cut-off saws with the point of file held toward the handle. I must confess that this is a new idea to me. I don't claim to be an old saw filer by any means, but I have had twelve years' experience in filing saws for myself and others, a d in no instance have I ever seen any one file a cut-off saw with point of file toward the handle. H. W. Holly, in his book entitled "The Art of Saw Filing," advises the opposite course. I have also seen directions for filing saws in several works, but no such instructions have been given for filing cut-off saws as those advanced by H. D. C. and D. Y. S. It may be that theirs is the best way to file a cut-off saw, as in grinding edge tools it is best to have the stone turned toward the edges, but I am not yet convinced of it. I should like to hear from others on this point. It is a point in question, saw points! Do you see?

Furring Brick Walls.

From T. V. D., *Rural Grove, N. Y.*—In furring I have found the best results to follow by laying ½-inch by 2-inch pieces in the joint dry, filling the back with mortar. This plan, by experience, has proven much better than by using 2 by 4. Pieces of the latter size will shrink and get loose; they are more expensive also. If expense is not counted, I would advise the use of 3 by 4 on dry brick.

From L. W. T., *Upper Alton.*—I would advise W. W. C., of St. Johnsbury, Vt., to use the thickest laths or sawed strips. Let them in the inside wall once in about every seven courses, without mortar, and nail the furring to them. Do not use 2 by 4; if you do, whenever they shrink there will be cracking in the hard finish of the house.

From S. B., *London, Ontario.*—A correspondent, M. W. C., of St. Johnsbury, Vt., asks the best way to fur a brick wall for lathing. He inquires: "Is it well to let a 2 by 4 joist in the wall to which to nail the lath?" I object to this myself, because, if the building takes fire at any time, the 2 by 4 would be liable to be burned out, and, as a consequence, would greatly weaken the wall. A better way is to get strips of wood from ¼ to ⅜ inch thick and, say, 1½ or 2 inches wide. Let the bricklayer build these into the wall about 2 feet apart. Your correspondent will find this more economical,



Design for Fence and Gate.—Contributed by A. M.

and at the same time much safer in the event of fire.

From S. W., *Maquoketa, Iowa.*—My plan for stripping brick walls is to lay in a lath about every eight or ten courses. The lath takes the place of the mortar. In this construction the mortar back of the lath must be spread rather thin, so that the brick will press down on the lath in order to hold it in place. A lath will hold a nail sufficiently, and is much easier put in than larger strips. Each bricklayer can drop in a lath when it is needed, and not wait for his neighbor to finish his course and help lay in the stick. The practice of plugging walls for nailing would be rather tedious for me.

From H. W. C., *Newark, N. J.*—In this city it is a common practice for the masons to lay a course of brick dry—*i. e.*, without mortar—about every 2 feet, which will permit the nailing of the one by 2 inch furring without plugging. If once in a while a place does not seem to hold a tenpenny nail, we put one on top of it.

A Word of Commendation.

From Robert Riddell, *Philadelphia.*—I was not aware of your excellent publication until a very short time ago, when I received a specimen copy. I cannot help but admire the marked ability displayed in its get up. The illustrations are very fine. By means of the line drawing every object is clearly shown and the practical application easily understood, even without referring to the letter-press description. This important feature should be appreciated by all who have to work and think.

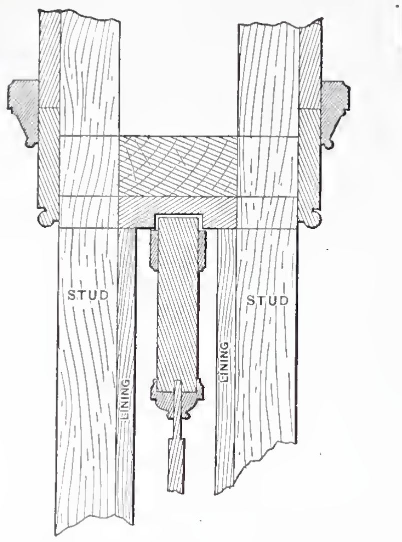
The efforts that are now being made by you and others to instruct the artisan and remove difficulties from his way, should meet with a warm response, not by mere words, but by actions sustaining the source or fountain from which flows such valuable information almost free. At no time have workmen ever had advantages for the cultivation of the mind equal to those of the present period. New ideas and useful hints are no longer concealed; all are coming forward to contribute to the advancement of skilled and unskilled workmen. I wish you success in your work of disseminating truth, which must eventually yield the best results.

Holcomb's Shingle Patent.

From R. D., *Widderley, New York.*—In the February number of *Carpentry and Building* I notice an inquiry with regard to Holcomb's patent on shingling hips of roofs, and have waited to see your answer before I gave an account of last summer's experience in this neighborhood. One of our lawyers had a document placed in his hands, by which to collect royalty from carpenters in this vicinity who had laid roofs embodying this improvement. Our builders have been laying roofs of this kind for seven or eight years past. I called to see the attorney, and in answer to my questions he informed me he had collected from three or four persons who had used the invention, amounting altogether to some $14 or $15, at the rates which were charged. Other parties had infringed the patent, he said, and were liable, but only in small amounts, which would not pay for collection. He said further that the patent was about to run out in any event. If desired, he would look it up for me, and tell me when it did expire. We have been using the improvement in this neighborhood with perfect impunity, and from my experience I think your correspondent need not be at all alarmed in regard to it. I advise him to go along as though nothing had happened.

From S. W., *Maquoketa, Iowa.*—Modesty and inexperince as a letter writer have kept me from writing before on the many topics which have been under discussion. I am at times amused, and at other times provoked, at some of the rules and ideas presented by the correspondents. Many of them are no nearer the truth than some so-called carpenter work is true mechanical skill. I might cite, as an instance, the brace rule of W. K. I., but I presume by this time his rule has been sufficiently discussed, so I will drop that part of the subject.

I desire to give my testimony with reference to the patent on shingling hips of roofs. About 15 years since, I was doing "jour" work in the southern part of New York. Our boss showed us how to shingle a hip roof in the way described in the patent. I have practiced it more or less ever since that time. I am free to say that it makes a better roof than any other method with which I am acquainted, but it does not look quite so well

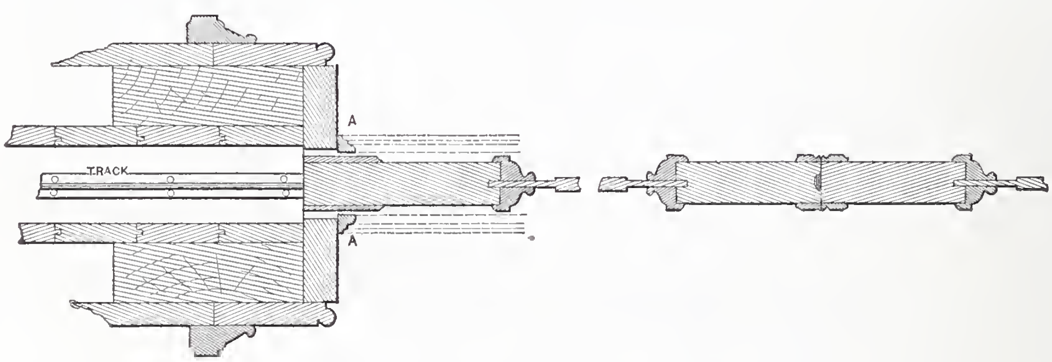


Construction of Sliding Doors.—Fig. 1.—Vertical Section through Top of Doors.—Letter from A. M.

as some others from the ground. I never had the least idea of its being patented until I saw a statement to that effect in "our paper."

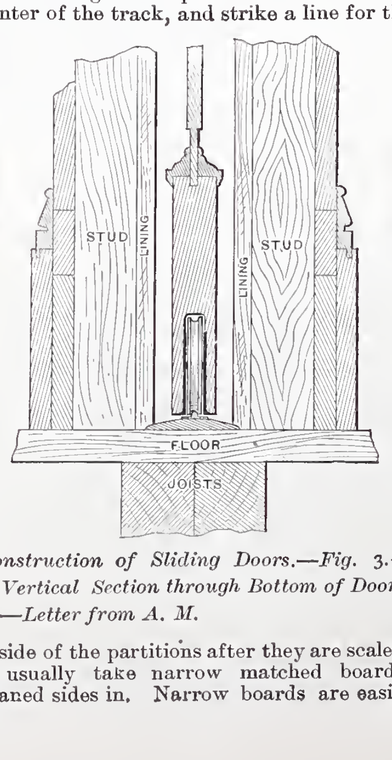
Construction of Sliding Doors.

From A. M., *Baltimore, Md.*—Perhaps I can give A. K. some information about the construction of a pair of sliding doors to run on the floor. Fig. 1 of the accompanying illustrations shows a vertical section from the top rail and head. Fig. 3 shows a vertical section from the bottom rail, sheave, &c. Fig. 2 represents a horizontal section through the stiles, jams, &c. The advice given by your correspondent A. A. in a recent number, with regard to everything about the partition being true, level, plumb and square and well trussed, is very good. Sliding doors, unless carefully constructed, instead of being a convenience become a nuisance. The width of the pockets should be at least 1 inch greater than the thickness of the doors, and if raised moldings are used in the panels, allowance must be made for them in addition. The depth of the pockets will depend upon the kind of locks used. Locks for sliding doors can be procured both with and without knobs. When the former kind is employed, the backs of the pockets are set so that when the doors are opened the stiles will project their full width past the face of the jam. When the latter kind is used, the depth of the pockets is laid off, so that when the doors are opened the edges of the stiles will be flush with the moldings on the face of the jams. The openings into the pockets should be about a half inch wider than the thickness of the doors, so that, should there be any irregularity in the door, there will be no rubbing against the edges of the jams. In the head of the jam, which should extend the full depth of the pockets, is a groove five-eighths of an inch deep, one-eighth of an inch wider than the thickness of the doors. The carpet sill is one-half inch thick, 3½ inches wide and the same length as the head. Some screw the track to the floor, in which case it is put down before the pockets are lined. I prefer, however, to secure it to the carpet sill and not fasten the carpet sill to the floor inside the pockets, for the reason that if the partition should settle, the sill can be easily taken up and leveled again. Care should be taken in putting in the sheaves to sink them the same depth, and also to give them a solid bearing throughout their entire length. I have seen sheaves which have been broken by the weight of the door from carelessness in this respect. The doors should be fitted short enough, so that by slipping the top rails into the groove in the head of the jam the doors may be readily placed on the track. The small molding shown at *a a*, Fig. 3, is put on after the doors are found to be in working order. It should be placed as close as possible, without interfering with the working of the doors on both jam and head.



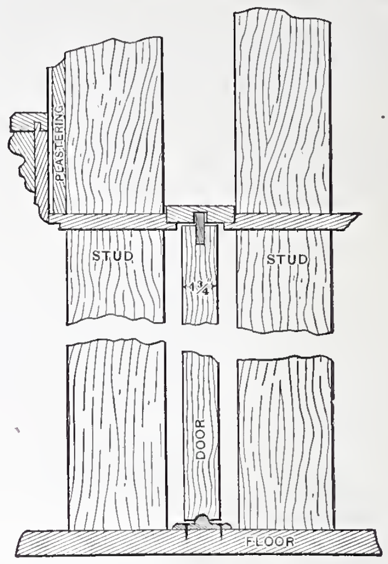
Construction of Sliding Doors.—Fig. 2.—Horizontal Section through Stiles, Jambs, &c.—Letter from A. M.

From C. B., *New London, Conn.*—The March number, as usual, was full of good suggestions and plans for the craft. Among the queries I noticed one from A. K., asking a method of arranging sliding doors to run on the floor. I will give him my plan. I first cut two studs one-quarter inch longer than I want my doors. I then take a piece of pine plank one-quarter inch thicker than the doors are. Next I joint and groove the edge in the center 1 inch deep. I use a three-quarter inch iron to plow it with. I next set the two studs the right distance apart, so that when the doors are open they will stop against them. I place the grooved piece on the studs with the groove down and fasten it firm. I then plumb down from the center of the groove for the center of my track on the floor. After the track is fastened in place, I take half of the thickness of the grooved piece each side of the center of the track, and strike a line for the



Construction of Sliding Doors.—Fig. 3.—Vertical Section through Bottom of Doors.—Letter from A. M.

inside of the partitions after they are scaled. I usually take narrow matched boards, planed sides in. Narrow boards are easily nailed. I seal up both insides at once, working on each side alternately, as it is difficult to nail after one side is sealed. It is not necessary to carry the boarding any higher than the top of the groove piece. I then fit a board and nail it on top in order to pre-

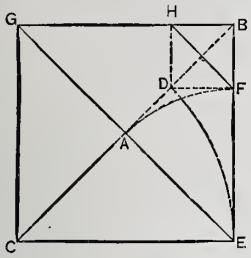


Construction of Sliding Doors.—Fig. 4.—Sketch Accompanying Letter from J. B. G.

vent the plaster, &c., from falling into the pocket. When I fit the doors I put a hard wood dowel in the center of the top rail of each door that will nearly fill the groove. A little tallow rubbed in the groove makes the doors run easier. The casters or wheels are usually put in the bottom rail, as near the stiles as possible. The grooved piece being fastened only at the ends, prevents the settling of the partitions fr— affecting the doors, and the covering over the pockets keeps the plaster and dirt out. When the doorway is arched, I use half inch jams, and usually give 10 inches spring. For a room 10 feet high, should use doors 7 feet 6 inches, measuring to the spring of the arch. I shall be pleased to see still other methods.

From J. B. G., *Louisville, Ky.*—Thinking I might give our friend A. K., of Ontario, some points in the construction of sliding doors to run on the floor, I inclose a sketch showing an end view. The doors are to be furnished with dowels to run in a groove at the top; the bottom to have sheaves mortised into the door to run on track. The track is to be screwed to the floor. Care must be taken to have the floor level. If everything is accurately fitted, there will be no trouble in the working of the doors.

From S. W., *Maquokcta, Iowa.*—In reply to A. K. for a plan of sliding doors to run on the floor, would say: I should get the Hetfield sheave, which is the best I know of, and use a brass track, thereby lessening the noise. Make the doors 7½ feet high, provided the width is not less than 6 feet. Lay the track straight and level. Make the doors out of two thicknesses of lumber, screwed together at the top of the doors, and screw a hard-wood stop on the head jam for this groove to slide on. By this construc tion he will have no trouble with his doors. My experience is that sliding doors are very liable to spring or warp, caused, no doubt, by the extreme heat they are apt to receive on one side, while the other is cold or damp. By making them double, this difficulty is to a great extent avoided. No difficulty comes from paint when the guides for the tops of the doors are formed by a stop on each side of the doors. By grooving the top and putting in a hard-wood strip for a guide, as above described, this difficulty is obviated. I do not consider that this plan of sliding the doors on a track at the bottom makes as neat a job as hanging them from the top. I put in two pairs of sliding doors last year,



Making a Square Stick Octagonal.—Fig. 1. Plan Proposed by B. F. S.

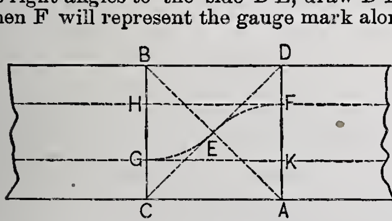
hung from the top. The rooms were afterward carpeted with the breadths running through the doorway, which was possible because there was no track. When the doors were open this arrangement presented a very neat appearance.

From G. W. C., *Yolo Yolo, Cal.*—Answering the question proposed by A. K., with regard to the construction of sliding doors, I would say that my plan is as follows: I use sash pulleys, letting them into the bottom of the door the same as for window jams. I bed a piece of ⅜-inch round iron in the floor, so that it rests solidly, using screws to hold it in place. At the top I employ a ⅜ x 1¼ inch strap iron band, square at both ends, so that it may act as a stop for the door both when open and shut. In the middle of the iron I have a ⅜-inch round piece, riveted and curved so that it will fasten to the wall above the door. I find this plan works very well.

Making a Square Stick Octagonal.

From B. F. S., *Feasterville, Pa.*—I noticed a communication in a recent number of *Carpentry and Building*, giving the *modus operandi* of forming a square piece of timber into an octagon. The correspondent proposes to make an octagon from a piece 2 feet square, by taking 7 inches from the corners each way, but it won't do. I suppose an early number of the paper will tell why.

Accompanying this is a simple plan, which I have often used, and in which I have never found an error. If there is anything wrong I hope some reader will show it up. Referring to the sketch (Fig. 1), draw a line through the square diagonally, as shown by B C, and with compasses set off on the diagonal line the width of either side of stick, thus obtaining the point D, as shown. From D at right angles to the side B E, draw D F; then F will represent the gauge mark along



Making a Square Stick Octagonal.—Fig. 2. —Rule Employed by W. H. S.

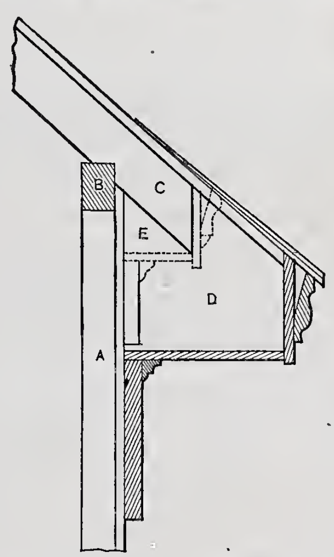
one side of the stick. From D in like manner draw a line at right angles to the side B G, thus obtaining the point H, the gauge mark upon the second side.

From J. P. F., *South Canton, Mass.*—In the March number of *Carpentry and Building* I notice a rule for making a square piece of timber octagonal. Perhaps it is not generally known that a very handy scale for the purpose is to be found on most pocket rules. Even the cheapest grades are provided with it in many cases. Along the inside face of the rule there may be noticed two scales, one on each of the inside edges as the rule is folded; one is marked M, and the other E. The gauge on the M line works from the middle of the timber, and that on the E line works from the edge of the timber. The M line is quite handy in cases where the timber is waney-edged. This rule is supposed to be mathematically correct, although I do not vouch for it. I have used it many times and know it to work considerably nearer than half an inch.

The following is the method of using the rule: Suppose we have a piece of timber 8 inches square, and desire to work from the center of the timber. Put 10 of the M scale on the center of the timber, and mark by the end of the rule; then reverse the rule, placing as before, and measure in the opposite direction, also marking at the end of the rule; the two points thus obtained will give the gauge lines. If it be required to work from the edge of the timber, use the E scale in the same manner as above described, measuring from the edge, however, instead of from the middle.

I once worked under a foreman who had spent an hour trying to form an octagon on the end of a stick of timber. He succeeded in covering the whole end with marks, and yet none of them were right. Finally, he asked me for my method of finding the proper shape. I explained to him the scale which was found upon his pocket rule. He replied, "That is easy enough," and so is everything else when you once know how.

From W. H. S., *Middleborough, Mass.*—I have read the methods of forming an octagon from a square already published in



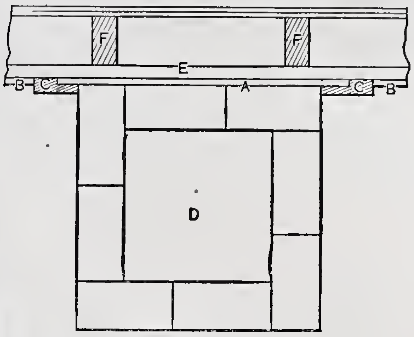
A. Studding. | D. New Furring Block.
B. Plate. C. Rafter. | E. Old Furring Block.

Repairing an Old House.—Fig. 1.—Cross Section of Cornice.—From E. H. C.— Scale, ½ Inch to Foot.

Carpentry and Building. I now send my mite upon the same subject. The scales for the purpose of laying off an octagon, to be found upon the squares and rules in common use are usually correct. The method by marking off 7 inches from the end of the square, as shown in the March number, is sufficiently correct for most purposes, but as clearly demonstrated in that number, is not mathematically correct. The rule which I herewith present is very simple, and is easily demonstrated by geometry or tested by square root.

Draw a square of the same dimensions as the lumber to be worked; then draw diagonal lines, as shown by A B and C D of the accompanying sketch (Fig. 2). One-half the length of the diagonal of the square measured across the stick, will give the points from which to draw the gauge marks. In other words, from A as center, with radius A E, strike the arc E F, cutting the side A D of the square in the point F. In like manner locate the points H G and K. Then lines drawn through H F and G K will be the gauge marks to which to dress the timber.

We are also indebted to H. M. G., of U. S. S., New Hampshire, Port Royal, S. C., for a diagram illustrating the same method of obtaining an octagon from a square. We also have a similar diagram from W. W. G., Wakeman, Ohio. Neither of these correspondents applies the diagram to the side of the timber, as shown above, but simply demonstrates the method of laying out an octa-



A. Old Clapboards. B. New Clapboards.
C. Rebated Strip, put over Ends of Old Boards.
D. Chimney. E. Boarding. F. Studding.

Repairing an Old House.—Fig. 2.—Cross Section of Chimney and Wall.—From E. H. C.—Scale, ¾ Inch to Foot.

gon within the square. In this connection it is only proper to remark that in the March number of *Carpentry and Building*, 1879, page 52, Fig. 6, the same problem was carefully demonstrated, to which we refer any of our readers desiring additional information.

Repairing an Old House.

From L. W. T., *Upper Alton.*—Leave the chimneys standing if you do not want to change them. Saw the old clap-boards down by the chimneys; set a strip or corner board similar to that on the outside corners of the building, so as to butt against the chimney. Take off the old boxing of the corners; nail on lookouts to lengthen out as much as is necessary. If the frieze is deep enough to drop down some, it will bring the crown mold nearer into line with the pitch of the roof, and make it look much better accordingly.

From E. H. C., *East Rochester, N. Y.*—I do not file away each number of the paper after once looking it through. First, I look it over carefully; then I read it through; then study it through, and, last and best of all, practice or test it through. I wish *Carpentry and Building* might be made a weekly paper. At present it don't come often enough for me.

I will lend P. S. S. a helping hand on his old building that he wishes to remodel. If I understand one of his questions correctly, he wants to know how to make the cornice on the rake, as well as on the eaves, wider. I trust the accompanying plan, which shows a section of horizontal and rake cornice, will help him. He don't tell us whether he wants to use the old cornice or not. If he does, he can undoubtedly do so by removing it with great care. He would require, however, to get out a few feet of each member to make up for whatever the cornice is lengthened. It would also be necessary to match on a strip of planceer.

The correspondent also wishes to know how he can remove the old clap-boarding and replace with new and narrow without taking down the chimneys. By this I take it that the chimneys were put up after the house was clap-boarded, and, accordingly, they lie against the clap-boards so that the latter cannot be removed. If this is the case, I should say, saw the clap-boards about 2 inches from each side of the chimneys. Then take a 4-inch strip long enough for each side of the chimney; rebate about 2 inches on from one edge of each strip, taking out enough to receive the ends of clap-boards that are left on ; then put the strip on over the old clap-boards, so that the inner edge will come against the chimney, leaving the outer edge to clap-board against. All this will be better understood by examiniug the sectional plan of chimney, clapboarding and wall.

An Appreciative Reader.

From G. N. C., *Hancock, N. H.—Carpentry and Building* suits me very much in some respects, but it forces upon me a realizing sense of my own ignorauce that is not at all agreeable. I thought ten years ago that I knew all about carpentry, but there seems to be so much to learn in this world, at least to one who is not blinded by conceit, that no one man can know it all. I am sure I can derive a great deal of information from the paper, and have already got my money's worth several times over.

ACKNOWLEDGMENTS.

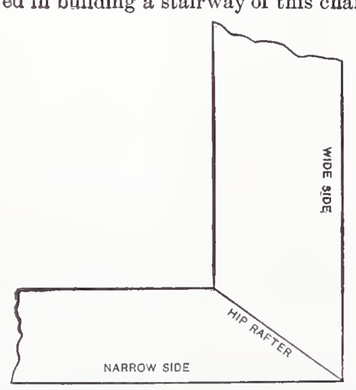
We acknowledge, with thanks, communications as follows:

A. B. J., *Cornwall, N. Y.*—Elevations and plans of a cottage, old English style. This correspondent, who gives his age as only 16 years, has made very creditable progress in his architectural studies. His drawings are well executed and the design has many good features.

J. W., *East Saginaw, Mich.*—A demonstration of the impossibility of parallel ellipses. We shall be glad to publish this letter, with accompanying diagram, when opportunity presents and the interest of our readers in the subject seems to warrant it.

E. A. W., *Cassville, N. Y.*—Elevations and plans of a house, to be built at an estimated cost of $2500. A creditable design, very carefully worked out by a practical builder.

A. W. H., *Harrisonburg, Va.*—A problem in stair building, or more particularly in hand railing. Required the rail for a circular stairs, in a funnel-shaped hall, the small end of the funnel being uppermost, the stairs getting steeper and the rail smaller as the top is approached. The stairs to run through two stories of 10 feet each. Hall 15 feet in diameter at bottom and 8 feet at top. Rail, 4½ inches at bottom, diminishing proportionately as it goes up. This is the description of a very peculiar and quite unusual form of construction. We publish it as a matter of some curiosity. We do not think a demonstration of the several problems involved in building a stairway of this character can be of general interest to our readers, and therefore we lay it aside to make room for matters of more practical importance.



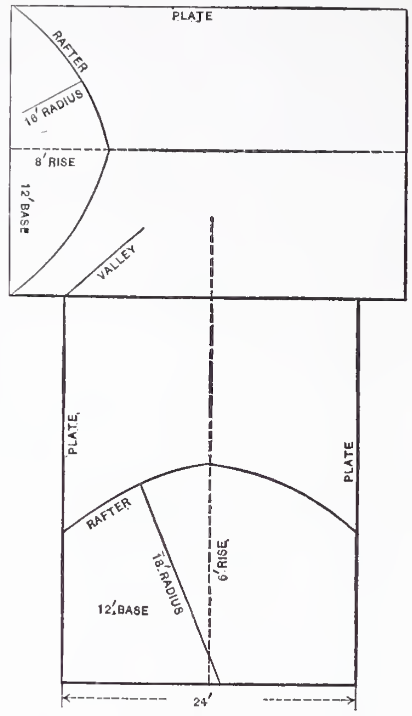
Curved Hip Rafter between Roofs of Different Pitch.—From J. A. E.

T. M. H., *Howell, Mich.*—Side elevation, plan and cross section of small frame church ; also framing of spire. We shall probably publish this whenever space permits. It comes from a practical man, and shows just how he constructed a church some two years since.

W. S., *Canada.*—Parallel ellipses, with diagram.

T. R. D., *Topeka, Kan.*—Short rules for backing inclined corner posts. We have carefully examined the rules offered, but fail to find any principle or foundation for them. Although they appear to work accurately in the examples cited, if we understand them they will not work in all cases. Accordingly, we recommend to our correspondent's attention the practical rules grounded upon mathematical principles, which have already been set forth in *Carpentry and Building*, as being more valuable than those he proposes, and less likely to fail him in the hour of need.

L. G. C.—Design, with description of colors, to be used for the decoration of a vestibule.



Valley Rafter between two Curved Roofs.—From M. W. C.

Several communications on the subject of ventilation shall have attention in an early number.

J. E. W., *Royalton, Wis.*, sends a design and specification of bridge truss, use of which we are obliged to defer for the present.

L. W. T., *Upper Alton, Ill.*, sends a description of a baptistery which we are unable to publish. Discussion of both mechanical and sanitary features at one time, and in a spirit tending toward levity, renders it unsuitable for our columns. We have also a letter from the same correspondent entitled "Gas Fixtures," by which he means the fast shinglers whose letters have already been published, which we reluctantly consign to the scrap basket. We believe our readers have had enough of this kind of shingling for the present.

Several other communications on the subject of shingling are passed for the same reason.

Refutations of W. K. I.'s brace rule still continue to come in. A number have been received since last issue. We take this method of acknowledging them instead of mentioning them in detail.

E. A. C. D., *Hudson, N. Y.*, is pleased with *Carpentry and Building* generally, but deprecates some of the unpolished pieces of timber sometimes found in the Correspondence department. He is quite ambitious in his own style. He says: "Some of the correspondents' letters clang, in harsh and grating lang—more correctly speaking, slang—phrases. How different—and, at the same time, how much more pleasing—is the pure, ringing, kind and considerate tone of the letters of others." Well, perhaps that is so, and possibly we shall be obliged to get out an expurgated edition, simply to please such fastidious readers as E. A. C. D.; but at present we believe the majority of our readers rather enjoy the "clang—lang—slang" of Wood Butcher, H. McG., L. F. A., B. P., T. A. F. E., L. W. T. and others. All of these writers employ forcible expressions, and in some cases quite vigorous English, but each has conveyed good lessons in the letters he has sent. We do not propose to encourage "clang—lang—slang" to an extent to make it offensive to our readers, but whenever a communication comes straight from the workshop, and is of a character likely to throw light in some dark corner, we shall not reject it simply because it is not sand-papered and varnished.

REFERRED TO OUR READERS.

Curved Hip Rafters between Roofs of Different Pitches.

From J. A. E., *Meadford, Ontario.*—Will some reader of *Carpentry and Building* give me a rule for getting the proper radius for hip rafters on O G veranda roofs, where one side is wider than the other, as illustrated in the accompanying sketch?

Valley Rafter between Two Curved Roofs.

From M. W. C., *St. Johnsbury, Vt.*—I inclose a diagram of a curvilinear roof. Main part is 24 feet wide, the rise of rafter being 8 feet. The L part is 24 feet wide, and the rise of rafter 6 feet. What I want is a rule for getting the valley rafter with the proper curve, if it has any curve at all.

Valley Rafters for Curvilinear Roofs.

From J. R. L., *St. Johnsbury, Vt.*—Will some of the readers of *Carpentry and Building* furnish me a rule for cutting a valley rafter for two curvilinear roofs for a conservatory? There is a curved roof on both main part and wing.

Dividing a Room by Curtains.

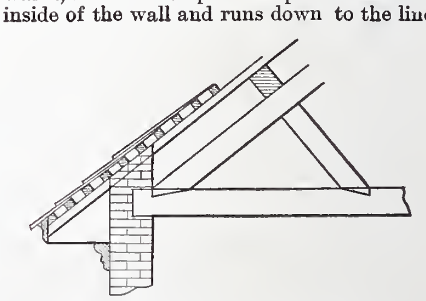
From A. K., *Smith's Falls, Ontario.*—Will some reader of *Carpentry and Building* show me how a large room, say 18 feet wide, may be divided by curtains so that when they are thrown open it will show the arch from one wall to the other?

Sash and Door Clamps.

From C. W., *Newport, Ky.*—I am in need of some clamps with which to put together doors and sash. Will readers of *Carpentry and Building*, who have had experience in such work, advise me as to the kind of clamps best adapted to the purpose?

How to Correct Defective Slate Roofs.

From W. C. T., *Worcester, Mass.*—I inclose a rough sketch of a section of a roof, so you may understand two questions I wish to ask. It will be seen that the brick wall extends up between the rafters against the roof boards, and as the attic is very warm, snow melts upon that part of the roof inside of the wall and runs down to the line of the wall, where it freezes, resulting in a backing up of the water, which drenches the walls. Is there any remedy for this difficulty short of taking off the slate and tinning the roof as high as the inside line of the wall? Second, it will be noticed that the slate is laid on slats. Whenever there is a driving snow storm, snow sifts in all over the attic. Is there a remedy for this short of taking off the slate and replacing the lath with matched boards? The building is 34 x 100 in plan. If some of the practical readers of *Carpentry and Building* will assist me in this matter they will confer a favor.



Defective Slate Roof.—From W. C. T.

Material for Covering Church Spires.

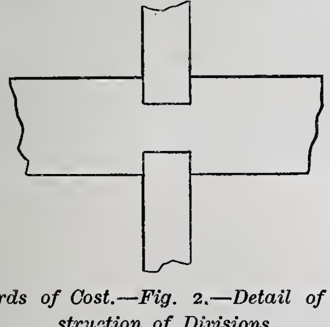
From J. T., *Davenport, Iowa.*—Will some of the readers of *Carpentry and Building* advise me as to the most suitable material for covering church spires? Which is the best to use, slate, iron or shingles?

Keeping Records of Cost for Use in Estimating.

From G. H. H., *Philadelphia.*—After reading the correspondence in *Carpentry and Building* for the past year with regard to estimating, I have come to the conclusion that estimating is in all cases partial guesswork. Several times in the past year I have thought of proposing a plan of my own for getting out a reliable workmen's list of labor and material, but I have withheld my ideas, thinking that some reader of the paper would suggest some good plan. Since none appears, I will endeavor to start the machine moving, hoping that others will put some spokes in the wheels too.

It is very evident that a builder could never spare time to stand in a building, in order to see just how long it takes to lay a floor, or to finish a door, or how much material is used. Time spent this way would be wasted by him, therefore I propose this idea, that a record be kept by individual workmen. There are enough mechanics who are readers of *Carpentry and Building* able to make a record of such work as they are performing, keeping an account of the time and the material used and sending the same to the Editor, to cover almost the entire field of a builder's work. Records of this kind should be classed as follows: First-class work—good material, joining the work, solid joints fitting all through. Second-class work—medium material, joining the work merely to show the face. Third-class work—rough material, work that is very common. Time should be taken based upon what is a good, honest day's work, and in no case should it be entered upon the basis of what a man can do when he is rushed, but rather what he can do working regularly day after day.

Now for an illustration, to make my idea better understood. A workman fits up a door. The first question that arises with reference to making out his report is, what kind of a door is it, hard wood or soft wood? Next, what are its dimensions, then the construction of the door. This idea is applicable to all departments of building. It may be employed by carpenters, masons, bricklayers, painters, plumbers, plasterers, tinners and others. By this means a list would be obtained which would be of great service to the readers of the paper at large. I would like to hear from others with regard to this idea.

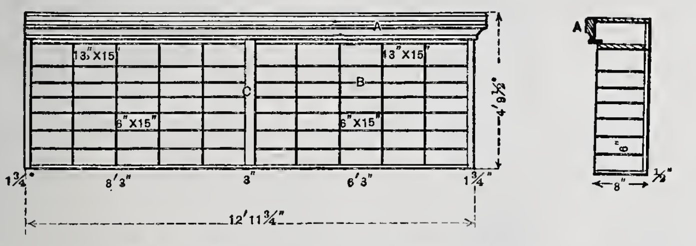


Records of Cost.—Fig. 2.—Detail of Construction of Divisions.

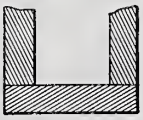
I will inclose a record of my own which will further illustrate the subject. The accompanying sketches show the work performed upon a pigeon-hole case. Three men were employed at the case; the extreme ends were 1⅜ inches thick, the center ends ⅞ inch thick, the shelves ½-inch thick, the divisions ¼-inch thick, top and bottom ⅞-inch thick, head covering, ⅞-inch thick; the back was made of pine ½ inch thick. The back was of mill-worked boards, matched and beaded, joints 2¼ inches apart. Wood was all mill-planed and replaned to thickness by hand, as mill-planed boards are always thicker in the middle than on the edges. The molding was worked by hand. Uprights were set in rebated shelves, and shelves were set in rebated ends. The sketches show the general construction. All was glued together and the back was nailed. The following is the bill of materials and labor:

½ matched walnut for back	feet,	76
½ mill-planed " " shelving	"	77½
1⅜ " " " ends	"	11
⅞ " " " top, bottom, middle and ends	"	38
1⅛ mill-planed walnut for moldings	"	6
¼ " " " divisions	"	36
⅞ " " " pine head covering and brackets	"	16
Glue	lbs.,	½
Nails, fourpenny	"	1½
Time	hrs.,	63

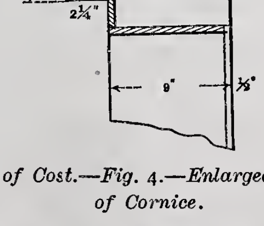
Note.—We refer this suggestion to our readers, believing that it is of value and should be carefully discussed. We reserve our own comments for a future time. Whether it is practicable for *Carpentry and Building* to become the receptacle of all the records G. H. H. would have sent here, we cannot at this time say. We are willing, however, to do all in our power to help along any system of estimating which is likely to prove desirable. We leave the subject with our readers, and hope to have a general expression of opinion from them.



Records of Cost.—Fig. 1.—Elevation of Pigeon Hole Case.—Letter from G. H. H.



Records of Cost.—Fig. 3.—Section at C of Fig. 1.



Records of Cost.—Fig. 4.—Enlarged Section of Cornice.

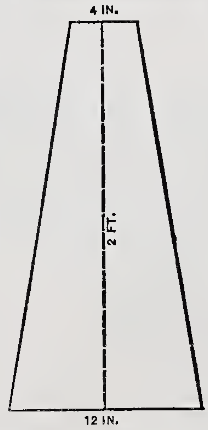
Utility of the Square—Problems Proposed.

From J. C. W., *Nevada, Iowa.*—I cannot resist the temptation to sail in and show how little I do know. But first I want to congratulate everybody connected with "our paper," and especially our Editor, for I really think we have one of the best of papers. The only strange feature about it to me is that there is so much given for such a small amount of money. I fall in line and call it "our paper," for I deem it an honor to be connected with it. Now for the display of my own wisdom.

I have been greatly interested in the various papers so far published, particularly those on the square, stair building and framing. I place the square first, because I consider that tool at the head of the carpenter's kit. I will wager that nine carpenters out of ten—I mean carpenters, not mechanics—think that all a square is made for is to lay off right angles, mortises, tenons, rafters and measure lengths. I find the square the most complicated, as well as the most simple, of tools. I have been using the square for more than 25 years, and am still finding out new principles and new uses. In this connection, I would like to hear from the readers of *Carpentry and Building* what rules they are employing for laying off hectagon and octagon miters without first drafting the figure and then bisecting the angle. These miters are often used in cylinders for stairs, and also in cutting the base and cornice around bay windows. I wish to call out the ideas of your readers on this subject. I have my own ideas, which I will forward in due time, if desired. Possibly I may find out a better rule than the one I am now employing.

Problems of Equal Areas.

From T. V. D., *Royal Grove, N. Y.*—I have a board, 12 inches wide at one end and 4 inches wide at the other, and 2 feet long, which I want to bisect parallel with the base, giving equal area to the two pieces. If some correspondent will demonstrate the problem by lines, I shall feel greatly obliged. I can solve the problem by figures, but when I come to determine lines properly in the question I am out. The inclosed diagram illustrates my wants better, perhaps, than my description.



Problem of Equal Areas.—Proposed by T. V. D.

Construction of Cisterns.

From H. W. J., *Frankfort, Ind.*—I have a question to submit to the readers of *Carpentry and Building.* I desire to learn their experience in putting in cisterns after digging the hole. Is it better to cement directly upon the soil or clay, or to wall with brick, and cement against the brick? I should like to hear this question discussed, with reasons for the opinions advanced.

Further Particulars Required.

From T. V. D., *Royal Grove, N. Y.*—I would attempt to answer the question of S. F. F., but he does not state whether the roof on the stable is to be flat, hipped or gabled.

How to Face an Outside Sash Door.

From C. D. S., *Springfield, Vermont.*—I would like to have the opinion of the readers of *Carpentry and Building* as to the right way of putting in an outside door which has a glass panel. Should the molded or putty side be exposed? Most of the builders here put the molded side out, which, it seems to me, is not right. I cannot see why it should not be putty side out, the same as windows. I am willing to be convinced, and if I am wrong I hope some one will show me reasons to the contrary.

Designs for Doors.

From J. B., *Portsmouth, Mich.*—Have you any designs, in the back numbers of *Carpentry and Building,* of doors for houses containing the details of construction? I want doors 2 feet 8 inches by 7 feet; also sliding double doors 6 by 9 feet. If there has been nothing published exactly meeting my requirements, please refer this to your readers. I think the subject of doors will be an interesting one in the department of Correspondence.

Note.—Designs of doors will be welcomed from our practical readers.

Construction of Gothic Window Frames.

From J. J., *York, Neb.*—I wish to ask a question. I have a contract for building a large church. I would like to know the best way to make Gothic window frames. Will the readers of the paper who have had practical experience favor me with diagrams? The walls are 6 inches thick, and the frames are to be constructed without weights or pulleys.

Kiln Drying Lumber.

From J. B. P., *Hartsville, Ind.*—I desire the privilege of asking a few questions through the columns of *Carpentry and Building*. Will lumber dry better and quicker in a kiln by leaving an opening at the top of the kiln for a day or two in order that the steam may pass off? Will the lumber crack as much or more than otherwise by so doing? Sometimes I have lumber which splits almost its entire length in the kiln. What causes it? Is it attributable to too much heat at the beginning? I would like to see this subject discussed.

Black Walnut Stain.

From E. A. W., *Cassville, N. Y.*—I want to ask the readers of *Carpentry and Building* for a recipe for a cheap black walnut stain.

Where Can Red Cedar be Obtained?

From D. C., *Sharon, Pa.*—I have a novel question to ask of the readers of *Carpentry and Building*. I am in want of some red cedar, an article not to be found in this market. Will some one tell me where I can get it to the best advantage? I will forward a communication, which will possibly repay the favor I ask above, for publication in a short time.

Design for Cupola.

From S., *Arcadia, Kansas.*—Will some reader of *Carpentry and Building* be kind enough to furnish a plan for a cupola suitable to be used upon a building for public purposes? The building is 24 x 40 feet, with 8-inch studs. The roof is third pitch, and the building frame.

Covering Hips of Mansard Roofs.

From A. H., *Harrisonburg, Va.*—We have had no experience in this vicinity with mansard roofs, but as some buildings finished in this manner are about to be erected, I desire to ask some questions. Will some reader give me the best way for finishing the hips of curved mansard roofs? What material shall I use and how shall it be managed? I desire also to inquire with reference to conservatories. What is the best protection against cold—how should the windows be arranged? Some plan in *Carpentry and Building* illustrating the construction of conservatories would be a favor at this time.

Prices of Building Materials in New York, April 20, 1880.

Blinds.—OUTSIDE.

Per lineal, up to 2.10 wide....$ .... @ 0.24
Per lineal, up to 3.1 wide .... @ 0.28
Per lineal, up to 3.4 wide .... @ 0.31
Per lineal, paint'd and trim'd 0.45 @ 0.55

INSIDE.

Per lineal, 4 folds, Pine .... @ .56
Per lineal, 4 folds, ash or chstnut .... @ .90
Per lin'l, 4 folds, cherry or butternut .... @ 1.30
Per lineal, 4 folds, bl'k wal't. .... @ 1.30

Bricks.—(Afloat.)

Pale .... ⅌ M. $5 00 @ 5 50
Jersey .... 8.00 @ .....
Long Island .... " 8.50 @ .....
Up-River .... " 8.00 @ 8.50
Havers'aw Bay, 2ds. " 8.50 @ 9.00
Havers'aw Bay, 1sts. " 9.25 @ .....

FRONTS.

Croton—Brown .... ⅌ M. .... @ $11.00
Croton—Dark .... " .... @ 13.00
Croton—Red .... " .... @ 13.00
Philadelphia .... " 19.00 @ 22.00
Trenton .... " 18.00 @ 21.00
Baltimore .... " 36.00 @ 38.00

Yard prices 50c. ⅌ M higher, or, with delivery added, $1.50 per M for Hard and $4 00 @ $6.00 per M for front Brick.

FIRE BRICK. (yard prices).

Red Welsh .... $35 00 @ ....
Scotch .... 30.00 @ ....
English .... 30.00 @ 35.00
Silica .... 40 00 @ 50.00
Stourbridge .... 50.00 @ 55.00
American .... 40.00 @ 45 00
Afloat, 500 ⅌ M less

Cement.—(Cargo rate, nominal.)

Rosendale, ⅌ bbl .... $ @ 1.10
Portland Saylor's American, ⅌ bbl .... 2.65 @ 3.00
Portland (imported) ⅌ bbl.. 3 00 @ 3 25
Roman .... " .. 2.85 @ 3.00
Keene's coarse ..... " .. 6 00 @ 6.25
Keene's fine .... " .. 9 75 @ 10.00
Add 25 cts. to above rates for yard prices.

Doors.—Net to 10 % dis.

RAISED PANELS, TWO SIDES.

2.0 x 6.0	1¼ in.	$1.10	....
2.6 x 6 6	1¼ in.	1.53	....
2.6 x 6 8	1¼ in.	1.58	....
2.8 x 6.8	1¼ in.	1.67	....
2.10 x 6.10	1¼ in.	1.90	...
3.0 x 7.0	1¼ in.	2.00	....

MOULDED.

Size.	1¼ in.	1½ in.	1¾ in
2.0 x 6.0	$1.81	....	....
2.6 x 6 6	2.33	2.68	....
2.6 x 6.8	2.28	2.72	....
2.6 x 6.10	2.32	2 80	....
2.6 x 7.0	2.39	2.91	....
2.8 x 6 8	2.37	2 92	3.56
2.8 x 7 0	2.49	3 03	3.75
2.10 x 6.10	2.61	3.16	3.96
3.0 x 7.0	2.73	3.41	4.20

2nd quality 15 cts. less.

Drain and Sewer Pipe.

Discount 50 to 55 per cent. according to quality and size of order.

Pipe, per foot.	Bends & Elbows, Each.	Sing.	D'bl. & V.	Traps, Each.
2 in..$ .13	$ .40	$ .48	$ ...	$1.00
3 " .. .16	.50	.61	...	1.25
4 " .. .20	.65	.75	1.30	1.75
5 " .. .25	.85	.90	1.55	2.50
6 " .. .30	1.15	1.05	1.80	3 50
7 " .. .35	1.50	1.20	2.05	5.00
8 " .. .45	2.00	1.45	2 45	6.00
9 " .. .55	2.50	1.70	2.85	7.00
10 " .. .70	3.00	2.00	3.30	8.00
12 " .. .80	3.75	2.52	4.24	10.00
15 " .. 1.25	5.00			
18 " .. 1.60	7.50			

(Branches: Longer than 1 ft. charged as pipe.)

House Branches pr. lin. ft. 15x6 $1.75; 18x6 2.50
Sewer Branches pr. lin. ft., 15 in. $2.25; 18 " 3.00

Glass.—(American.)

Prices current per box of 50 feet.

SINGLE.

Sizes.	1st.	2d.	3d.	4th.
6x 8—10x15	$7.50	$6.75	$6.25	$5.75
11x14—16x24	8.50	7.75	7.25	6.50
18x22—20x30	10.75	9.75	8.75	7.75
15x36—24x30	12.25	10.75	9.00	8.50
26x28—24x36	13.00	11.50	9.75	9.00
26x36—26x44	14.50	13.25	10.75	9.50
26x46—30x50	15.00	14.00	11.25	10.50
30x52—30x54	16.00	14.50	12.00	...
30x56—34x56	17.25	15.50	13.50	....
34x58—34x60	18.25	17.25	15.00	....
36x60—40x60	20.75	18.75	17.25	....
DOUBLE.				
6x 8—10x15	$12.00	$11.00	$10.00	$9.25
11x14—16x24	13.75	12.50	11.75	10.50
18x22—20x30	17.25	15.75	14.00	....
15x36—24x30	19.75	17.25	14.50	....
26x28—24x36	21.00	18.50	15.75	....
26x36—26x44	23.25	21.25	17.25	....
26x46—30x50	24.00	22.50	18.00	....
30x52—30x54	25 75	23.25	19.25	....
x56—34x56	27.75	25.00	21.75	....
34x58—34x60	29.25	27.75	24.00	....
36x60—40x60	33.25	30.00	27.75	....

Sizes above—$10 per box extra for every five inches.

An additional 10 per cent. will be charged for all glass more than 40 inches wide. All sizes above 52 inches in length, and not making more than 81 inches, will be charged in the 84 united inches' bracket. Discounts: 50 @ 5% to 50 & 15

French

WINDOW, PICTURE AND CAR GLASS.

Prices current per box of 50 feet.

SINGLE.

Sizes.	1st.	2d.	3d.	4th.
6x 8—10x15	$8.00	$6.75	$6.25	$5.75
11x14—16x24	8.75	8 00	7.50	7.00
18x22—20x30	11.25	10 50	9.75	8.75
15x36—24x30	12.75	11 50	10.00	.
26x28—24x36	13 50	12 25	11.25	. .
26x36—26x44	14 75	13 75	11.75	..
26x46—30x50	16 25	15.00	13 00	....
30x52—30x54	17.25	16 00	13 50	...
30x56—34x56	18 75	16.75	15 00	...
34x58—34x60	19.50	18.00	16.00	...
36x60—40x60	21.00	19.50	18.00	..
DOUBLE.				
6x 8—10x15	$12.00	$11.00	$10.00	$9.25
11x14—16x24	14.75	13.75	12.75	11.75
18x22—20x30	19.00	17.75	16.00	....
15x36—24x30	21.50	19.25	16 50	....
26x28—24x36	23 00	20.75	18.25	....
26x36—26x44	25.00	23 00	19.25	....
26x46—30x50	27.00	25 00	21.25	....
30x52—30x54	28.50	26.00	22.25	....
30x56—34x56	30 00	27.75	24.75	....
34x58x34x60	31.75	30 00	27 00	....
36x60—40x60	35 50	32.50	30.25	....

Sizes above—$10 per box extra for every five inches.

An additional 10 per cent. will be charged for all glass more than 40 inches wide. All sizes above 52 inches in length, and not making more than 81 united inches, will be charged in the 84 united inches' bracket.

Discounts: Single, 40 & 10 to 50 & 5; Double, 60 & 10.

GREENHOUSE, SKYLIGHT AND FLOOR GLASS

Per square foot, net cash.

⅛ Fluted plate, case 10c; cut to size 14c.
3-16 Fluted plate " 13c. " " 16c.
¼ Fluted plate " 16c. " " 18c.
¼ Rough plate " 16c. " " 18c.
⅜ Rough plate " 21c. " " 27c.
½ Rough plate " 28c. " " 33c.
¾ Rough plate " 45c. " " 55c.
1 Rough plate " 55c. " " 65c.

Hair.

Cattle .... ⅌ bushel..$ .... @ 0.17
Goat .... " .... @ 0.20

Lath.

Cargo rate .... ⅌ M $ 1.65 @ 1.75

Lime.

Glen's Falls, or Keenan's common, cargo rate ⅌ bbl .... .90 @ ....
Glen's Falls, or Keenan's finishing Jointa .... 1.10 @ ....
Rockland, common .... 1.00 @ ....
Rockland, finishing .... 1.15 @ 1.25
Add 25c. to above figures for yard rates.

Lumber.—(Yard prices.)

Pine, very choice and ex.. dry, ⅌ M. ft. thick .... $65 00 @ $70.00
Pine, clear .... 60.00 @ 65.00
Pine, selects .... 45.00 @ 50.00
Pine, selected, box .... 20.00 @ 22.00
Pine, common box .... 18.00 @ 20.00
Pine, common box, ⅝ .... 15.00 @ 16.00
Pine, 1¼x10, 13 ft., matched, each .... .40 @ .43
Pine, 1¼x10, 13 ft.. culls .... .28 @ .30
Pine. 1x10, 13 ft., good matched, each .... @ .30
Pine. 1x10, 13 ft., common, matched, each .... .23 @ .25
Pine, 1x4½, clear, match'd, each .... .23 @ .25
Pine, 1x4½, merchantable, matched, each .... .17 @ .18
Pine, 1¼x4½, cl'r, match'd, each .... @ .35
Pine, 1¼x4½, merchantable, matched, each .... .28 @ .30
Spruce, 1x9, 13 ft., rough... .18 @ .20
Spruce, 1x9, 13 ft. matched, each .... .20 @ .22
Spruce, 1¼x9, 13 ft., rough. .21 @ .22
Spruce, 1¼x9, 13 ft., matched, each .... .23 @ .25
Spruce, 2x9, 13 ft., rough.. .36 @ 40
Spruce, 2x9, 13 ft., match'd, each .... .40 @ .42
Spruce, 2x4, 13 ft. .... .13 @ .14
Spruce timber, flat, ⅌ M ft 19.00 @ 20.00
Spruce timber, square, ⅌ M ft .... 22.00 @ 22.00
Hemlock, 1x10, 13 ft., each. .. @ .17
Hemlock, 2½x4, 13 ft., each. .14 @ .15
Hemlock, 3x4, 13 ft., each.. .. @ .16
Hemlock, 4x6, 13 ft., each.. .40 @ .43
Ash, good, ⅌ M ft .... 45.00 @ 55.00
Oak .... 45 00 @ 55.00
Oak, quartered .... 70.00 @ 90.00
Maple, common .... 25.00 @ 35.00
Maple, good to 2 in .... 40.00 @ 45.00
Maple good thick .... 45.00 @ 55.00
Maple white .... 55.00 @ 60.00
Chestnut .... 45.00 @ 60.00
Bl'k walnut, good to choice 85.00 @ 100.00
Black Walnut 2d .... 55.00 @ 65.00
Black walnut, ⅝ .... 75.00 @ 85.00
Black walnut, selected and seasoned .... 100.00 @ 120.00
Bl'k walnut counters, ⅌ ft. .12½ @ .20
Cherry, wide, ⅌ M ft .... 85.00 @ 100.00
Cherry, ordinary .... 60.00 @ 80.00
Whitewood, or Poplar 1 to 1½ inch .... 40.00 @ 50.00
Whitewood, or Poplar ⅝ in. 30.00 @ 35.00
Whitewood, or Poplar ⅝ panels .... 35.00 @ 45.00
Shingles, extra sawed pine, 18 in. .... 5.00 @ 6.00
Shingles, clear sawed pine, 18 in., 2 nd .... 4.00 @ 5.00
Shingles, cypress, 7x24 .... 14.00 @ 18.00
Shingles, cypress, 6x20 .... 12.00 @ 14.00
Shingles, Cedar, 6x24, No. 1 — @ 22.00
Shingles, Cedar, 6x24, A's.. — @ 16.00
Shingles, Cedar, 6x20, No. 1 — @ 12.50
Shingles, Cedar, 6x20, A's.. — @ 10.00
Shingles, Cedar Eastern ... — @ 3.50
Shingles, Pine .... — @ 3.75
Shingles, Spruce .... — @ 3.50
Yellow pine dressed flooring, wide, ⅌ M ft .... 30.00 @ 35.00
Narrow ditto .... 35.00 @ 40.00
Yellow pine timber .... 30.00 @ 45.00
Locust posts, 8 ft., ⅌ in ..... .18 @ .20
Locust posts, 10 ft. .... .24 @ .25
Locust posts, 12 ft .... .25 @ .30
Chestnut posts, ⅌ ft .... .3 @ .3½
Mahogany, ⅛ in. ⅌ ft .... .5 @ .7
Mahogany, ⅜ in. ⅌ ft .... .8 @ .10
Mahogany, ½ in. ⅌ ft .... .10 @ .12
Mahogany, ⅝ in. ⅌ ft .... .12 @ .14
Mahogany, ¾ in. ⅌ ft .... .14 @ .16
Mahogany 1 in. ⅌ ft .... .16 @ .18
Rosewood, ⅛ in. ⅌ ft .... .11 @ .15
Rosewood, ¼ in. ⅌ ft .... .16 @ .20
Rosewood, ⅜ in. ⅌ ft .... .24 @ .28
Rosewood, ⅝ in. ⅌ ft .... .40 @ .45
Rosewood, 1 in. ⅌ ft .... .60 @ .75
Satin wood, ½ in. ⅌ ft .... .25 @ .35
Satin wood, 1 in. ⅌ ft .... .35 @ .50
White holley ¼-inch .... .10 @ .12
White holley ⅜-inch .... .15 @ .18
Cedar (Cuban and Mexican) ⅌ ft .... .10 @ .14
Cedar (Florida) .... @
Less than 1 inch .... .10 @ .24
1 inch and over .... .25 @ .30

Moldings.

60c. to 80c. per inch per 100 feet, according to quality.

Paper.

Rope, waterproof building, ⅌ lb .16 @ .17
Rosin Sized Sheating, ⅌ lb. .4 @ .5
Dry Sheating ⅌ lb .... .3 @ 3½
Tarred Felt. ⅌ lb .... @ .3

Plaster.

Calcined City .... Millrate. $1.25 @ ....

Sash.—Net to 10 % dis.

GLAZED.

Dimensions of windows.	12 Lights. 1¼pl.	12 Lights. 1¼c.	12 Lights. 1⅛c.	8 L's. 1⅛c.	4 Lights. 1¼c.	4 Lights. 1½c.
2.1x3.6	$1.12	1.20	....	....	....	....
2.4x3.10	1.28	1.36	....	....	1.52	....
2.7x4.6	1.59	1.67	....	....	1.90	2.10
2.7x4.10	1.68	1.75	....	....	2.20	2.30
2.7x5.2	....	1.85	....	....	2.28	2.40
2.7x5.6	....	....	....	2.49	2.45	2.60
2.7x5.10	....	....	....	2.54	2.60	2.75
2.10x4.6	1.71	1.81	1.92	....	....	....
2.10x5.2	1.91	2.00	2.16	2.51	2.50	2.65
2.10x5.6	2.05	2.16	2.35	2.56	2.61	2.83
2.10x5.10	2.35	2.45	2.65	2.69	....	3.05

c. means counted checked—plowed and bored for weights.

Hot bed sash, glazed $2.35

HEAD LIGHT.

Two or three Lights, Glazed.

Size.	1¼	1½	Size.	1¼	1½
2.6x1.0 ..	65	75	2.10x1.0..	65	80
2.6x1.6...	75	85	2.10x1.6..	80	90
2.8x1.0...	65	75	3.0x1.0...	70	85
2.8x1.6...	75	90	3.0x1.6...	95	1.05

Slate.

By car load, delivered in New York.

Purple roofing slate, ⅌ sq're. $5.50 @ $6.00
Green slate .... 5.50 @ 6.00
Red slate .... @ 10.00
Black slate, Pennsylvania... 4.00 @ 4.50
Tiles, 1¼ in. rubbed, ⅌ sq. ft. .25 @ .28

⅌ sup. ft.

Steps and platforms, 1 in. thick 30c
" " 1½ " 40c
" " 2 " 55c
Risers, 1 inch thick 35c
Coping, 1½ " 35c
" 2 " 49c

Lineal ft.

Window sills, 4x7 .... 55c
" 3x7 .... 45c
Window caps, 4x10, plain 80c
" 4x8, " 60c
" 3x10, " 55c
" 3x8, " 50c

Stair Material.

BALUSTERS.

Black Walnut.	1½ in.	1¾ in.	2 in.	2½ in
Fancy Turned	7c	9c	10c	16c
Neck Turned	9c	10c	12c	19c
Fluted or Octagon	12c	14c	17c	25c

OCTAGON PANELED NEWELS.

Panels Veneered with French Walnut.

8-inch Newels, with Cap $6.12
9 " " " 6.88
10 " " " 7.60

SOLID NEWELS, WITH CAPS.

Black Walnut.	5 in.	6 in.	7 in.	8 in.
Fancy Turned	$1.60	$1.90	$2.50	$3 40
Octagon	2.10	2.40	3.00	3.90

STAIR RAIL.

Worked out and finished ready to put up. Easements and cylinders counted double. Price per foot (Newels and Balusters not included).

Black Walnut.	3 in.	3½ in.	4 in.	4½ in
Molded	40c	45c	50c	53c
Toad Back	45c	50c	63c	68c

STAIR RAIL, UNFINISHED.

Price per foot.

Black Walnut.	3 in.	3½ in.	4 in.	4½ in
Molded	11c	13c	15c	17c
Toad Back	12c	14c	16c	18c

Stone.

Cargo rates, delivered at New York.

Amherst freestone, in rough, ⅌ C ft .... $0.85 @ $0.90
Berlin freestone, in rough... 0.85 @ 0.90
Berea freestone, in rough.... .... @ .80
Brown stone, Portland, Ct... 1.25 @ 1.50
Brown stone, Belleville, N. J. 1.00 @ 1.50
Granite rough .... .50 @ 1.00
Dorchester, N. B., stone, rough .... ⅌ foot. .... @ 1.00

BLUE STONE

Rubbed hearth, 10 ft. or under 25c
Rubbed hearth, 20 ft. or under 35c
Rubbed hearth, 30 ft. or under 45c
Rubbed hearth 4 ft. or under 50c
Rubbed sills 30c
Sawed & Planed 40c
Sills and lintels .... @ 18c
Sills and lintels, fine quarry cut sills .... @ 35c
Coping, 11 to 18 in. wide .... 20c @ 34c
Coping, 20 to 28 in. wide .... 38c @ 6cc
Coping, 30 to 36 in. wide .... 65c @ 80c
Steps, 8 in .... @ 60c
Steps, 7 in .... @ 55c
Steps, 6 in .... @ 35c
Steps, door. per in. wide .... @ 3c
Platforms, promiscuous, 4 in... .... @ 32c

Vault Lights.—Nominal.

Platform, sq ft $3.50
Step and risers, sq. ft 3.50
Floor light, sq. ft 2.50
Roof light, sq. ft 2.50
Platform, 2d quality, sq. ft 2.60

COVERS.

Diameter.	Round.	Hexagon.
14 inch	$3.00	$0.00
16 "	3.75	4.00
18 "	5.50	6.00
20 "	8.00	8.50
24 "	14.00	15.0
26 "	16.00	17.0
30 "	23.50	25.0
36 "	31.00	33.0

CARPENTRY AND BUILDING

A MONTHLY JOURNAL.

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A Suburban House.

We present herewith a perspective view, and a carefully engraved set of elevations and plans of a suburban house, recently erected at Short Hills' Park, New Jersey, under the superintendence of Arthur B. Jennings, Architect, of New York. Our engravings represent the house so thoroughly that an extended description is rendered unnecessary. It will be noticed that the construction is of a character commonly known as "brick and frame," the lower story being of the former and the upper story of the latter. The outer surfaces of the walls in the upper story and under the roof gables are finished with ornamental shingling, which not only forms a good weather protection, but gives the building a picturesqne appearance. In style the house is of a character now quite popular with those who are building suburban homes in the neighborhood of our large cities. The exterior has many pleasing features, and, taken as a whole, it conveys the impression of strength and stability. The details are exceedingly plain, so simple, indeed, that enlarged drawings are hardly necessary to represent them. The roof lines are finished with terra-cotta, a grotesque finial surmounting the peak of the front gable. The open balcony communicating with the upper chamber on the second floor, and inclosed by a very simple railing, is a pleasing feature, while it forms a lounging place which will doubtless be appreciated by the occupants of the house. Referring to the plan, it will be seen that the arrangement is upon quite an elaborate scale. There has been no crowding in the way of economy of space. The vestibule and halls are large; there is an abundance of closet room, and the arrangement of the stairs is made a conspicuous feature in the principal story of the house. Upon the second floor the arrangement of the chambers is such as to afford an abundance of light and air. The rooms are spacious, each one communicating by its own proper door with the halls, and each provided with ample closet room. The bathroom, it will be seen, is much larger in size than those usually provided in houses of this character.

By reference to the elevations, it will be noticed that the house stands high, the cellar, or basement, being partly above the ground, thus admitting an abundance of light and sufficient means of ventilation, two very important considerations which are frequently disregarded. The rear elevation shows an outside cellar door, an arrangement of great convenience in suburban houses.

Suburban House.—Designed by Arthur B. Jennings, Architect.—Fig. 1.—Perspective View.

Japanese Builders.

In Japan the skilled workman occupies a higher place, as regards social position, than that held by tradesmen. Among mechanics the carpenter is looked on as the workman *par excellence*, the *dai-ku*, the great workman. He is at once architect, contractor and joiner—although in the building business the subdivision of labor is carried out further than in any other business, especially in all that concerns the details of the management of the timber.

When a house is to be built, or rather the block of buildings that constitutes a habitation, or shops or offices, a carpenter is sent for; the plan is discussed; the outlines of the whole decided on; and in a few days the estimate is settled at so much the *tsubo* (about 11 feet square), measuring from the middle of the corner posts or vertical angl. s.

A plan on a large scale is drawn on wood, with sections and elevations, using the *ken* (about 6 feet) as the unity. Then follows the section of the ground, which is carefully measured and leveled with a water level. This level is made of a piece of wood 4 or 6 inches in length, carefully squared and planed. On the upper surface runs a groove, in the middle and at the two extremities of which holes are scooped out; water is poured

Suburban House.—Fig. 2.—Front Elevation.—Scale, ⅛ Inch to the Foot.

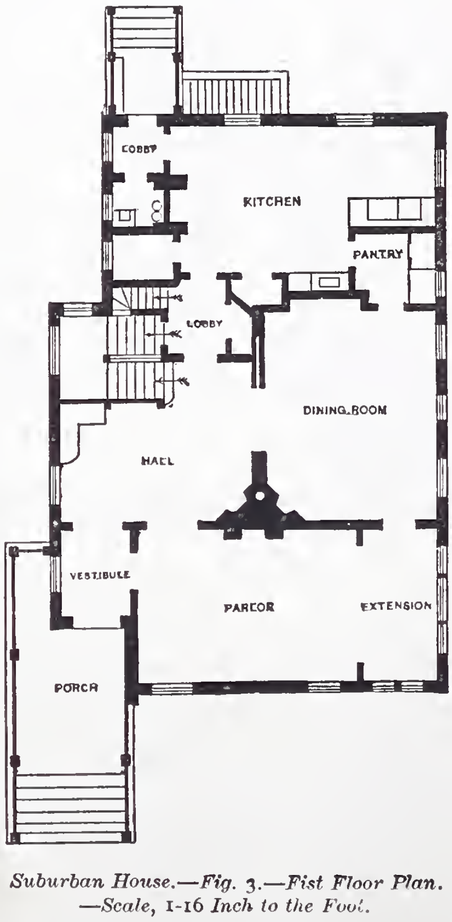
into the middle hole, and the level is moved about till the holes at the extremities are equally filled, and consequently on a level.

If there be no hindrance in the selection of the site, a southern aspect is chosen; the northeast is the one most avoided. Certain rooms having to be made in the luckiest part of the house, astrologers and soothsayers are consulted.

The position of the kitchen—that of the altar of the household gods and other details having been determined on with all due formalities—a "propitious" day is waited for to give the first stroke of the mattock, and to begin the foundations. These, except in the case of large houses or shops to be guarded against fire, give little trouble. The diggers now come on the scene (these correspond to our working men), and from among them the corps of firemen are recruited.

If piles are to be sunk a scaffolding is erected, and for the sinking of these a large rammer of hard wood, with an iron hoop at the end, is used, the dimensions of which vary according to the requirements of the work; to the upper part are attached as many ropes as there are workmen to lift it. Two light, flat boards are fastened parallel to the longitudinal axis of the rammer and placed under the superintendence of a workman. These boards serve to direct the rammer in its fall when the gang let go the ropes. Moreover, the foreman, standing at the lower part of the scaffolding, rectifies, if needful, the direction of the rammer by means of a small cord which he holds in his hand. The gang, during the whole of this work, chant a chorus of a hideously discordant character. This is an ancient custom, which, according to tradition, drives away the evil spirits. The song gives occasion to gross language and gestures. But then this corps of "laborers of the earth" are rude and savage fellows.

Generally, in laying foundations they make a cutting some inches wide, which is filled with rubble, over which several layers of roughly cut stone are placed—basalt, granite or sandstone. The size of these stones varies from 10 to 11 inches wide and from 24 to 30 inches long. In the more important buildings these last layers are crowned with string courses of stone of better quality to support the floorings. If the roofs are large and heavy, the feet of the most important posts are fastened into mortises cut out of large blocks of stone, and thus these posts are prevented from getting displaced in case of earthquakes. Stonecutters have but few chances of exhibiting their skill. They never trouble themselves about the bed of the stone quarry, which they place with a view to the convenience of working.



Suburban House.—Fig. 3.—Fist Floor Plan.—Scale, 1-16 Inch to the Foot.

While these different preparatory works are going on, the contractor arranges with the timber merchant, whose provision of wood is piled up in shallow docks, so as to keep the timber constantly submerged, the Japanese workmen preferring to work the wood when damp. The timber is roughly squared and cut so as to give finished pieces, including the tenons, of about 6 feet, 8 feet, 12 feet, 15 feet and 18 feet. The purchased timber is transferred to the wood-yard, where the sawyers, who also form a guild, retail it at the required dimensions by processes and with tools that are peculiar.

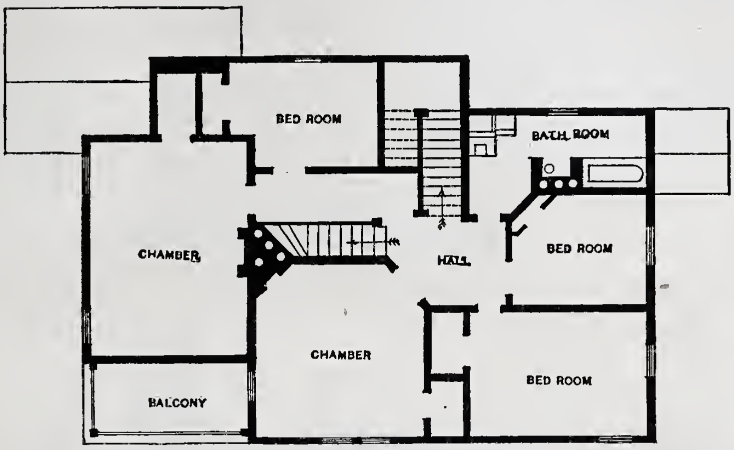
To prevent the timber splitting or warping, the carpenter saws it to the middle, and as the wood dries and the slit widens, he fills it with a tongue of the same wood.

The carpenters take their measures from the diagram we have mentioned above. The frame for the roof is made of rough beams of irregular shape, which are put in their places just as they are sawed. There are, however, builders who do not follow this course, and who, having entire confidence in their plans and measurements, prepare their timber beforehand, indicating the joints and tablings, as well as the position they should occupy. When the whole frame is thus prepared, a "propitious" day must be found to put in its place. This operation is soon got through, for the carpenters and their friends are eager to feast on the good things that are abundantly provided for them on these occasions.

Processions, superstitions, devotions and other practices play a great part in the construction of edifices and houses in Japan. But we have no space to do more than mention this fact, as a proper description of these ceremonies would of itself fill some columns.

Most of the walls and partitions of Japanese houses are made of panels or sliding frames, covered sometimes with transparent paper, sometimes with thick layers of paper; these latter are used to make the inner partitions. The exterior walls and a certain number of the interior partitions are coated with plaster. To do this the frames are lined with a close trellis of slit bamboo, on which three layers of clay are laid; they are then finished off with the final coating.

The right-hand man of the carpenter, or, if you will, of the architect, for it is all one, is the plasterer, the maker of the moldings. He is an artist, the Japanese being renowned for their perfection and marvelous skill in the plastic arts. We are not to be surprised to find their skilled workmen masters in all that pertains to ornamentation in plaster. They use chiefly lime made from calcined shells, which they mix with mucilage obtained by boiling seaweed in soft water. The outer surface of the walls is often protected by this mixture, to which is added smoke black, frequently broken shells, bits of siliceous gravel and coarse but bright sand are applied like a coating upon the plaster of the interior partitions, and give a charming aspect to a room by the contrast they produce with the matting of subdued tints and the screens and panels covered with bright, harmonious-colored papers.



Suburban House.—Fig. 4.—Second Floor Plan.—Scale, 1-16 Inch to the Foot.

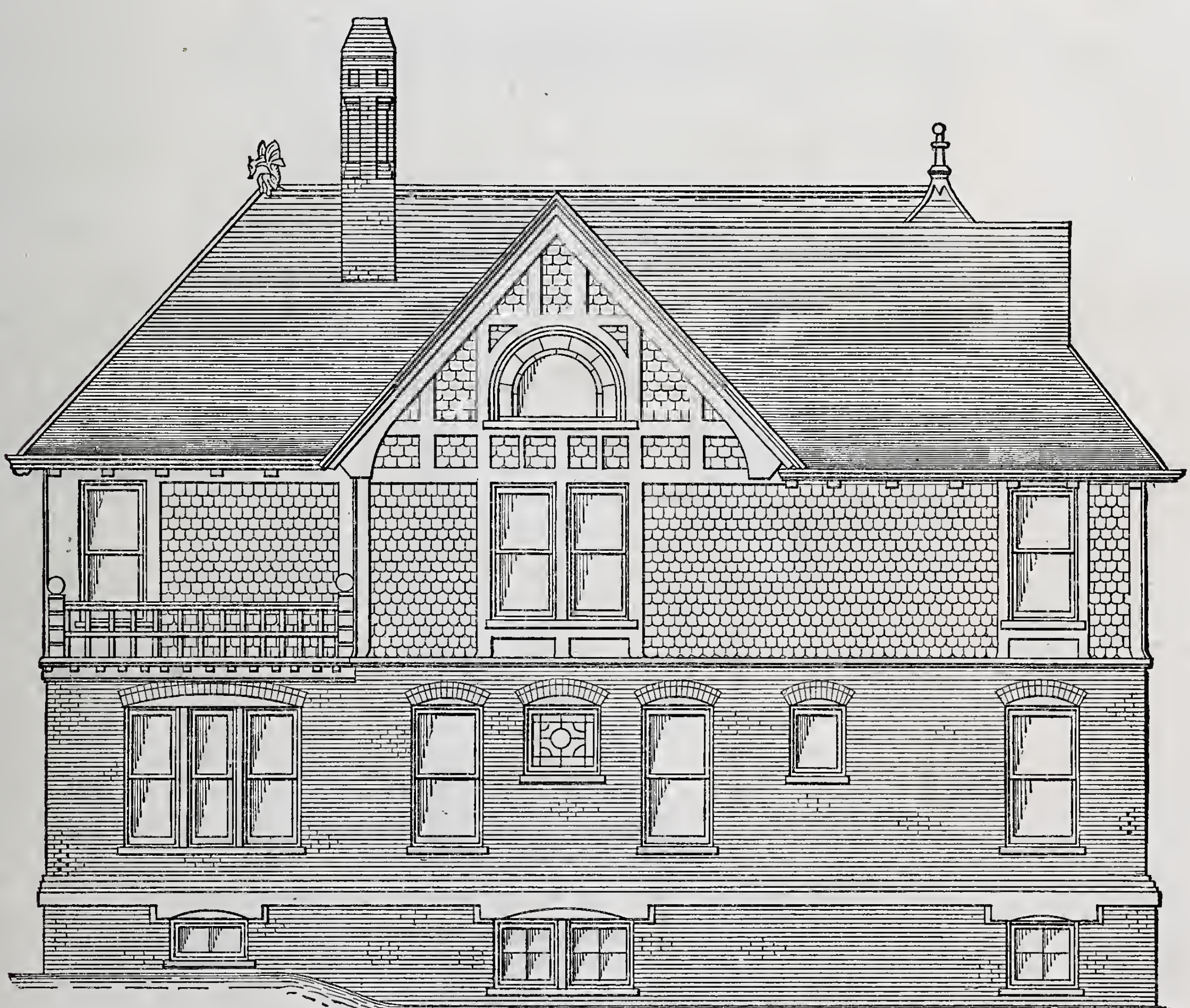
The Timber of Lebanon.

We are indebted to an English contemporary for the following interesting article on the Cedar and Fir of Lebanon, the timber used by Solomon in the construction of the Temple:

It may not be out of place, nor wholly unprofitable, if for a while we divert attention from the present and turn our thoughts to a past age, which is separated from us by nearly three hundred centuries, and we can hardly fail to experience a sense of elevation on reflecting that records of far more than an ordinary character, and dating back to so remote a period, make frequent allusion to a product with which we are so intimately concerned.

It will have already been anticipated that reference is intended to be made to the history of an ancient people, a considerable remnant of whom dwell among us at the present day, peaceably engaged in the arts of commerce. Up to the early periods referred to, the Hebrews had occupied themselves too much with warfare, for which they had an undue predilection, to know very much of anything else; and, with Othello, they might truly say that they had "used their dearest action in the tented field." Accordingly we find that among them the arts and sciences were in general very much neglected. Even in the matter of building, and the trades connected therewith, they were comparatively ignorant, and when any work of special importance was undertaken, the assistance of their neighbors had to be requisitioned.

Although blessed with such an abundance of the vine and fig tree that every one of them could find shelter thereunder from Dan to Beersheba, and mention is further made of "the olive trees and the sycamore trees that were in the low plains"—it was up one of the latter that the small-statured but eager Zaccheus climbed to get a passing sight of One whom it was well worth his while to see—yet their home supply of timber for building purposes seems to have been very limited; but, fortunately, they had not far to seek for what they wanted. Just beyond the northern border of their territory,



Suburban House.—Fig. 5.—Side Elevation (Right).—Scale, 1/8 Inch to the Foot.

in the region known as Phœnicia or Cœle Syria, there was an extensive chain of mountains designated by the generic title of "Lebanon," in which locality existed immense forests of most valuable timber, chief among which was the renowned cedar, a tree that was appreciated to an extent bordering on enthusiasm, and frequently alluded to in their songs. Considerable quantities of fir also grew there, and mention is besides made of the mysterious algum or almug tree.

The district of Lebanon was under the dominion of Hiram, designated "King of Tyre," between whom and David, the "sweet psalmist of Israel," there was close affinity, for we are distinctly told that he was "ever a lover of David." Accordingly, when the latter wanted a suitable house built, he made known his desire to his ancient ally, who thereupon "sent messengers to David, and cedar trees, and carpenters, and masons, and they built him a house."

We will digress here for a moment in order to point out another purpose to which the timber of Lebanon was applied. It is stated that "David and all the house of Israel played on all manner of instruments made of fir wood, even on harps, and on psalteries, and on timbrels, and on cornets, and on cymbals." It may be assumed that these were of a primitive kind, and that the melody they awakened would hardly come up to the standard demanded by musical critics of the present day.

David was not satisfied to live in a house of cedar while the ark remained in a tent, or "under curtains," as it is expressed, but because of the blood that he had shed he was prohibited from building a proper receptacle for it. The promise was, however, conveyed that his son should accomplish the task of erecting a temple that was to be "exceeding magnifical of fame and of glory throughout all countries." David, however, collected some of the material necessary for the work, and it is quaintly recorded that he "prepared cedar trees in abundance, for they of Tyre brought much cedar wood to David."

Solomon having succeeded to the throne of his father, lost no time in proceeding with the building of the temple, and this he was enabled to do through being in the exceptional position of having no wars on his hands; accordingly he sent to Hiram, requesting him to command cedar trees to be hewn out of Lebanon, and paid him a compliment by saying, "Thou knowest there is not among us any that can skill to hew timber like unto the Sidonians." Hiram readily complied, and promised to supply all that should be desired, not only of cedar, but of fir, and it was arranged that the same should be brought down from Lebanon to the port of Tyre, and thence conveyed by sea in flotes to Joppa, where it would be landed and taken overland to Jerusalem, which was only a short distance. The quantity of timber cut down must have been enormous, for we are told that there were fourscore thousand hewers engaged on the mountain, but it may be that only a comparatively small portion was used for the work in hand, the surplus being taken into stock and subsequently distributed over the country; hence it was that Solomon "made cedars to be as the sycamore trees that are in the vale for abundance."

We are told that the temple on Mount Moriah was covered with beams and boards of cedar, and that the chambers which were built against it rested thereon with timber of cedar. The whole work was completed by Solomon in seven years, "and he built the walls of the house within with boards of cedar, both the floor of the house and the walls of the ceiling, and he covered them on the inside with wood, and covered the floor of the house with planks of fir." There is some little vagueness in this description, but we may safely affirm timber entered largely into the composition of the building.

It may be assumed that the Sidonians, besides being skillful in hewing timber, were proficient also in wood carving, a great deal of which work was displayed about the temple, for it is stated that the "cedar of the house within was carved with knops and open flowers." Mention is also made of two large winged figures, designated cherubims, which were made of olive wood, and which were each 15 feet high, the wings being spread out and measuring 15 feet from tip to tip. There were two doors, also made of olive wood, and upon these were carvings of figures, flowers and palms. Other doors there were made of fir, and these were carved in the same manner.

In addition to building the temple, Solomon had a magnificent house constructed for himself, which took thirteen years to finish, and the timber of Lebanon furnished a good portion of the material. We gather that this building was supported upon "four rows of cedar pillars, with cedar beams upon the pillars, and it was covered with cedar above upon the beams."

At the period to which we have referred, Britain was inhabited by a race of painted savages, who wandered about either aimlessly or with fierce intent among primeval forests; but what a change has come over the spirit of the scene! Judaism, banished from its native soil, left only a trail of desolation where once fertility reigned. The temple, which was a source of pride and wonderment, has long ages ago passed away and left "not a rack behind," while a remnant of the race who worshipped therein, and whose ancient records serve both as a warning and a guide, dwell securely among us, and are enabled to behold hundreds of buildings in London alone which, in an architectural sense, are infinitely superior to the widely-renowned building where tradition held that men ought to worship.

In conclusion, it is worthy of record that Solomon, with his vast erudition, did not overlook "the subject of timber, for we are told that he spake of trees, from the cedar that is in Lebanon even unto the hyssop that springeth out of the wall."

Suburban House.—Fig. 6.—Rear Elevation.—Scale, 1/8 Inch to the Foot.

Gas Burners.

A well-known English gentleman of high scientific reputation, in answer to a question in regard to the best means of burning gas, replies as follows:

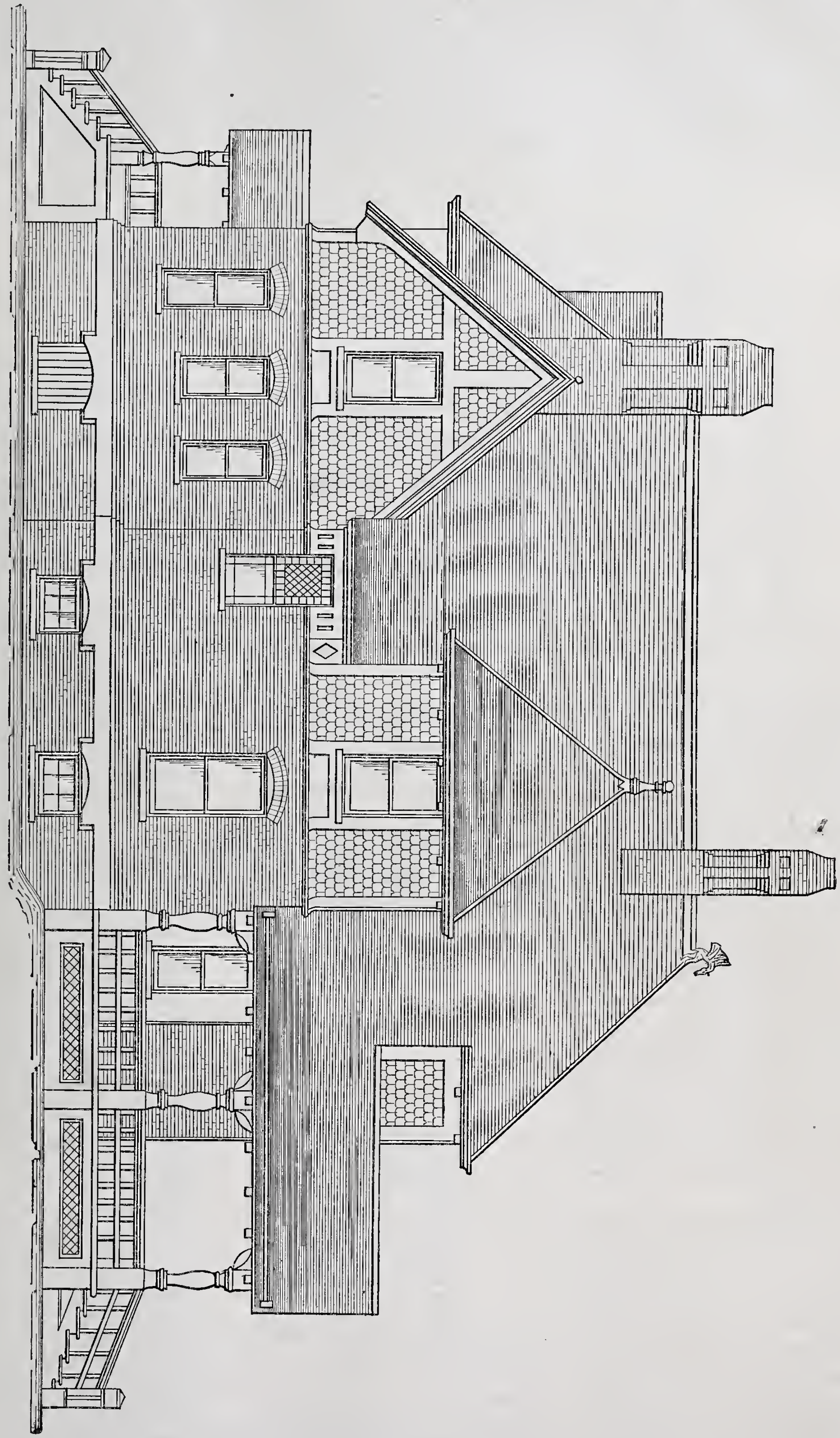
You have a brighter light by burning gas from two batswings, placed so that both form one flame, than by burning the gas from the two flames independently. Some years ago we made experiments in this direction, and also by heating a tube, through which the gas passed before burning, but we did not obtain so much increased illumination as we had anticipated from the first trial experiments. Still, where more than one gas light is required, a saving is obtained; the explanation of the increased brillancy is this: In all flames there are three so-called areas—first, the area of no combustion; second, the area of partial combustion; and third, the area of complete combustion. Now, the luminous portion of the flame is that called the area of partial combustion, and in this portion of the flame the molecules of carbon are heated white hot. When, however, in this heated condition they meet with oxygen, they combine with it to form carbonic anhydride. Now, by raising the temperature of the carbon molecules, without allowing their combination with oxygen, we produce a more intense illumination; hence, by causing two flames to heat each other, we have the illumination more brillant than by allowing the carbon molecules to leave the flame without obtaining the highest amount of illumination from them.

A similar discovery in regard to the increase of light was made many years ago. There are in England already several patents depending on the principle of putting several burners side by side. Why they have not come into use we do not know, except that they are, of course, more expensive than the ordinary nipples. It is not quite certain that the double burner does really give all the increased light which it appears to do. Part of this, at all events, is due to the fact that the more gas we can burn in a single flame the greater the degree of light we get from it—that is to say, a burner burning 6 feet properly gives much more light then two burners, each consuming 3 feet. The common plan of putting three small burners near together, like a trefoil, is a great mistake so far as obtaining light is concerned, though in shop windows, where the system is chiefly employed, the effect may possibly be considered to compensate in some degree for the loss of light.

Polish for Marble Mantelpiece.—Wash the marble thoroughly with diluted muriatic acid or warm soap and vinegar; should this not restore the polish, then apply the following preparation of wax, which is harmless even for painting, and is most excellent for furniture. Boil a quart of water and dissolve half an ounce of potash in it; when dissolved, add a quarter of a pound of virgin wax; boil it well together for nearly an hour; put it away to cool, when the wax will be on the top; then put the wax in a mortar; rub it well with the pestle, adding sufficient rain water to make it into a soft paste; rub some of this on the marble with a rag; polish with a soft duster.

The Original Purpose of Moldings.—Moldings were originally employed to decorate surfaces of wood or stone which sloped either vertically or horizontally from one plane to another. Thus, the moldings of a door represent the beveled or chamfered edge of the stout framework which holds the slighter panels. It is obvious, therefore, that these moldings ought to be worked in the solid wood, and form part of the framework.

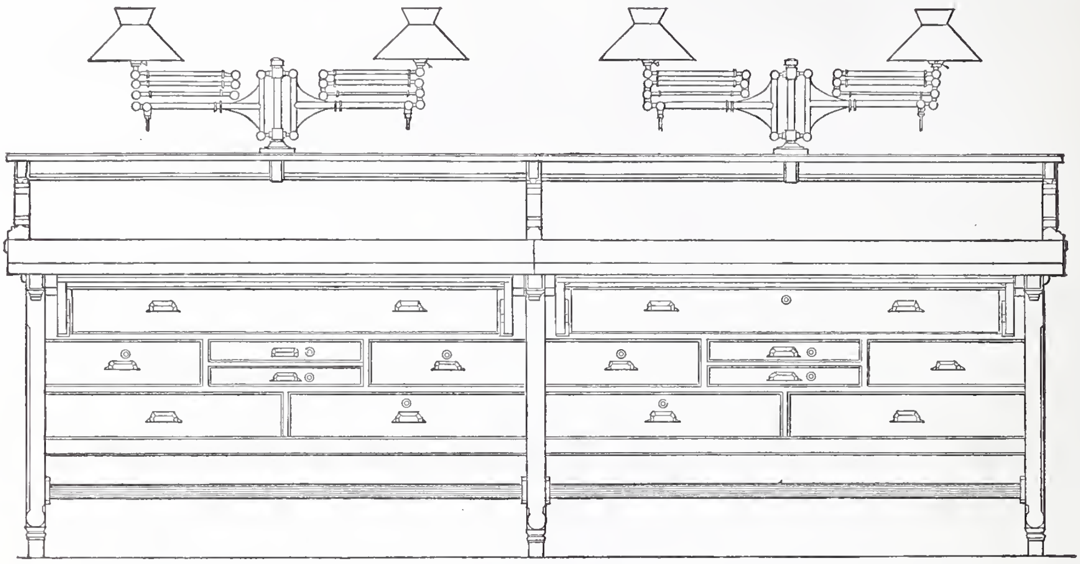
The leaves of certain plants, when conventionally treated, become excellent decorative forms. Of these, ivy, maple, crowfoot, oak and fig leaves are well adapted for the purpose.



Suburban House.—Fig. 7.—Side Elevation (Left).—Scale, ⅛ Inch to the Foot.

Some Model Drafting Tables.

We are indebted to the *Engineering News*, of this city, for the originals from which the accompanying cuts were made, and the particulars, from which our description is written, of the drafting tables with which the City Engineer's office at Providence, R. I., has been recently equipped. The subject of drafting tables is one in which many of our readers are particularly interested, and we think the presentation of what is probably the most elaborate and complete system of tables ever put in use in this country will be very acceptable to many of our subscribers.



Model Drafting Tables.—Fig. 1.—Side Elevation of Double Table.—Scale, ½ Inch to the Foot.

The entire furniture in the office is made of quartered Indiana oak, finished in white shellac and rubbed down. The designs were originated by the draftsmen employed in the office in which the furniture is used. In all respects the convenience of those who are to employ the tables has been carefully consulted.

Fig. 1 shows a side elevation of a double table, in which both sides are alike. Fig. 3 represents the end elevation of a double table, showing the doors and the instrument cupboards. Fig. 4 shows a section through a double table, taken at a point to exhibit the arrangement of the instrument cupboards. By comparing Figs. 3 and 4, the manner of adjusting the drawing boards will be understood. Fig. 3 shows the drawing boards pitched, while Fig. 4 shows them lowered to a horizontal position.

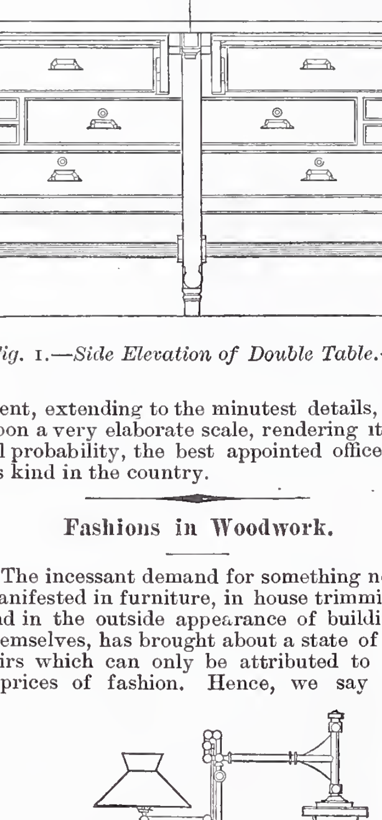
Besides the double tables to which our description so far has referred, there are in use a number of single tables, the end elevation of one of which is shown in Fig. 2. This elevation shows the doors to instrument cupboards, a section through which is to be found in Fig. 5. The latter figure also shows the means by which the adjustment of the drawing boards is effected—being the same as in the double tables to which we have already alluded.

In the double table the top drawers and the bottom drawers in one half extend the full width of the table, one top and one bottom pulling out on one side of the same, and the other two on the opposite side. All of the other drawers extend but half the width of the table, eight of them pulling out on one side, and the opposite eight on the the other side. For symmetry and appearance on the side where the drawers do not pull out, and where the spaces are left for cupboards, the tables are made with drawer fronts and handles. All of the drawers are fitted with what are known as pillar slides, which act as stops and firmly support them whenever they are pulled out. A noticeable feature of these tables is the gas-pipe foot rests, which are located 10½ inches above the floor.

Those of our readers who examine the engravings at all cannot fail to notice the peculiar arrangement of the gas lamps. These lamps are made of large size pipe or tubing, very strong, and by the peculiar parallel motion which is provided in the brackets, may be adjusted to almost any hight or position. In Fig. 1 the gas lamps are shown put back out of the way. Fig. 3 shows an end elevation of the lamps in the same position. Fig. 4 shows the lamps somewhat elevated, although not up to their extreme hight. Fig. 2 shows the lamp turned in such a way as to bring it down close to the draftsman's work. Fig. 5 shows the lamp extended, so that its rays fall even a little outside of the edge of the drawing board. In passing, we may remark that the entire fittings of the office to which we have referred, as well as its general arrangement, extending to the minutest details, are upon a very elaborate scale, rendering it, in all probability, the best appointed office of its kind in the country.

Fashions in Woodwork.

The incessant demand for something new, manifested in furniture, in house trimmings and in the outside appearance of buildings themselves, has brought about a state of affairs which can only be attributed to the caprices of fashion. Hence, we say say



Model Drafting Tables.—Fig. 2.—End Elevation of Single Tables.—Scale, ½ Inch to the Foot.

"fashions" in woodwork rather than "styles" in woodwork. A well-known furniture house of this city describes the present fashions in woodwork, furniture, upholstery and drapery as follows:

Every season brings new devices in woodwork and furnishings for interiors, for fashions in dress do not vary more quickly than fashions in room decoration. Throughout, however, the innumerable changes rung on materials in upholstery and styles in decoration, there subsist always certain principles which are supposed to form somewhat the furnishings of most houses, whether the prevailing style be mediæval, Queen Anne, Japanese or Moorish. Halls and vestibules, generally speaking, are finished and furnished so as to appear much darker than the rooms leading from them. The dining room is also dark rather than light. Reception and drawing rooms call for light without glare, and are relieved with rich color in the upholstery and drapery. Sleeping apartments are light and airy in appearance. The fashion of the present season provides for halls, woodwork and furniture of dark oak, finished in antique style, or of mahogany. The grand staircase is, of course, of corresponding material. In dining rooms usually the same woods are employed, though occasionally cherry, with narrow moldings of brass, are introduced. There is still a fancy for ebonized wood in parlors, where, however, rosewood is again a favorite, and now and then white holly is selected. This last should, however, be mentioned as an exception rather than a rule. Where ebonized wood is employed it is frequently lighted up with a molding or marquetry of brass or white holly. Libraries are, for the most part, finished in dark oak.

In the decoration not only of woodwork, but of the furniture associated with it, there is a tendency to plainness. Carving takes on to some extent the Japanese designs now common in upholstery and paper hanging. This is, it should be explained, a passing fancy rather than a standard style. Among the more recent of fashion's freaks is furnishing one or more rooms in Moorish style, where the designs for woodwork, furniture and drapery are drawn by some well-known artist. A tendency is seen in much of the new furniture to broad, low forms, which give the appearance of great breadth to high ceilings. In this class of furniture hall-racks and bureaus are supplied with low, broad, beveled swinging mirrors to suit the construction of the furniture with which they are associated. In the upholstering of parlors raw silk, or, more fashionable still, silk and wool, is used in Oriental colors and designs. Odd pieces of furniture, such as pillow chairs and ottomans, are occasionally made entirely of silk plush, with no other trimming than a mixed fringe and heading of some Oriental stuff. For libraries, bed rooms and country houses, French crape cloth, in design similar to cretonne, but differing in finish, is in high favor on account of its durability and cheapness. Sleeping rooms for girls just out of the nursery are provided with light wood sets upholstered with blue French crape cloth or cretonne, and half canopy beds.

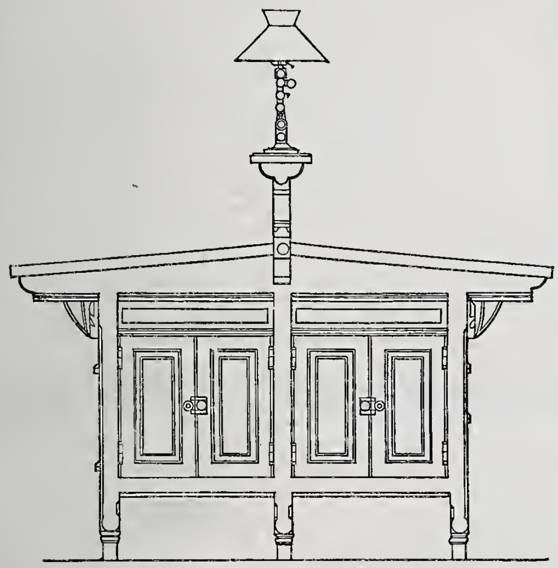
In the country during the coming summer the fashion of *portières* in place of doors will prevail. Indeed, it may be said that draperies of all sorts was never more in use than at the present time. Curtains hang not only in front of windows and doorways, but before bookcases, alcoves and in every place where an excuse for them can be found. The colors most in demand are golden and russet browns, olive-green shades, antique reds and blues, and in fact all unobtrusive tints suitable for any furniture. As regards patterns, the heavy wool stuffs incline to Oriental designs, while light materials run more to sprays and Watteau effects. Ornamentation by means of embroidery and *appliqué* work, exceeds all bounds ever before observed.

The Significance of Certain Architectural Terms.

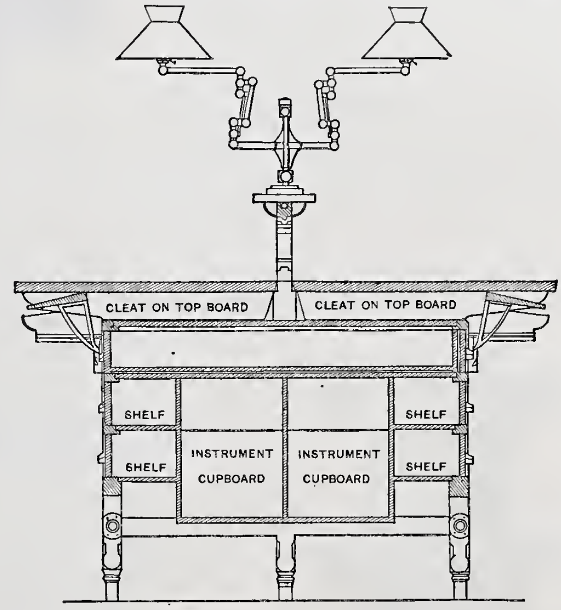
The following gossipy talk about the use of certain terms very frequently employed in connection with architecture, as well as furniture, is taken from a recent issue of an exchange:

Every furniture dealer and every furniture manufacturer makes daily use of the words "Gothic," "Queen Anne," "Renaissance," "Jacobean," &c., purporting to convey clear and definite ideas; but to how many that use them are their significations clear? It is quite certain that, as applied to style in furniture, there is great confusion in their use, that they are constantly misapplied, and that few designers and still fewer manufacturers and dealers have any knowledge whatever, either of the general characteristics or underlying principles expressed by those words. As proof of this, it is only necessary to cite one example. Ask the man who speaks of "Queen Anne" style a hundred times a day, what is the distinguishing characteristic of that so-called style, and the chances are great that he will reply: "The plentiful use of spindles," when, as a fact, spindles were very rarely used in the furniture of Queen Anne's period, and neither in ornament, outline or construction did it bear the slightest resemblance to its modern namesake.

"Renaissance" is another term perhaps more generally and more vaguely used than any other, and under this title is apt to be included any eccentricity of construction, ornament or design. Nor is this to be wondered at, for that great awakening in literature, art and architecture was so universal, that the classic prototype was speedily subjected to great variations, and took to itself the incongruities and feebleness, as well as the vigor, of many countries and peoples. Therefore, while the term Renaissance is used to designate any style based upon classic construction and ornament, its proper use is in a generic, rather than a specific sense, denoting a group or family of styles, which though having certain indispensable common features, differ widely among themselves, through the influences of national character, climate and other conditions.



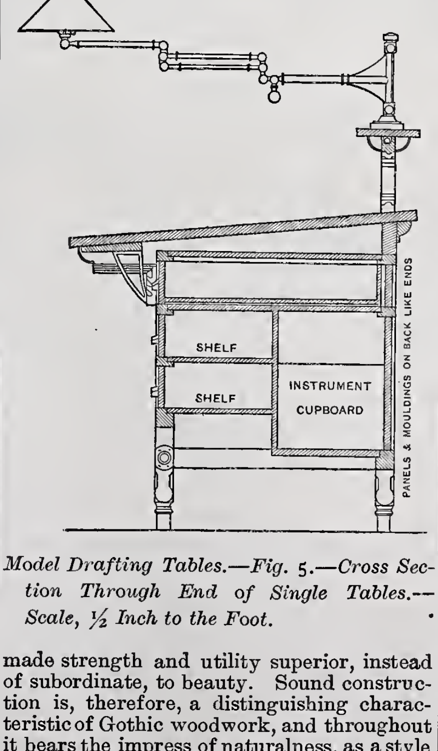
Model Drafting Tables.—Fig. 3.—End Elevation of Double Table. —Scale, ½ Inch to the Foot.



Model Drafting Tables.—Fig. 4.—Cross Section Through End of Double Table.—Scale, ½ Inch to the Foot.

During the long stagnation of the Middle Ages, a period when literature, art and every other development of the human intellect was at its lowest ebb, architecture and its cognate arts of building and construction had also become greatly debased. All guiding principles were lost, and the grandeur and beauty of Grecian and Roman structures exercised no influence upon the barbarians of Early Christian and Byzantine periods, whose depraved tastes knew no standard but their own grotesque productions.

With the development of the Gothic styles came again the eternal principles of proportion, harmony and beauty, but with small effect upon articles of domestic use. Comfort in the house was unknown; the age was not then far enough advanced for that, and while the glories of ecclesiastical and public architecture were expanding their marvelous beauties, wood construction made but slow advance. Huge, clumsy, uncouth, the woodwork of the Gothic period had one great merit—it was essentially sound in construction; it was another manifestation of the northern sturdy common sense that



Model Drafting Tables.—Fig. 5.—Cross Section Through End of Single Tables.—Scale, ½ Inch to the Foot.

made strength and utility superior, instead of subordinate, to beauty. Sound construction is, therefore, a distinguishing characteristic of Gothic woodwork, and throughout it bears the impress of naturalness, as a style that grew up naturally out of the needs of the people, whatever of refinement or ornament it possessed being an aftergrowth upon a basis of utility.

With the Renaissance styles the case is essentially different. With the Greeks and Romans the classic styles were a natural growth, springing from and developed by those peoples' needs and eminently suitable to them, but the vicissitudes of 1800 years had brought about no small change of conditions, even on the soil of Italy, where the classic styles had reached their most florid development. What was suitable in the republics of Greece and Rome was not suitable in the atmosphere of the later Middle Ages, and in the revival of the classic styles, the inexorable necessity for adaptation to use, divorced, as unsuited to modern needs, the construction, proportion and beauty, of classic structures. The result was not in all respects admirable. The stateliness and severity of classic outlines admitted a free use of ornament, which, however, rarely wandered from its appropriate place, but in the Renaissance styles, dignity and stateliness were soon lost, construction was perverted, ornament was multiplied and misapplied, and harmony, the chiefest charm of the beautiful classic models, was no more understood. It was the inevitable result of an attempt of an age to change its natural genius, and graft upon itself the product of another and far distant age, for which it had neither sympathy nor understanding.

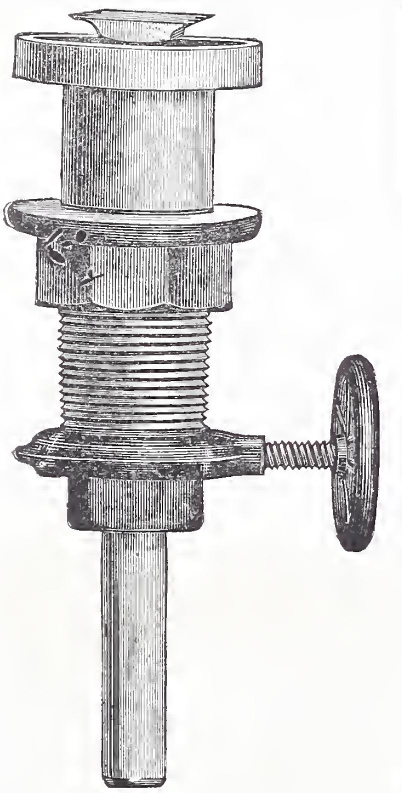
From an imperfect understanding and insincere admiration speedily sprang artificialty and unnaturalness; profuse classic ornamentation was indispensable and construction was made to conform to its needs, soundness and utility becoming secondary considerations. So-called ornament reigned supreme, and every department of art was subjected, in a period of wonderful activity, to the pernicious influence of artificiality—a legacy which the world of art groans under to this day.

It was impossible that woodwork should be exempt from the influence of the false standard, and the sound construction of Gothic models was abandoned, and in its place was substituted the construction of a perverted architecture—a construction that at its best was utterly inappropriate for, and never applied to, wood. The taste that saw no incongruity in reproducing Grecian temples in the fifteenth century, likewise saw no incongruity in treating wood as though it were stone, and to other architectural shams of the age was added the sham of architectural woodwork. All the features of stone construction reappeared in wood; wooden columns, wooden architraves and cornices, wooden pediments, wooden arches—details that in furniture have no *rationale*, no purpose, no meaning; details that offer every temptation to false construction, or if the construction perchance be sound, that weigh it down and weaken it.

A distinguishing characteristic of the Renaissance styles in woodwork has been the subordination of utility to a false beauty—false, because of the hopeless struggle to force false standards upon an incongruous material. Grace, beauty, symmetry and proportion are pre-eminent in many Renaissance forms, but mainly in independent conceptions, and seldom in full harmony with utility and construction.

To this day, therefore, the bane of Renaissance woodwork is that ornament and construction are not considered relatively, but separately; that ornament is an end by itself, and not a means to a harmonious whole, and that its relative value is greatly exaggerated.

It will therefore be seen that a sharp antithesis may be drawn between Renaissance and Gothic woodwork. Gothic work is vigorous, strong and soundly constructed; deficient in grace, heavy in outline, and somewhat poor in ornament, but its principles are sound and its defects extraneous and rapidly disappearing. Renaissance work is graceful, full of beauty of curve and outline, delicate details and vigorous ornament, but falsely constructed, weak, ill-adapted to its use, and based on false principles; artificiality is its leading characteristic, and its defects are almost radical, but still capable, in proper hands, of a rebirth that shall make it of unapproachable excellence. That will



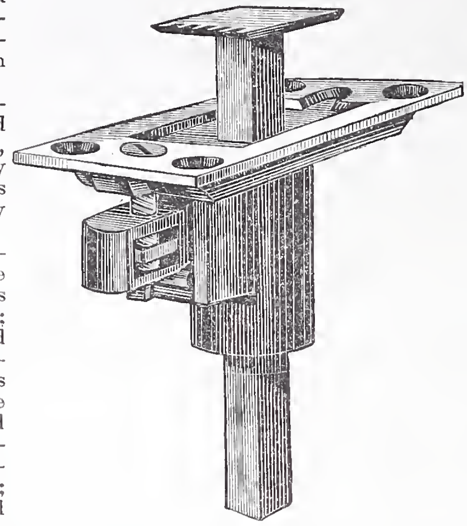
Recent Novelties.—Fig. 1.—Bench Stop.—Millers Falls Co.

be when its votaries learn that the duty of ornament is "to decorate the principal lines and surfaces of the structure, rather than to conceal and falsify them by the application of extraneous and arbitrary forms."

Recent Novelties.

Among the novelties in builders' tools, builders' hardware and building materials to which our attention has been recently called, are those illustrated and described herewith. The Millers Falls Company, whose New York office is No. 74 Chambers street, have brought out what is known as the "Security Bench Hook," which is shown in Fig. 1 of the accompanying illustrations. This bench stop is quite substantial in character and is positive in action, inasmuch as there are no springs to get out of order. By the adjusting nut it can be made to fit any thickness of bench. An inch and three-quarter hole receives the shank of the stop. The stop is made of forged steel, and is so arranged that it can be turned instantly to present either of its four faces to the work. The shaft is of wrought iron and is screwed into the stop.

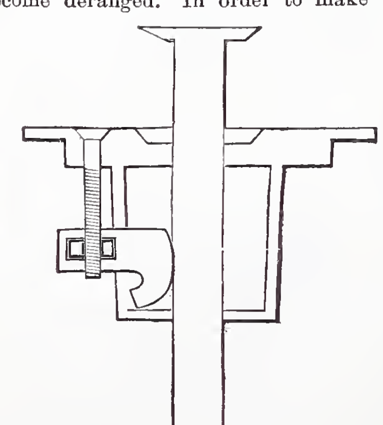
Figures 2 and 3, represent another form of bench stop which has just been put on the market by Asa Farr, 136 Chambers street,



Recent Novelties.—Fig. 2.—Morrill's Bench Stop.—Perspective View.

N. Y. Fig. 2 gives a general view of the stop, and Fig. 3 a sectional view. As may be seen by examination of the engravings, it has no spring and is so arranged that its action is quick and positive. By examination of Fig. 3, it will be seen that the spindle is held in place by a cam, which in turn is operated by a screw, the head of which comes to the top of the bench. A half turn of the screw serves to release or fasten the spindle in position. The manufacturers guarantee it made of the best materials, the spindle and plate being of wrought steel, and tempered to suit the purposes for which they are employed.

Messrs. C. M. Marcellus & Company, 91 Liberty street, N. Y., have just put upon the market what is known as "Crockford's Bit Brace," an illustration of which is shown in Fig. 4. The peculiarity of this brace is that the shank of the bit or drill, as the case may be, enters it at the side, and is held in place by the adjusting screw operating against its end. As may be seen by examining the cut, there is no occasion for the use of small parts or springs in its construction, and accordingly there is nothing about the article liable to become deranged. In order to make the



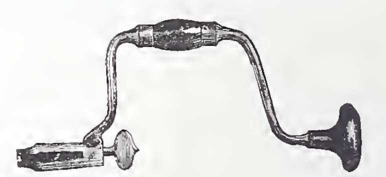
Recent Novelties.—Fig. 3.—Morrill's Bench Stop.—Sectional View.

brace serviceable for bits or tools with square shanks, it is constructed in such a manner that it can be entered from the center of the end, thus making it measurably useful with those tools which are not of the exact size to use in connection with the adjusting screw.

The same house has also put upon the market what is known as "Crockford's Extension Bit Holder," a representation of which is shown in Fig. 5. This bit holder is 22 inches long, and is adapted for use with any brace. The illustration gives so complete a representation of it that extended description is unnecessary.

M. W. Robinson, of 79 Chambers street, is offering what are known as "Holt's Gimlet Bits," one of which is represented by Fig. 6 of the accompanying illustrations. These bits are made the same as the well-known twist drill, with the addition of a conical reamer point, which is clearly shown in the cut. It is this peculiar point that adds value to the tool in keeping it central and steady. It acts as a guide to the cutting lips, and thus relieves the sides or surface of the blade of the friction felt with ordinary bits. These bits are ground on centers, and are calculated to bore straight. They are so constructed that there is no liability of wood being split by them, and their character is such that they work equally well in almost all kinds of wood, save only knots. The bits when dulled by use are easily sharpened with a file, the only care necessary to take being to leave the point and cutting lips of the original shape; hence it will be seen that the bits may be used as long as any of the twist remains.

Hobart B. Ives, of New Haven, Conn., is now supplying the trade with his improved door bolt, illustrations of which are shown in Figs. 7 and 8. Fig. 8 shows the bolt in position as applied to the door. Fig. 7 shows the case taken off, exposing the working parts. By examination of this latter figure it will be seen that the throw is given to the bolt by means of the crank operated by the spindle, and that the bolt is locked by the same means whenever it is either in or out. The spring is of a shape to be quite easily worked, and the whole thing is put up in a remarkably small compass and in very



Recent Novelties.—Fig. 4.—Crockford's Bit Brace.

neat shape. The manner of applying the bolt to the door is very simple, both the bolt and the striking plate being slipped into a round hole. A 13-16 inch bit is required for the purpose. A smaller bit makes the hole for the thumb key, and six screws hold the parts in place. The hole in the striking plate to receive the bolt is somewhat elongated in a vertical direction, thereby compensating for any sag which may take place in the door.

We have examined some specimens of the Phœnix sheeting paper now being put upon the market by C. B. Hewitt & Bro., of 48 Beekman street. This paper is chemically prepared in such a way as not to spread flames, and is therefore claimed to be very much superior to the building papers in common use. We experimented with some of the samples handed us by holding pieces in a flame for some time. So much of the paper as was directly in contact with the flame was gradually consumed, but the fire extended no further into the surface of the paper than the width of the flame in which it was held. The part consumed first became red hot, somewhat after the manner of a piece of metal, and in that condition was quite brittle, the fiber or strength of the paper being completely destroyed by the action of the flame. From the very limited experiments which we made we should suppose that this paper had many advantages over ordinary building papers in use on account of its uninflammability. It is put up in rolls 32 inches wide, with about 1000 square feet in each roll.

Removal.—The well-known architectural publishing house of Bicknell & Comstock, whose place of business has heretofore been at No. 27 Warren street, have recently removed to more accessible quarters, at No. 194 Broadway, opposite the Western Union

Building, where they will be pleased to see any of their many friends who may chance to be in the city.

Wooden Roof and Bridge Trusses—Strengths of Materials (Concluded).

BY GASTON M. ALVES.

In the two previous papers the safe tensile, crushing and transverse strengths were given for materials used in wooden roof and bridge trusses. It is not to be supposed, however, that all building woods are equally strong, or that some structures do not require less of the ultimate or breaking strength to be used than others. In order to provide for these considerations we can add or subtract, as the case may be, to the results obtained from the rules and tables heretofore given; but it will be more convenient to increase or decrease the loads, and then obtain the dimensions of the material from the rules and tables. In proportioning roof trusses of the soft woods of good quality, take only the actual loads and find the dimensions of the truss from the rules and tables. If of the soft woods of superior quality, take only 80 per cent. of the loads. If of white oak of good quality, take also only 80 per cent. of the loads, and if of white oak of superior quality, take only 64 per cent., or say two-thirds of the loads.

In proportioning bridge trusses of pine of good quality (some of the soft woods are not suitable for this purpose) take 150 per cent., or say add 50 per cent. to the loads and find the dimensions of the truss from the rules and tables. If of pine of superior quality, add 25 per cent. to the loads. If of white oak of good quality, add also 25 per cent. to the loads; and if of white oak of superior quality, take only the actual loads.

In proportioning wrought-iron bolts or rods for roof trusses, take the actual loads and find their dimensions in the table. For bridge trusses, add 25 per cent. to the loads, and find their dimensions in the table.

Agreeable to the above, the following table will show the strains in pounds allowed on the materials per square inch. The transverse unit of strain is that of a rod 1-inch square, placed upon supports 1 foot apart, and uniformly loaded.

	Tensile.		Crushing.		Transver.	
	Roofs	Bdgs.	Rfs	Bdgs.	Rfs	Bdgs.
Soft woods, good quality........	2000	1280	1000	640	125	80
Soft woods, superior quality.	2500	1600	1250	800	156	100
Oak white, good quality........	2500	1600	1250	800	156	100
Oak white, superior quality.	3120	2000	1560	1000	195	125
Wrought iron...	10,000	8000	....	....	....	....

There is yet another strain, the consideration of which is at times quite important, that building material is subjected to, termed *shearing* or *detrusion*, and which may act on timber both across and parallel to the fibers. The former is illustrated by the supports of a beam tending to shear or cut through the beam; the latter, by the foot of a rafter notched into a tie beam, tending to shear or split off that portion of the tie-beam beyond the notch.

The safe strength of wood to resist shearing may be taken as follows:

Oak, 600 pounds per square inch across the fibers.
Pine, 350 " " " " " "
Oak, 150 " " " parallel with fibers.
Pine, 100 " " " " " "

The books say that the shearing strength of material is in proportion to the area sheared through, but, manifestly, the bearing in the first case and the depth of the notch in the second case has much to do with it.

In this age of spikes and nails, it is very desirable that more should be known concerning their strength and permanent reliability. According to Trautwine, a tenpenny nail driven through a board and into an upright post or scantling, would require about 300 pounds to break it. The nail driven into oak or pine, according to him, would give way by shearing off at the joint between the board and post.

Bevan, according to Tredgold, gives greater strength to sixpenny nails (which about correspond to our eightpenny) driven into deal, and states that the nails gave way by bending and drawing out. As before stated, it is very desirable that more should be known about the strength and reliability of spikes and nails at this time, when they are so much used and are frequently depended upon in important work, and it is suggested to the readers of *Carpentry and Building* that they give the benefit of any information they may have upon the subject. The points desirable to be known are about as follows:

1. What are the strengths of the different size spikes and nails used as above described? Do they give way by drawing in any woods, and, if so, what kinds of woods?

2. How long may they be relied upon in the different kinds of woods, both in exposed situations and under cover from the weather? Are there any acids in any woods, green or dry, that destroy them? How long will scantlings nailed or spiked together maintain a reliable cohesion?

And other such problems that readily suggest themselves, and which many intelligent mechanics know more or less about, but which the books know very little about. If the readers of *Carpentry and Building* would give such information as they could upon the subject, the Editor could condense it into one article, and there is reason to believe it would be very valuable to practical men.

It is believed that at this time the use of spikes and nails is too indiscriminate, and that in some instances they are improperly used; and if this be true, it is of great importance to know in what conditions and situations.

Tree-nails, or wooden pins, is an old and reliable means of fastening timbers together. They have been used for ages, and their reliability proven by time. Their strength is the shearing strength of the wood of which they are made, which may be found above. Tree-nails should not be driven in too tight, as they would weaken the timber into which they are driven by tending to produce a splitting strain. The best way is to fit them snugly, and enlarge their ends where sawed off by wedges of soft wood driven into a saw split after they are in place. When they come through on the other side they should be wedged on that side also.

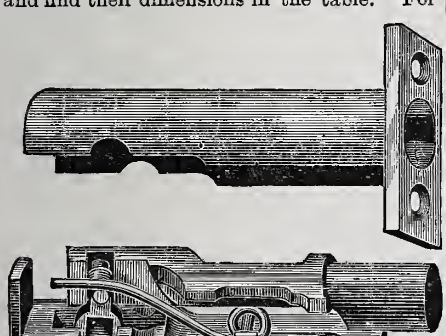
Wrought iron straps are frequently used in trusses. Assuming the safe tensile strength of wrought iron to be 10,000 pounds per square inch, the safe strength of a wrought iron strap will be about 14,000 pounds per square inch of the section of the bar of which it is made. If the bent portion of the strap is proportionately enlarged, it will be proper to take 20,000 pounds per square inch as the safe strength; that is to say, 10,000 pounds per square inch for each shank of the strap.

It is very important in the use of wrought iron to see that all welds are properly made, and that the iron is not "burnt," otherwise the strength will be very greatly impaired.

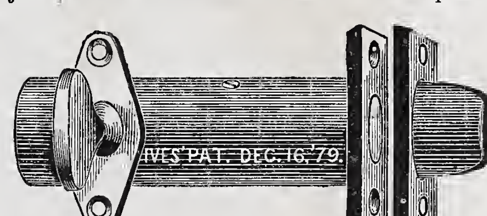
The next paper will treat of the methods of calculating the strains in a few of the common forms of roof trusses.

Recent Novelties.—Fig. 5.—Crockford's Extension Bit Holder.

Recent Novelties.—Fig. 6.—Holt's Gimlet Bits.



Recent Novelties.—Fig. 7.—Ives' Improved Door Bolt.—View Showing Working Parts.



Recent Novelties.—Fig. 8.—Ives' Improved Door Bolt.—The Bolt as used.

Hints Concerning Saws.—A saw just large enough to cut through a board will require less power than a saw larger, the number of teeth, speed and thickness being equal in each. The more teeth the more power, provided the thickness, speed and feed are equal. There is, however, a limit, or a point where a few teeth will not answer the place of a large number. The thinner the saw, the more teeth will be required to carry an equal amount of feed to each revolution of the saw, but always at the expense of power. When bench saws are used and the sawing is done by a gauge, the lumber is often inclined to clatter and raise up the back of the saws when pushed hard. The reason is that the back half of the saw, having an upward motion, has a tendency to lift and raise the piece being sawn, especially when it springs and pinches on the saw or crowds between the saw and the gauge, while the cut at the front of the saw has the opposite tendency of holding that part of the piece down. The hook or pitch of a saw-tooth should be on a line from one-quarter to one-fifth the diameter of the saw; a one-quarter pitch is mostly used for hard, and a one-fifth for softer, timber. For very fine toothed saws designed for heavy work, such as sawing shingles, &c., even from soft wood, one-quarter pitch is best.

Varnish for White Woods.—Dissolve 3 pounds of bleached shellac in 1 gallon of spirits of wine; strain and add 1½ more gallons of spirits. If the shellac is pure and white, this will make a beautifully clear covering for white wooden articles.

Real art can accommodate itself to the simplest and most practical shapes, as well as to the most delicate and subtle forms of refined manufacture. There is no limit to the hight of dignity which it can reach; there is no level of usefulness to which it will not stoop. You may have a good school of design for the art workmen; you may have a bad school of design for the art workmen; but you can have no grand school, for both the blacksmith and the goldsmith are bound by æsthetic laws of equal importance, and the same spirit which guides the chisel must direct the lathe.

Roof Truss of the Madison Square Garden.

The Madison Square Garden disaster, which has been noted in all the newspapers, and the discussion of the causes of which has extended to papers outside of New York, cannot fail to have been noticed by many of our readers. The verdict of the jury, which was rendered on the 8th ult., censures the Harlem Railroad Company, who owned the building, for employing an architect who was not conversant with the construction of buildings, and the Department of Building for neglect of duty in allowing the building to be erected contrary to law and in an imperfect manner. As many of our readers may have already observed, it has been a question whether the accident was immediately caused by the breaking of one of the roof trusses or by the giving away of the wall underneath. It never will be known to a certainty which gave way first; but the roof trusses broke and the wall crumbled; both were specimens of gross ignorance, if not downright rascality, in building. A description of the trusses supporting the roof, some of which broke at the time of the accident, will doubtless be of interest to our readers, especially so since the discussion of roof trusses has been in progress for some time past in our correspondence department.

The accompanying engraving, the original of which appeared in the *Railroad Gazette*, represents an elevation of one of the roof trusses which fell, and a plan of the lower chord. The span, it will be noticed, is about 40 feet, and the hight of the truss in the center about 6 feet. The main rafters were 8 x 6. The lower chord, or tie-beam, was made in two parts, each 8 x 3. One of these parts consisted of scantling, butted together in the center at B, and the other was made in three pieces, butted together at A and A′. A spliced piece was spiked over the joint at B in some of the trusses, but after they fell it was difficult to tell whether such pieces were nailed to all of them. The pieces forming the tie-beams were simply spiked together, and it is possible that it was to this insecure way of fastening that the fall of the roof was due. Considering the span, it will be noticed that the trusses have comparatively little hight. The purlines employed were out of all proportion with the balance of the framing, so that the thrust of the rafters and the consequent strain on the tie-beam was very great. The *Railroad Gazette* in its comments says: "It will be noticed that between the joints A and A′, the whole tensile strain due to the horizontal thrust of the rafters had to be resisted by the nails which held the two pieces together between these two points. These nails were subjected to a shearing strain. All the rafters which fell were broken through the center of the tie-beam, as indicated by the irregular line at C, the two halves of each truss being in contact. On examination it was found that the joints A and A′ were drawn apart about ⅝ of an inch, which showed that the nails yielded under the strain, and thus allowed the tie-beam to stretch. When this occurred there was of course nothing to sustain the rafters, and all their weight and that resting upon them had to be supported by the tie-beam alone, which was then of course broken in two."

The *Architect and Building News* takes a different view of the matter. We quote:

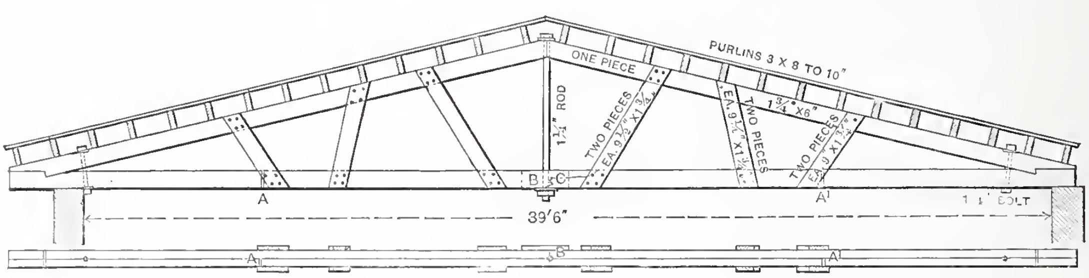
"That the tension alone of so light a roof could tear apart such a tie-beam, even if feebly spiked, we cannot think likely, and if the beam had begun to stretch by the bending of the spikes, why did not the stretching continue? A nail partly drawn out yields more and more easily, and it would be strange if the beam should extend gradually half an inch, and then with a sudden jerk snap itself in two. Even supposing this possible, neither the form nor the position of the rupture is such as a failure of this kind would occasion. The natural place for the parting of this tie-beam would be at A or A′, half way between the suspension rod and the bearing, where to a severe tensile strain is added the heavy cross stress caused by its own unsupported weight, increased in this instance by the weight of the principal rafter and its load, which by means of the pieces which form a burlesque of strutting is transferred directly to the tie-beam. The actual form and position of the break points, we think, to a downward pressure exerted upon the beam by the strut nearest the center, resisted by the force of the king rod, so that the wood, being unable to yield, was thrust apart by the action of the strut. It is not impossible that the quiescent weight on the rafters may have been sufficient to break off the tie-beam in this way; certainly the mode of strutting was well adapted to secure such a result; but the dimensions of the timbers render it unlikely unless a load of snow should add to the strain, while the effect would be perfectly accounted for by a previous movement of the wall dragging the truss off its bearing, and allowing its end to strike the floor as it fell. The inertia of the falling roof would then add force amply sufficient to drive the tie-beam asunder when its movement was stopped by an obstacle. The partial drawing out of the nails would also in such a crash be likely to occur simultaneously with the parting of the tie-beam, while this double action would be improbable under a protracted strain.

"But when, leaving the roof, we regard the wall which supported it, it seems still more certain that this, as the weakest part of the whole construction, must probably have fallen first. Gross as was the ignorance displayed in the design of the roof, it is surpassed by the recklessness with which so serious a piece of construction as that of an almost unsupported wall, 200 feet long, was disposed of."

It is impossible to find language sufficiently expressive to describe the brutal, blundering stupidity of construction of this character. It would seem as though those who built this structure did not know enough about the strains to which it was to be subjected to tell whether that on the tie-beam was one of tension or compression. As may be seen by the engraving, the roof was made so that the tie-beams which were subjected to a tensile strain were only suited to resist one of compression; whereas the rafters, which were compression members, would have safely withstood a very great strain of tension.

One of the daily papers calls attention to the fact that the strength of these trusses was not dependent on the quality or quantity of timber that was in them, but on the nails that spliced them. In lieu of using a continuous beam, by a happy thought the builder spikes or nails five overlapping scantlings together, and provides for a tensile strain of some six tons with a splice that would not safely sustain one ton.

The engraving represents other features of construction to which we have not alluded, and shows them so plainly that further description is unnecessary. It is proper to remark, however, that the trusses were spaced to be 14 feet from center to center. Our practical readers will have no difficulty, from the data presented, in making calculations and arriving at their own conclusions.



Framing of Roof of Madison Square Garden, which fell April 21.—Scale, ⅛ Inch to the Foot.

Fire Places in Summer Time.

Instead of fire-places being an eye-sore during all the summer time or the season in which they are out of use, they may be made quite attractive if properly treated. Now that the winter is over and stoves taken down, it may not be amiss to make the following suggestions with regard to them: Provide a box or drawer about 6 inches deep, made of rough pine boards, and so construct it that it will slide in between the jams of the fire-place, fitting snugly on back and sides. The front may be ornamented with tiles or marble slabs, or with any other material that is in keeping with the general finish of the mantel above the fire-place. Fill this box with earth and plant in it a few healthy ferns. These plants do not require much light, and if they receive an ordinary amount of care and moisture they will soon fill the chimney opening with their handsome forms. They grow rapidly and luxuriously in a situation of this kind, and instead of filling the drawer with earth, flower pots containing plants or shrubs that require but little sunlight may be placed in it. Ivy or some other of the creeping vines may be planted in the box and made to trail up the jams of the mantel or to hang in graceful festoons on its frieze. A tasteful housekeeper will experience no difficulty, with these suggestions, in making the fire-place an attractive part of the house for summer time, as well as winter. When tiles and marble slabs are unattainable, paper, calico or paint may be used on the front of the box or drawer. A little study upon the part of any one disposed to carry out these suggestions in a practical form, will determine many minor points to which we have not referred. There is no reason why the gaping fire-places common to many of our houses should not be made beautiful in summer time.

Measuring the Hight of Trees.—In former numbers of *Carpentry and Building*, rules for estimating the hight of trees have been given, most of which have referred directly to the trunk of the tree, or so much of it as is available for purposes of timber. The rule which we are about to state is applicable to cases where the entire hight of the tree is desired, but it may also be used where the hight of the principal limb is required. Having ascertained the hight of the entire tree, any portion of it may be determined by a simple calculation. When a tree stands so that the length of its shadow can be measured, its hight can be readily ascertained as follows: Set a stick upright in the ground, measure its shadow, also the shadow of the tree; then, as the length of the shadow of the stick is to the hight of the stick, so is the length of the shadow of the tree to the hight of the tree. This may be illustrated by a simple example. Suppose the perpendicular hight of the stick is 4 feet, and that the length of its shadow is 6 feet, and that the length of the shadow of the tree is 90 feet, then we have the following proportion 6 : 4 :: 90 : 60. In other words, multiply the length of the shadow of the tree (90) by the hight of the stick (4), and divide by the length of the shadow of the stick (6), which gives as the result 60, the hight of the tree.

CORRESPONDENCE.

The volume of our correspondence remains as large as ever, and still covers a great variety of subjects of interest to our readers. While it is impossible to publish in any one number of the paper all the letters received during the previous month, yet we are able, by judicious selections, to present a better arranged correspondence department for the perusal of our readers, by reason of the large number of letters on hand from which to select, than we could were we limited simply to the number required to fill these pages. As may be seen by the present issue, and also by the last number, we have surrendered one-half of the paper to our correspondents, an arrangement which, we believe, will please our readers.

We allow letters on the subject of ventilation to occupy a large portion of our space this month. This is a topic of vital interest to all concerned in building or living in houses, and we trust a perusal of what here appears upon the subject will induce still further letters from practical men among our readers.

We have omitted the usual department of "Referred to Our Readers," not for lack of material, but for the sake of clearing up some of the subjects already under discussion. There are enough questions before our readers at present for all practical purposes. Next month we will resume the publication of these questions.

One or two letters which were received quite late, notably that of "Wood Butcher," have been allowed to take precedence over communications received before them. Considering the interest in the subjects discussed by these letters, we think they will be acceptable.

Design for a Steeple.

From C. H. M., *Fair Haven.*—In response to the request of I. M. T., in the March number of *Carpentry and Building*, I have prepared a sketch of a steeple, and send the same herewith. I trust the drawing will find favor in your mind, and if published will be of some use to your correspondents. The parts are so clearly represented that detailed explanation is unnecessary.

I suggest that you double up the price and send us *Carpentry and Building* semi-monthly.

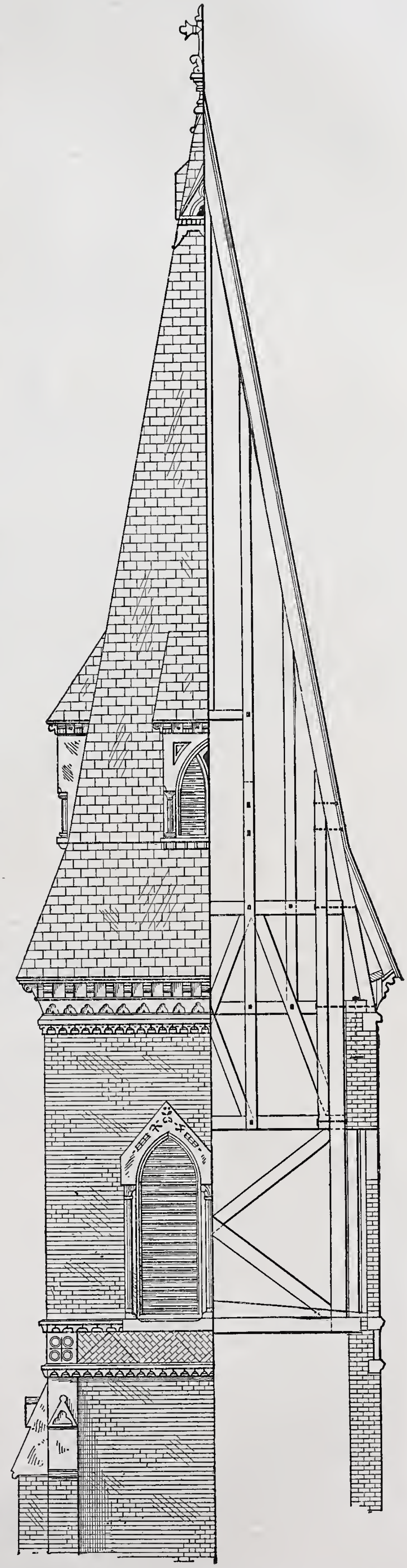
Tempering Small Tools.

From H. B. J., *Oneonta, N. Y.*—If it is not asking too much, I would like to have published. directions for tempering small hand tools, such as punches, chisels and drills.

Answer.—The usual directions for tempering tools of this character are given by describing the color to which the tool must be reduced after it has been hardened. We do not know that our correspondent will have very good success, unless he has had an opportunity to see a tool maker at work, or to see some one temper small tools. The first step is to make the tool hard, and the second one to reduce it to the proper degree of hardness or proper temper. In general, the tool must be heated and then plunged into water, taking care to hold it vertical and carrying it straight down, without allowing it to deviate to one side or the other. This is necessary in order to prevent it from warping, as it is likely to do if one side is cooled more rapidly than the other. When treated in this way the piece has been made almost as hard as fire and water can make it, and it is altogether too hard for any useful purpose, because it is almost as brittle as glass. The next step is reducing the temper till the right degree of hardness is obtained. If we had means for raising steel to exactly the temperature which we might wish, the remainder of the process would be comparatively simple. For example, for chisels and shears we should have a temperature of 490° F. We cannot, however, do this with sufficient accuracy, and must, therefore, be content to approximate it. After the chisel has been hardened, we brighten a place upon it by rubbing it on a brick or with emory paper. If now we expose it to heat, it will be found that the bright portion goes through a variety of changes in color, from yellow to blue. The colors having once been seen on steel, are quite easily recognized. The yellow, or white yellow, is used for the hardest tools, while the steel blue is employed for saws and springs. Punches usually have their temper reduced until the reddish yellow makes its appearance. Chisels are softened until the red begins to change to purple, or the purple is turning to blue, while drills have their temper reduced until the orange appears. The means for heating the steel to the right temper are various. Sometimes the tool is laid upon a piece of hot metal until the proper color appears, when it must at once be removed and plunged into water. It may be held over the coals and heated in that way; and in the case of saws, a very common practice, we believe, is to set fire to the oil in which they have been first tempered, and allow it to burn until they receive the proper color. From what we have said, it will be seen that to say a piece of steel has been tempered to a straw color, implies that it was first hardened and then reheated until the straw color appeared upon it, and that reheating was discontinued at that point and the steel at once cooled. In most books a great deal of accurate direction is given, in regard to the color and the number of degrees of heat necessary to temper each class of cutting tools, and in fact steel for all sorts of purposes. Indeed the directions are so exact that a novice might suppose nothing more would be wanted for obtaining exactly the temper needed for any particular tool. The fact is, however, that the question of heating and reheating to obtain the temper is complicated by a great variety of circumstances. One of the first and most important of these is the fact that different kinds of steel are not of uniform character, nor does the steel of any one brand always behave in precisely the same manner.

The tools which our correspondent mentions are comparatively easy to harden, as compared with many that the blacksmith or tool maker is called upon to temper, and it is, therefore, possible that he may be able to obtain a fair degree of satisfaction with his own work. The first heating should be brought to an even cherry red all over. In the first operation the great danger is burning the metal, as it is called. This term exactly describes what takes place. The iron of the steel is burned, combining with the oxygen of the air, and the steel is ruined by an accumulation of the oxide or iron rust throughout its substance. Sometimes steel can be heated by immersing it in melted lead, or by heating it in melted glass, as is done with certain kinds of fine work in large manufactories. In these cases the steel is absolutely excluded from contact with the air, and there is no danger of burning. We have succeeded in making steel very hard, and giving it a good cutting edge at one operation, by sprinkling it with the "cherry-heat welding compound." The metal was heated first, just hot enough to make the compound stick to it, and after being well covered with it put back into the charcoal fire, and brought up to a red heat. Without any delay it was then plunged into cold water. This gave a good temper, but the steel was of a peculiar French make.

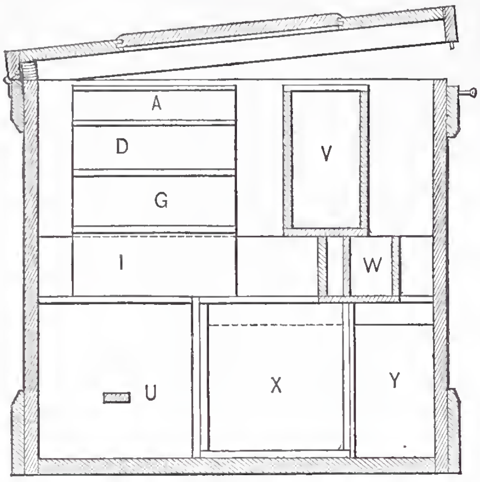
In regard to the distance to which the steel is to be dipped the



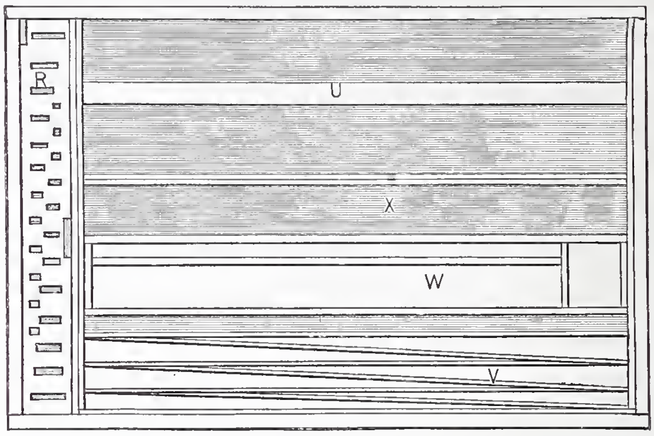
Design and Construction of Steeple, by C. H. M.—Scale, 1/8 Inch to the Foot.

second time, no very definite rule can be given. The second heating to a red heat should be for a distance of three times the diameter of the steel.

If our friend will make a few experiments, he will be able to understand directions for hardening much better than he can at present. If he does not succeed, and will give us an account of his attempts, we will endeavor to help him out of any difficulty into which he may have fallen.



X. Y. Z.'s Tool Chest.—Fig. 1.—Cross Section near End; A D G I, Case of Drawers; V, Saw Rack; W, Drawer for Level, &c.; U, Molding Planes, &c.; X, Planes; Y, Mallets, Hatchets, &c.



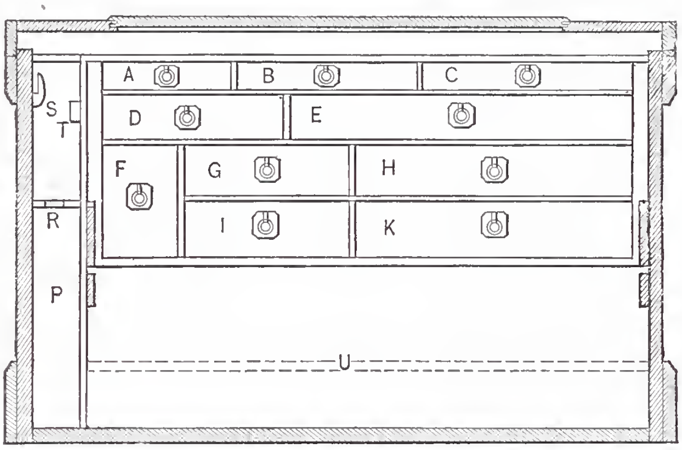
X. Y. Z.'s Tool Chest.—Fig. 3.—Horizontal Section; V, Looking into Saw Rack; W, into Drawers for Level, &c.; X, to Bottom of Chest; U, Support for Molding Planes, &c.

A Tool Chest.

From X. Y. Z., *Springfield, Ill.*—Inclosed you will find drawings of a tool chest constructed by me some 16 years ago. If you think them worthy of a place in your valuable paper you may engrave them. It differs somewhat from any of those in your last issue, but may have features which can be combined with them. At the time of building this chest I was so situated that I had but little use for any of my tools excepting square and scratch awl, and wished to have a chest that I could not only get one tool out of without disturbing others, but one which would enable me to see at a glance if a tool was not in its place; so I literally built my chest around my tools, and the result has been that I have not lost one of them. I will not go into particulars of why I located departments in particular places, as most of them will be obvious.

Fig. 1 represents an end section, A D G I being a movable case for drawers which run through and are faced alike on both sides. The top of this case is shown at M in Fig. 4. V is my saw till, the top of which is shown at N, Fig. 4. W is a drawer for level, bow-saw frame and adz handle. Y is a space for mallets, hatchets, adz heads and similar heavy tools, and is reached by shoving the saw till and drawer over on the slides. X is the body of the chest, for planes. U is for molding tools, rabbet and bead planes and plows, being two rows divided by a strip, as shown by the dotted lines in Fig. 2.

Fig. 3 is a ground plan of the chest. V is the saw till. W shows the arrangement of the drawer for levels, and represents it drawn out from beneath the saw till. The end of this is shown at W, Fig. 1. This drawer being longer than the level, is partitioned off at one end. The square apartment thus formed at the right I have found convenient for such odds and ends as any carpenter will accumulate. R, the space at the left, in Fig. 3, shows the chisel rack in which, it will be seen, I have room for two sets of firmer chisels. I also place my framing square in this rack, the tongue passing through the mortise shown at the left-hand corner, and the blade resting on a support shown at S, Fig. 2. My panel-square blade I pass through the mortise seen near the center of this space in Fig. 3, and rest it on a support, T, Fig. 2. By this arrangement the blades of squares and chisels come in the space P, Fig. 2.

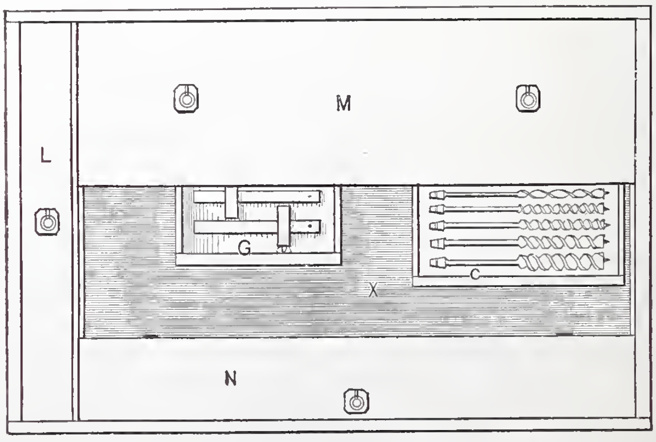


X. Y. Z.'s Tool Chest.—Fig. 2.—Longitudinal Section near Center, Showing Face of Drawer Case at Top, Space for Molding Planes, &c., at Bottom, and Section Through Chisel Rack at the End.

Fig. 4 represents a top section of the chest. G and C are two drawers drawn out of the case, showing the tools kept in them. M is the sliding case already referred to by the same letter. N is the top of the saw till, which is hinged, and is raised by the flush drawer ring shown in the sketch. L is the cover to the chisel rack, and is not hinged, but raised by flush drawer ring.

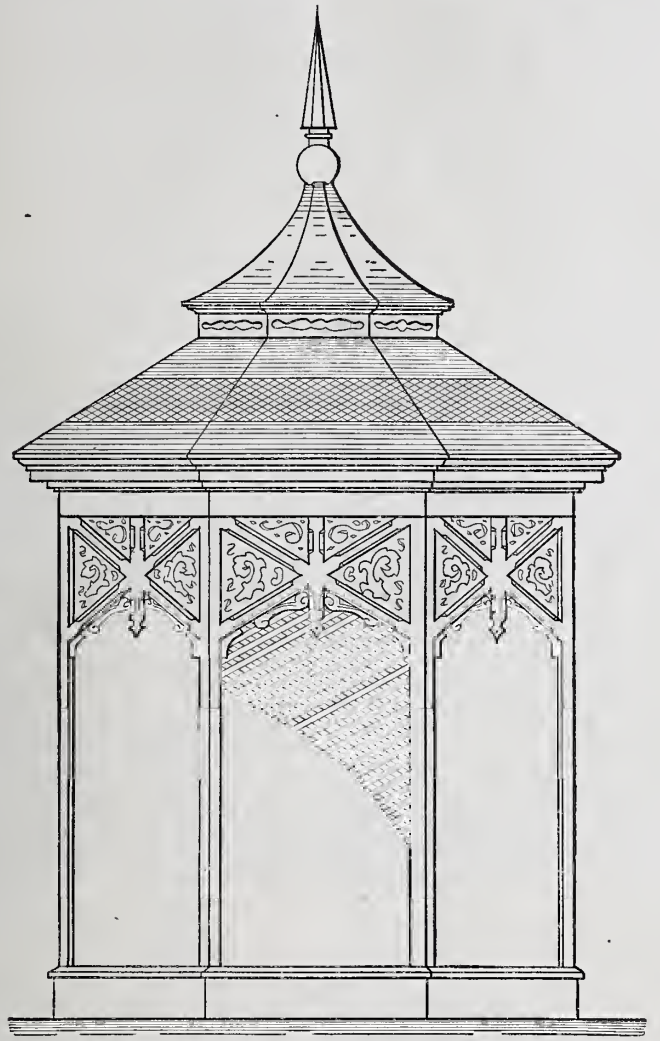
Drawer A, Fig. 2, is for plow bits; B, for center gouge and gimlet bits; C, for auger bits. D has room for two oil stones in front, and three departments for screws or nails in the rear; E is for bevels, try-squares and tools of that class; F has two compartments, front one for oil can and the rear for chalk and chalk lines; G is for gauges; H, gouges; I, for miscellaneous tools; K, for drawing knife, brace and spoke-shave, so arranged as to take up only half of the drawer in front, the rear being divided into three compartments for finishing nails; U is the space occupied by the molding tools, already alluded to, the dotted lines showing the partition between the two rows.

The movable case containing the drawers above described, moves on pieces of whalebone, which permit it to slide easily. It will readily be seen that if I wish tools from the body of the chest, also from the drawers, both places are accessible when the movable case is shoved back to the rear of the chest. If anything is needed from the molding tool department I have only to draw the case forward, which exposes it to view and still leaves the drawers available. I also have a box running the whole length of the



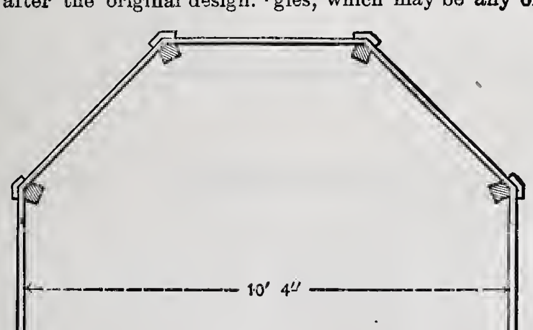
X. Y. Z.'s Tool Chest.—Fig. 4.—Horizontal Section near Top; M, Top of Drawer Case; N, Lid to Saw Rack; X, Bottom of Chest; G and C, Drawers, designated by like letters in Fig. 2, partly drawn out; L, Lid to Chisel Rack.

chest, excepting the chisel rack end, which is shown at X, Figs. 1 and 4, which can be raised to the top of the chest between the saw till and the case, thus holding everything in its position while the chest is being moved. The body of the chest is made in the ordinary manner, dovetailed at the



Design for Well House, by J. H. T.—Elevation.—Scale, ¼ Inch to the Foot.

corners, top put together, as shown by Figs. 1 and 2. I suppose some old chip who has been there himself will ask the question, "Did you ever finish your chest?" Well, no; not entirely after the original design.



Design for Well House, by J. H. T.—Plan.—Scale, ¼ Inch to the Foot.

A little of the ornamentation about the lid has never been put on. But who ever saw a carpenter's chest finished?

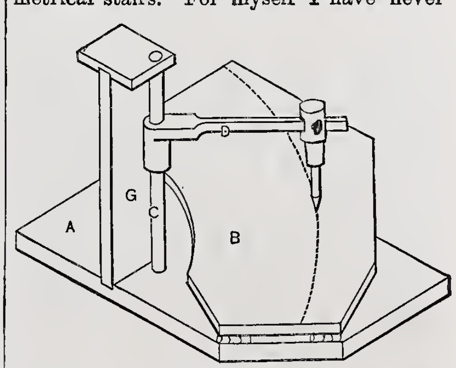
Design for Well House.

From J. H. T., *Paris, Arkansas.*—A correspondent in the April number asks for the design of a fancy well house. I inclose you a tracing of a design made by me last fall. The well house may be set on either piers or solid brickwork. It should have a 4 by 6 sill, a plate of the same dimensions, and rafters, 2 by 4; the corner posts, 4 by 5; center finial, 5 by 8, to be turned, or octagon in shape. The finial should extend through the ceiling on the inside, with a neat turn drop. The first part of the roof will be shingled and have a belt course of cut shingles, which may be any of a variety of designs, according to the taste of the builder. The upper part of the roof to be covered with best roofing tin; the scroll work of the upper band is open, thus affording ventilation. The inside should be sealed over from the commencement of the curved roof. The remainder should be sealed on the rake of the shingle roof, with narrow matched and beaded ceiling. Number the base, frieze, corner boards and chamfered ribs. Ribs in scroll portion should be of 1½-inch lumber; the small work to be ⅝ inch lumber, tongued or rabbeted in flush with back of corner boards. The frame should first be put up and then latticed complete. Next put on the corner boards, cornice, &c. The cornice should be of ⅞-inch lumber, with 12 inches projection. The lattice I would make 1 inch wide and ⅜-inch thick, and have the same well nailed and clinched together at the centers with clout nails. A house of this description should be painted inside and out, roof and all. Much will be added to its appearance if the painting is done in a tasteful way. I suggest, for the lattice face of scroll work, scrolled bell on upper deck and light stone color. The base, water table, corner boards, chamfered pieces on small work, cornice molding on upper deck and the finial to be a dark stone color. The chamfered angle ribs to be light blue; the inside of scroll work to be red; the entire roof to be light brown; the interior to be light stone color, with ceiling of blue.

A Machine for Laying Out the Rail in Cylinder Stairs.

From E. G. H., *Osian, Iowa.*—*Carpentry and Building* must profit its many readers if it does not profit its publishers. The interchange of ideas will have a tendency to stimulate study in first principles of construction, so necessary as a foundation to correct and good workmanship.

In the November number, a correspondent asks for a simple method for laying out the rail in a cylinder stairs, while B. P., in the February number, has given him a recipe that is safe and sure. I inclose a sketch of a patented instrument, an examination of which may throw some light on the subject for him. The device is a method for drawing the face molding for hand railing to geometrical stairs. For myself I have never



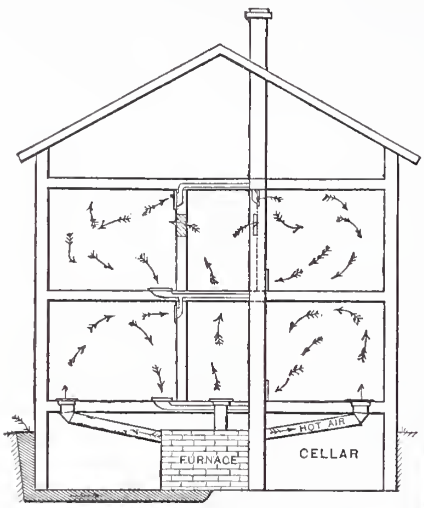
A Machine for Laying Out the Rail in Cylinder Stairs.

used it, as it is more convenient to lay down the required lines on a hall floor where the stairs are to be built, obtaining at once the starting and landing, size of cylinder, number and pitch of treads, with all the leading lines involved in making the molds for the rail, than to construct the instrument. The sketch I inclose is copied from the cut in the Patent Office Report for 1859. A is the base made of plank, B the inclined draft board hinged to base plank, C is a standard with cap through which and the base a rod G is fixed. The rod carries the arm D, which moves freely up and down the rod, and at its extreme point a socket movable on the arm is provided with either steel or pencil point. Upon the draft board the paper for the pattern of face mold of rail may be tacked, or the plank for the section of rail may be fixed. The draft board is inclined to the pitch of stair and made stationary; then the arm carried around will describe the face mold for winding stairs circular on the plan and of uniform rise. It is better, however, to understand the geometry of the thing than to use a machine of this kind. Some stairs are elliptical in plan, some have quarter sections, either circular or elliptical, which changes the direction of the falling mold, as well as the face mold, and in execution requiring a clear conception of the various curve lines which they contain.

For curves of rail at stair landing, the expedient sent by J. H. F., of Little Rock, Arkansas, though old, is none the worse for age. It was in use nearly three years ago, when I was an apprentice. It is quite a simple method of describing the ellipse, and of very wide application. In the study of the ellipse, a figure of so much importance to the mechanic, I may contribute something at a future time, but I cannot promise to be original. Mathematical truth in these days has been so extended by great investigators that it is easy for the incautions to incur the full weight of the line, "Fools dare to enter where angels fear to tread."

Ventilation.

From J. LOUIS PFAU, *Quincy, Ill.*—Ventilation is a subject about which much has been said and written, and it is quite remarkable



Ventilation.—Fig. 1.—Showing Correct Method of Placing the Chimney and Heating Pipes, Furnace, &c., in a House.

that, in view of this, so little of the practical is known. In olden times, when our houses were built of logs, there was no need of providing for ventilation; but in these days, when houses are built air-tight to keep out the cold gusts of wind in the winter season, fresh air is kept out at the same time, and other arrangements must be made to supply this elixir of life. Architects generally pride themselves on being thoroughly posted in the art of ventilating buildings, and still some of them make the most astounding blunders, impressing one quite strongly with the marvelous ingenuity shown in inventing such blunders.

Time and again has the writer been shown plans and personally inspected buildings said to be perfectly ventilated, and was astonished at the amount of costly ventilating apparatus, so intricate in detail as to require an expert to understand it, and yet, in the majority of cases, if there were any correct principles used, they were so impeded by some clap-trap or other that the friction would be so great as to cause a complete failure. The great trouble with men who erect such things is that they do not pay for these blunders. Were they to be held responsible for the successful working of their plans, they would study and experiment in making them more simple, use more common sense, and allow nature to ventilate buildings, by giving it the opportunity and by making the necessary and simple channels. It is high time this loose and reckless planning should be condemned, and we should make it our duty to initiate ourselves into the so-called methods of ventilation.

The first thing to study is: "The air we breathe and the laws governing it." Air and all other gaseous bodies are exceedingly elastic and mobile in their nature, their equilibrium, if such a property may be attributed to them, being susceptible of disturbances from very slight causes. These causes are most generally the action of heat and cold, the air expanding with heat and contracting when cooled. Air is also easily impregnated with poisonous gases—for instance, such as are thrown off by respiration and produced by insensible perspiration. Thus, if a number of persons are confined in a close room for any length of time, the air becomes putrid and utterly unfit to breathe. We seek for ventilation to take away the air as it becomes vitiated and supply its place with pure air, and the simpler the method we employ, if it be correct, the greater will be our success.

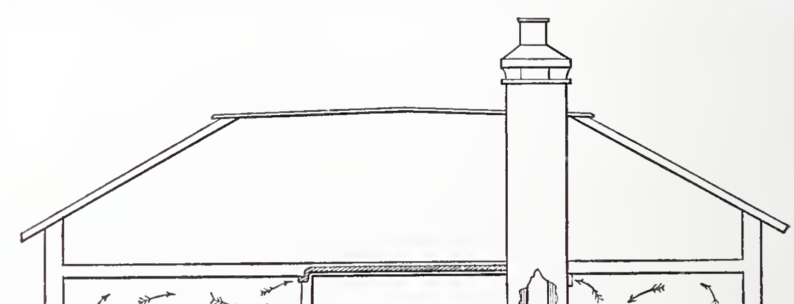
No arrangements need be made for ventilation in the summer, because where rooms have large windows they can be thrown open and the best of ventilation secured; but to ventilate in the winter season, when it is necessary to keep the house closed, requires some scientific knowledge. I have two plans of ventilation, to be used in connection with heating apparatus. No. 1 I generally use in dwellings; No. 2 in public buildings, schools, &c., where large numbers of people congregate.

Plan No. 1, shown in Fig. 1, consists of a series of flues similar to those used for smoke—a separate flue for each room, and if the room is larger than 18 feet square, two flues should be used. These should not be smaller than 8 inches square inside, and should be perfectly smooth, so as not to retard the flow of air. They should start even with the floor, at which point a register is inserted, and continue, without a break or connection, to the top of the house in the same manner as a chimney. The differeuce of density of air in the room and that at the top of the house causes an upward current in the flue, which is increased in proportion to the hight of the flue. Some architects build hollow walls and leave hollow spaces in floors for the passage of air; but, although the principle may be the same, yet the current is retarded by friction, and is therefore a failure. Air must pass in a body as nearly round as possible, and the flues must have smooth sides or walls in order to insure success.

In the foul air of which we wish to free our rooms the principal harmful gases are carbonic acid, sulphuretted hydrogen and nitrous oxide, beside some other vitiating agents which are specifically heavier than common air at the same temperature, and through the lungs repeatedly. Although originally pure and wholesome, it will soon be so strongly impregnated with these gases and lose so much of its oxygen as to be rendered utterly unfit for breathing, and the individual who continues to respire it shortly becomes asphyxiated.

As persons become accustomed to an impure atmosphere, they do not feel the direct and immediate effects, but while enduring it, often wonder why they suffer from headaches and other troubles due to the lack of fresh air, or why Providence suffers such scourges as the zymotic diseases to attack them. To rid the room of the heavy impurities which we have mentioned, a register, say, 10 x 14, is placed in the flue close to the floor, and another above it near the ceiling, only about one-tenth as large. Both registers open into the same flue. Through the upper register all the lighter gases which rise to or collect at the ceiling are expected to escape. To secure perfect ventilation, it is absolutely necessary to have a current of fresh air enter the room, to supply the place of that which would otherwise not flow outward at all. By this system we have a steady current of air, which first enters the furnace from the outside as fresh, cold air. Passing through the furnace, it is warmed and expanded by the heat, and the cold air, rushing in from the outside, rapidly propels the hot air upward through the different flues. The fresh air—warmed to perhaps 200° F.—is, of course, much warmer than the air in the room, and at once rises to the ceiling when it enters a room and drives out or displaces the cooler air in the room. This latter gradually sinks to the floor and is forced out of the register into the ventilating flue, through which it passes out of the house. While in the room it becomes foul, and in passing out takes the foul vapors or gases with it. The warm air may come from a furnace or steam coil in the cellar, but it is absolutely necessary that it be a current of warm air.*

When a house is built with large inside partition walls, the ventilating flues should be placed in these walls, and the hot-air



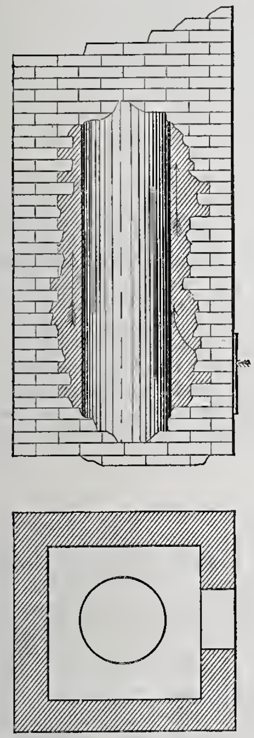
Ventilation.—Fig. 2.—Diagram shows Hot Air Pipe going up in the Outside Walls of the Building. Partition Walls are used for Same Purpose when Convenient. Several Exhaust Stacks are used in a Large Building.

constitute about nine-tenths of the total impurities. Carbonic oxide and carburetted hydrogen (deadly gases) are lighter than common air, and constitute about one-tenth of the impurities. It will readily be seen that in a close room nine-tenths of the foul air is next to the floor and one-tenth next to the ceiling. The room being occupied by a number of persons, these gases naturally accumulate and eventually fill the room, and in the absence of a good system of ventilation the same air must necessarily pass register at the exposed end of the room, in a manner similar to that shown in Fig. 1. In frame buildings, where brick flues are built, I would advise building one large chimney with partition or a series of flues, near the center of the building, as shown on

* I cannot condemn in too strong terms the plan of using steam coils in rooms only. This method of employing them gives a dead heat only and does not move the air a particle. A stove is better, as it has a small opening at the bottom for the purpose of supplying the fire with air, and thus it takes some air from the bottom of the room.

sketch (Fig. 2). Place the furnace as near the center as is convenient. Bring the cold air direct from the outside, as shown in Fig. 1, and conduct the hot-air pipe to the outer sides of the rooms.

When a two-story house is built and the upper rooms are to be used for sleeping purposes only in the winter, I do not think it best to conduct hot-air pipes to the rooms above. The best plan is to place a large register in the hall below, and then have transoms over every door in the upper portion of the house. Then the upper rooms are to be ventilated in the manner which we have already described. By this plan a pleasant atmosphere, with a temperature ranging from 45° to 60° F., may be obtained



Ventilation.—Fig. 3.—Section of Chimney on Enlarged Scale, showing Smoke and Hot Air Flues.

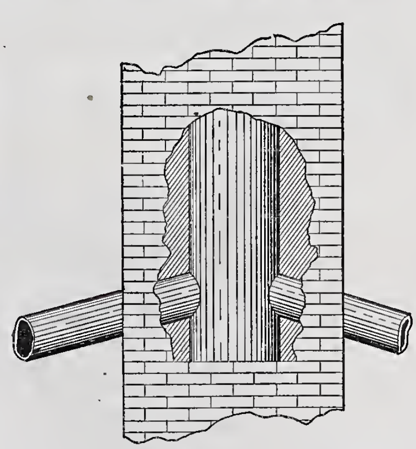
alike in the halls and the rooms. To accomplish this it is only necessary to use the register say from 6 o'clock in the evening and during the night, keeping it closed during the day.

This method of heating is shown in Fig. 5. When it is, however, combined with flues in the outer walls, the ordinary arrangement of flues is utilized to obtain proper heat and ventilation. The upper portion of Fig. 2 shows the best method of arranging the flues, &c., for heating upper rooms.

For public buildings I sometimes use the exhaust plan. This is also used in dwellings, as it is more efficient, and will carry off a greater quantity of foul air than the plan just described. I build a sheet-iron smoke stack of sufficient size to carry off the smoke from furnace or boiler, making it of No. 16 or 18 sheet iron, and extending it from the cellar up to and through the roof, as near the center of the building as I can conveniently get it. Around this pipe I build a brick chimney, leaving an air space between brick chimney and smoke pipe of from 8 to 12 inches, according to size of building. With this space I connect all the rooms in the house, the same as in the former plan. The space in the chimney around the smoke flue is warmed by the heat and smoke passing up the smoke stack, and the natural upward current of air is greatly augmented. In a tall building the air travels up through this exhaust stack at the rate of from 18 to 25 miles per hour. No opening should be allowed into this exhaust space in the stack except from the regular ventilating registers. This plan works well when all others fail; it is cheap and at the same time simple. Fig. 2 illustrates the general construction, while Figs. 3 and 4 show details on a larger scale.

No public building should be erected without ventilation in this way. People should be especially careful in the matter of school houses, for we should guard the air which our children breathe, and look after its purity with as great care as we do the food which we give them. Fine and imposing school structures are often built without the slightest provisions for ventilation. A case in point comes to mind. In 1874, at Barry, Pike County, Ill., the school directors were erecting a fine school building. The district is a wealthy one and able to do what it undertakes in the best manner. The writer happened to be in the place just as the foundation walls were up. Calling upon the directors, he found that no provisions of any kind had been made for ventilation. The directors were stubborn and would listen to no such "new-fangled notion." Every argument was brought to bear on them, but to no purpose. They would not even build the flues which would enable a more reasonable set of directors—if such should ever be elected—at some future time to provide ventilation at no great expense. Not an inch would they budge from their opinions. The reply was that they were taught in schools without ventilation, and their children could get along just as well as they themselves did. In such matters it is very important that the people should be careful in electing men who are to take charge of such weighty matters, and at least select those who have common sense and sound knowledge; otherwise, through ignorance, the lives of children may be sacrificed.

Intimately connected with the subject of ventilation is the subject of hot-air furnaces. These have been severely condemned, and in a great many cases very justly. Many manufacturers are so eager to make sales and to undersell every one in the market that they build small, cheap furnaces which, when placed in a house, must be driven to such an extent in cold weather that the air must be overheated in order to warm the house. What is required is a furnace with a large heating surface. With a large, smooth air chamber, a great volume of moderately warmed air can be had, and a good ventilating apparatus can be made to do itself full justice. The furnace which I have found to answer the requirements best is built in great part of wrought iron. The fire-pot is the only portion of cast iron. Such a furnace may be given all the heating power necessary, without adding too much to the cost. By a proper variation of the thickness of the metal, an equal heat may be obtained from all portions of the surface. I have made these furnaces for all kinds of



Ventilation.—Fig. 4.—Method of Connecting the Furnace Smoke Pipes with the Central Flue of a Large Chimney.

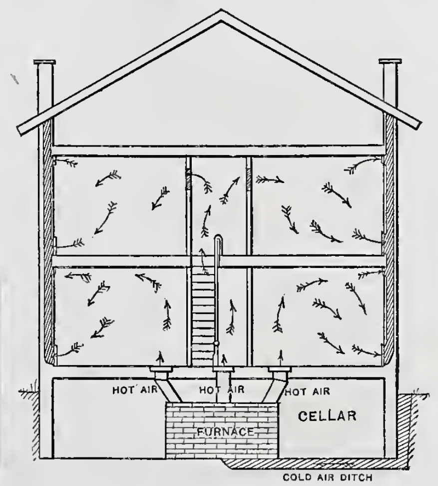
fuel, and find they came nearer to giving a salubrious summer atmosphere than anything that has been introduced.

Note.—The use of "bottom ventilation," as it is sometimes called, is absolutely essential in any system of ventilation which is successful in giving a pleasant and pure atmosphere. Although the air at the top of the room may smell very badly and be very hot and oppressive, it is by no means as bad as that at the floor, and it is found by practical experience that a very small opening will allow all the smells and bad air to be found at the top of a room to escape without improving the atmosphere in the room, so far as the comfort of those living in it is concerned. With an exhaust draft from the bottom of a room, it is comparatively easy to make it comfortable and keep the air pure.

We once saw an attempt made to ventilate and heat a large school building by taking the hot air to the rooms over the transoms. In that case it resulted very disastrously, for the rooms could not be made comfortable in cold weather, and each one had to be provided with a stove. As the building had not been designed for stoves and chimneys, the results can better be imagined than described. In that case the rooms had to be made warm enough to sit in.

Ventilating School Rooms.

From A. R. Morgan.—As I understand the situation described by L. S. C., East Machias, Me., in a number of *Carpentry and Building* some time since, he refers to a school room, size undefined, heated by two



Ventilation.—Fig. 5.—Section of House, showing Method of Heating and Ventilating Sleeping Rooms in Upper Story. The ordinary arrangement of the Flues is Utilized to obtain Ventilation and Heating for the Rooms both above and below. Greatly inferior to the Plan shown in Fig. 1.

cylinder stoves and "a 24-inch circular register in the center of the ceiling," with an opening in the attic, from which extends a pipe connecting "with the hood outside." Said school room is intended for 50 or 60 scholars, and he asks "whether, ventilating pipes and registers should be proportioned to the number of scholars, or the area of the room, or both?"

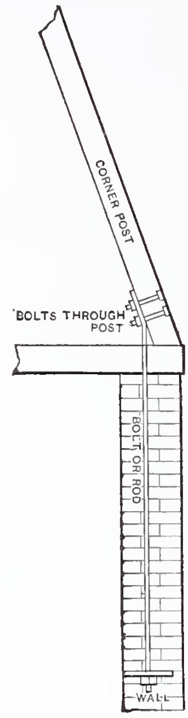
Before replying to the latter inquiry, I would remark that leaving a hole in the ceiling of a room and dignifying the aperture by miscalling it a ventilator, does not necessarily add much to the purity of the atmosphere in a room. Very intelligent people often neglect the means for supplying fresh air, and they also forget that heated air will flow as directly to an outlet in the ceiling as water will flow from a hole left in the bottom of a tub. How long would it take to fill a barrel with water by pouring into it an inch stream of water, while there was a 2-inch auger hole in the bottom?

L. S. C. having made no mention of introducing a supply of fresh air, we legitimately infer that his only sources of supply are through the crevices around the doors and windows; or perhaps he may have been reading the articles recently published in the *Popular Science Monthly* upon the "Permeability of Walls to Air," by Max Von Pettenhofer, and therefore depends upon the room walls for his supply. If my inference is correct, the air which becomes heated by contact with the hot surfaces of his two stoves (convection) obeys the inevitable law of gravity (or levity) and rises directly to the top of the room and escapes with great celerity through the 24-inch ceiling outlet. In a room so warmed, the air-heating power of the stoves is of very little practical account, for the heated air is lost through the aperture above; the objects contained in the room are warmed almost entirely by direct radiation; first, from the heated surfaces of the stoves themselves, and, secoud, from the heated walls of the room after the latter have become warmed by radiation from the stoves, and the temperature throughout will be found to vary just in inverse ratio to the squares of the distances between the objects and the sources of heat. It may be 90° F. near the stoves and 32° F. at the remote corners, in zero weather.

There are "pathies" in ventilation, as well as medicine, and the "doctors" disagree as to the best modes. Some authorities advocate warming solely by radiant heat, while a large quantity of fresh, cool air is furnished for respiration. In this case the only method for obtaining uniform temperature throughout, is to have the floors and walls uniformly warmed, while the rooms are deluged with an abundant supply of fresh, cool air—a method which is complicated, expensive and difficult. Others recommend introducing fresh air from out of doors, warming it in its transit to the ceiling, and the removal of the effete air from a register at or near the floor.

Avoiding all discussion of conflicting theories, we maintain that the practical value of any mode of veutilation may be fairly measured by its capacity to wholly renew the atmosphere in any given room or building within certain requisite limitations of time. The caliber of "ventilating pipes and registers" depends very much upon the mode adopted for warming. The situation described by "L. S. C." is apparently faulty from beginning to end. He provides no especial fresh air supply, and his ceiling opening, whether larger or smaller, merely serves to waste the heated air by conducting it out of the room. Air and water are both fluids, and both obey with automatic certainty that hydro-dynamic law which compels all fluids to seek a level according to relative specific gravity. Heat works wonders here as well as elsewhere; it is one of the omnipotent forces. We are taught that "heat is a mode of motion" and that heat and motion are transformable forces. We know that heated air travels upward as naturally as water falls, and when we reflect we find that all air currents, from simple drafts in chimney flues to "light airs" and bolder breezes; from the stately trade winds which waft the navies of the globe, to the gale, the tempest and the irresistible tornado which strands them, all move in obedience to that universal law—fluids seek their level according to specific gravity. The bag of hydrogen, rising by its levity amid the surrounding air, but obeys the same immutable law of gravitation which causes the apple to drop from the tree. Whatever exceptions appear to our limited comprehension, nature never deviates from her orderly course. The necessary conditions being provided, no matter how trivial the incident nor how stupendous the crisis, a power which never falters nor fails guides to a constant and unerring result. No matter how complicated nor how cunning the human device, water of its own gravity can never be made to run up hill, and, for quite analogous reasons, many known human inventions relating to ventilation have utterly failed. We illustrate by comparison a simple method of ventilation which, when properly applied, can never fail, because it is in complete harmony with natural laws. Set on end a barrel, having a tube inserted from above downward, extending nearly to the bottom, with a faucet in the side near the top. Pour water into the tube and it falls to the bottom, filling the barrel gradualy from below upward (the fluid always level) until it reaches the faucet, through which it escapes and falls to the ground. By continuous pouring a constant current may be established, filling and emptying the barrel with a frequency depending upon the caliber of the pipes used. Invert this process and cause heated air to flow into a room, instead of water into a barrel, and what will be the result?

The heated air will rise to the ceiling and spread itself there in a level stratum from end to end of the room. For every cubic foot of air thus introduced an equivalent in bulk will escape from below; for instance, through an open fire-place, into the chimney, drawn upward by the difference in specific gravity between it and the out-door air. An apparatus so constructed as to heat the fresh air in its transit to the ceiling, and which provides for exhaustion through openings at or near the floor, like that of an open fire place, will give uniform temperature throughout upon the same level, and its ventilating power will be measured by the size of its supply and exhaust pipes. Such an apparatus will deliver into any



Construction at Base of Church Spire.—Suggestion by G. H. H.

given room a specific volume of fresh air, moderately warmed, say to the temperature of 130° F., and therefore of a lighter specific gravity than that of the air exhaled from the lungs, loaded with its carbonic and aqueous vapors (about 90° F.), and thus being heavier than the air above, it gravitates, with the current of cooler air, toward the floor, and is drawn off below instead of being diffused above the heads of the inhabitants. As it is drawn off below, the warmer and purer air above is brought down to a comparatively level stratum to take its place, thus furnishing to every individual the best air in the room for respiration.

It would be difficult to asphyxiate a person with carbonic-acid gas and noxious vapors so long as he could get his nose to the fresh air, and the only reasonable alternative is to bring the fresh air to his nose.

The specific dimensions for inlet and outlet pipes in a properly constructed apparatus depends upon the amount of space to be warmed and the amount of air to be removed—a matter of merely elementary calculation.

The velocity of a current of air heated to 130° F. up a 6-inch smoke-pipe, is equal to a delivery through that pipe of 6500 cubic feet of air per hour, by measurement with Casellar anemometer. Given a room, 15 x 15 x 10 feet (or 2250 cubic feet air contents), supplied with fresh air by a pipe 8 inches in diameter, delivering into the air-veuting chamber of an open stove (the fresh air flue pipe must be larger than the exhaust pipe, because cooler currents flow with a less velocity) with a 6 inch smoke-pipe, and you will fill and empty that room as often as 2250 will go in 6500, or three times per hour. By enlarging these pipes the amount of ventilation may easily be increased.

The above is given as a matter of fact, easily capable of demonstration. For larger rooms there must be larger apparatus and larger conduits, all of which are matters of mere mathematical calculation.

From P. & Co., *Elmira.*—Will you have the kindness to name an issue of some paper published by you containing a plan of school house with improved ventilation?

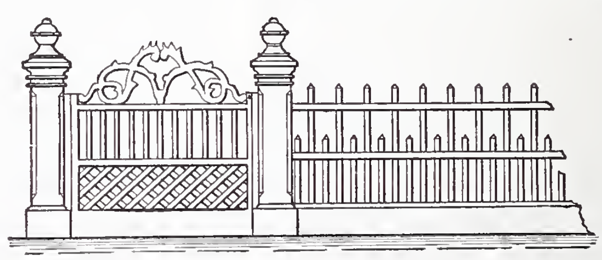
Answer.—The present number of *Carpentry and Building* contains as complete a discussion of the ventilation question as anything that has yet appeared. We trust that our correspondeut will find in it all that he may wish.

Construction at Base of Church Spire.

From G. H. H., *Philadelphia, Pa.*—I have a suggestion to offer J. M. F. with reference to the construction of the base of his church spire. Why not take one bolt in length equal to the two shown in the sketch, and with a hard iron plate at the head, say 9 inches square, build it into the corner of the wall, commencing down at lower block and setting the bolt rod so as to come up immediately into the corner post? By this construction there will be no blocks to give way by shrinkage or decay. It further has the advantage of being cheaper. I inclose a rough sketch of my idea.

Design of Fence.

From L. S. C., *East Machias, Me.*—I inclose you a sketch of fence, the measurements of which are not intended to be arbitrary. The hight should be governed by the position of the fence. For instance, if it be placed near a street and is somewhat elevated by a rising grade, it should be built shorter than if the grade were low or if it were built on a level. It is capable of some variation, both in design and in construction. The pickets might be mortised through the rails, in which case I should use them square, or nearly so—say 1 by 1¼ inches. On the other hand, if the pickets are nailed on the side of the rail, with a band piece outside of them, I should use pickets thicker and wider, say ⅞-inch thick by 1½ inches wide.



Design of Fence, by L. S. C.—Scale, ¼ Inch to the Foot.

The Labor Market &c.

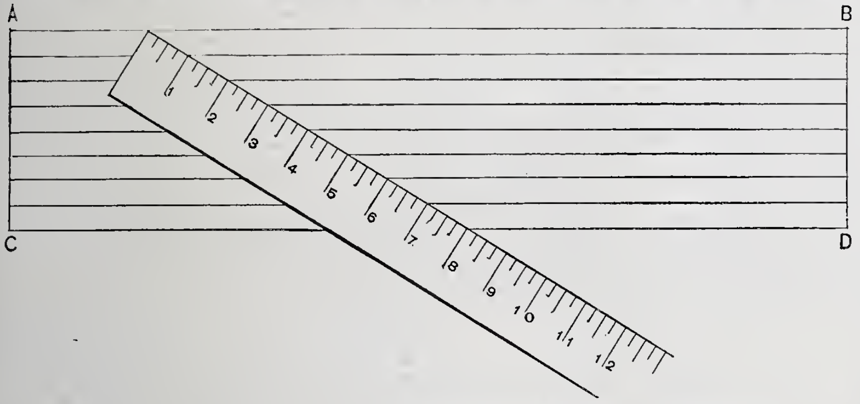
A correspondent suggests that this department of the paper be made a medium of communication between mechanics in various sections of the country with reference to prices paid for labor and the demand for mechanics. He supports his suggestion by a statement of reasons, the principal one of which is that mechanics, as a class, are at present poorly paid, and that better remuneration for work performed is necessary to encourage a better class of men to engage in mechanical pursuits.

With reference to such a use of the correspondence department of *Carpentry and Building*, we have to say this, that in its present crowded condition we do not see how it is possible for us to spare space, even if it were desirable to attempt an interchange of views in the manner our correspondent suggests. We believe that a majority of our readers are more interested in the discussion of mechanical topics at present, so far at least as our paper is concerned, than in a discussion of the labor question; accordingly, we must decline to act upon our correspondent's suggestion for the present. We are glad to receive hints of this kind from whomsoever may see fit to write us, and we trust our correspondent will appreciate the reasons which influence our decision at this time.

Dividing a Line or Surface into Equal Parts.

From J. D. S., *Middletown, Conn.*—Many years ago I found, in an encyclopedia of drawing, a rule which has been of great service to me since, and which, I have no doubt, will be of service to many of your readers. The rule was entitled, "A short method of dividing a line or surface into a number of equal parts when an ordinary rule does not evenly measure the dimensions." Its application was as follows: Suppose the width A C in the accompanying sketch be required to be divided into eight equal parts, and that it measures 7¼ inches. It is evident that an ordinary rule does not afford the subdivisions, nor apply directly, but if 8 inches be applied obliquely across the space between the parellels A B and C D, so as to measure it exactly, and thereby point off 1-inch intervals on the edge of the rule, eight equal divisions will be effected through which parallel lines may be drawn.

Should the width be greater than 8 inches, and the same number of parts be desired, then use 16 inches of the rule or the square in the same manner, pointing off 2-inch intervals, instead of 1-inch, as mentioned in the first instance. In this way the same result will be attained.



Method of Dividing a Given Line or Space into any Number of Equal Parts.

Measurement of Stone Work.

From E. E. S., *Oshkosh, Wis.*—I will attempt to answer M. P. E.'s question with regard to measurement of stone work in a wall. In this vicinity it is customary to divide the number of cubic feet by 100, in order to ascertain the number of cords in the wall. We generally deduct for all openings, and measure corners once for quarry measure. The mason in laying is entitled to double corners, and all openings counted solid. I have known of disputes where parties claimed that 128 feet constitute a cord. Custom, however, has made 100 feet of stone work in a hole stand for a cord in this vicinity. Custom sometimes makes laws which must be observed.

Blue Process of Copying.

From G. P. W., *Atchison, Kansas.*—Will some reader of *Carpentry and Building* give me full particulars of what is commonly called blue printing, used largely by architects for copying, drawing, &c.

Answer.—If our correspondent will refer to page 198 of last year's volume (October number), he will find full particulars with regard to the blue process of copying. We do not think it necessary to print the information again at the present time.

O G Band Molding under Stool Cap.

From G. N. C., *Hancock, N. H.*—In answer to questions of a recent correspondent in *Carpentry and Building*, I would say that I use O G band molding inside under stool cap. I place butts 6 inches down from top of door, and 10 inches up from bottom of door. I put knobs 2 feet 10 inches from floor. This arrangement has given satisfaction where used so far. I locate hinges on blinds about 5 inches from top and 7 inches from bottom.

Finial.

From J. S. T., *Arizona.*—Will you please give, through the columns of *Carpentry and Building*, the correct pronunciation of the word finial; also its definition?

Answer.—The pronunciation of the word, as laid down in Webster, is as nearly in accordance with the spelling as is possible in our peculiar orthography. The "i's" in both the first and second syllables are short, and the accent is upon the first syllable. It is defined as the knot or bunch of foliage on flower that forms the upper extremities of pinnacles in Gothic architecture. The term is also applied to the pinnacles themselves.

Furring of Walls.

From G. N. C., *Hancock, N. H.*—I had the management of several brick buildings in Chicago, and, from experience, have a decided preference for a 2 x 4 joist laid in the wall. I have also used a three-eighth-inch lath, laid flatways. Either plan is preferable to the wedge.

Construction of Bridge Piers.

From C. D. S., *New York City.*—Any answer to the question asked by M. H. S., with regard to bridge piers, must at best be unsatisfactory, owing to the meager description he gives of the situation and facilities for building. Assuming that below the 12-foot strapper of gravel is to be found a rock or other firm bed, the best construction of any style of bridge, and the only one suitable for a stone bridge, is masonry; but this is not the cheapest possible construction. If the bridge is to be of wood, two plans may be recommended. The first is the better, but it necessitates a pile driver, which is, perhaps, not easily obtained in the locality in which your correspondent is situated. Piles are to be driven in a row perpendicular to the axis of the bridge, and at a distance of about 3 feet from each other, one row for each pier. These piles must penetrate to the substratum, and are to be capped by a piece of timber mortised to their ends. From this foundation the supports of the bridge are to rise. These supports should be stiffened by diagonal braces. An ice fender is formed by driving three more piles than would be otherwise necessary at the up stream end of the row, topping them by an inclined piece and suitably bracing the construction.

The second plan is in general more expensive, and not so reliable, but has the advantage of requiring no pile driver or other expensive machinery. A crib work of heavy timbers is built up from the gravel, with a slight batter, and strengthened by iron rods. Broken stone is then thrown in, and the whole is brought either to the surface of the water or sufficiently above it to form a direct support for the span. In this construction some danger is incurred of the gravel washing away from beneath and allowing the crib to settle unevenly. This may be guarded against by excavating a little before the crib is placed in position, and afterward surrounding it by broken stone.

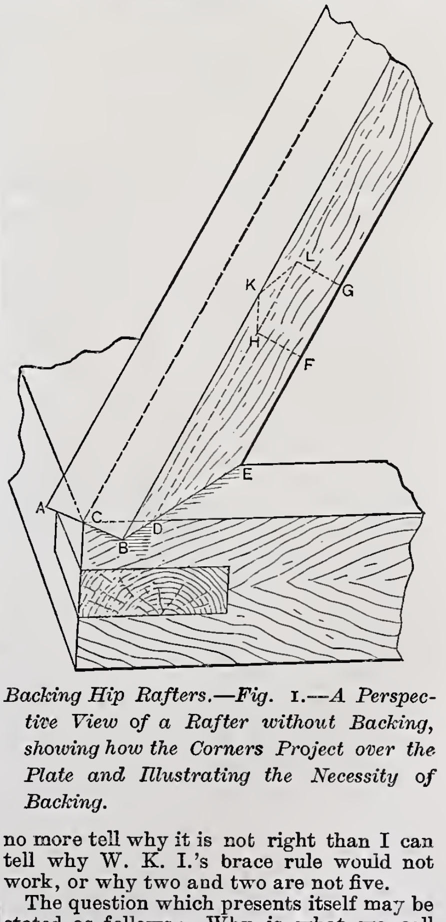
If your correspondent makes use of either of the methods here suggested, I should be glad to know his results. I hope he will lay them before the readers of *Carpentry and Building.*

Backing Hip Rafters—Wood Butcher's Reply to G. H. H.

From W. B., *Springfield, Mass.*:

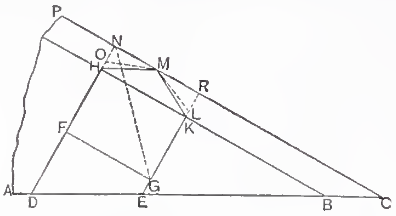
"'Twere ever thus from childhood's hour,
That chilling fate has on me fell;
There always comes a soaking shower
When I aint got no umberel."

And now G. H. H. has opened his shower bath upon my defenseless head, and the cold streams run down my spinal column, chilling the very marrow of my bones. I think if your correspondent could see poor, inoffensive W. B. taking his noontide nap on a hot summer day, after eating his dinner of bread and hard-boiled eggs, enriched with salt, as he lies stretched upon his bench, his few remaining gray hairs scattered over his faithful old jack-plane, which supports his head, his glasses removed to rest his tired eyes and his antiquated straw hat drawn well down over his nose to protect his face from falling dust, his well-worn apron wrapped around his head to protect his bald scalp from the flies, he would be sorry that he had united with those flies to give discomfort to that poor old head. G. H. H. says he is docile. I am glad to know it. I hope he is also hospitable. The former quality I admire; the latter I enjoy. Your correspondent also says that W. B. likes to be heard and no questions asked. Now, he greatly mistakes my disposition. I like to be heard on all occasions, and therefore like to be tapped at all points that wisdom may flow. But why has G. H. H. made it necessary for me to sharpen my pencil, and smooth off a shingle, and forego my usual nap? Because I said his impracticable rule should be branded? He asks what brand will I put upon it? "Shakey," sir, "shakey." He says I must surely know what is wrong with it if I am able to brand it. I only know that it has no foundation in mathematical principles, but I can no more tell why it is not right than I can tell why W. K. I.'s brace rule would not work, or why two and two are not five.



Backing Hip Rafters.—Fig. 1.—A Perspective View of a Rafter without Backing, showing how the Corners Project over the Plate and Illustrating the Necessity of Backing.

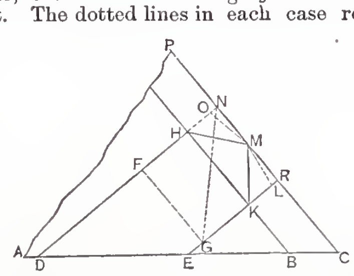
The question which presents itself may be stated as follows: Why is what we call backing necessary? I answer, it is necessary because a rafter, when cut square through by a level plane as for the foot joint, and placed at an angle across the plate, the corners stand out beyond the face of the plate. These corners, starting at the same level as the center of the rafter and rising at the same pitch, when they have reached



Backing Hip Rafters.—Fig. 2.—Elevation and Sectional View of Rafter, showing Backing Lines.—Rise, 7 Inches to the Foot.

the line of the plate will have raised in proportion to the pitch of the rafter. Hence, it follows that this amount must be taken off from the upper corners of the rafter, in order that the sheeting board may fit against it. All this I have attempted to illustrate by Fig. 1 of the accompanying sketches. C B D represents the amount projecting beyond the face of the plate, and which must be taken off from each upper corner of the rafter in order to admit of the sheeting board fitting tight against it. A line carried up the side of the rafter from the face of the plate at its junction with the foot of the rafter, and parallel with the upper edge of the rafter, will show the amount necessary to be taken off for the backing. In other words, in Fig. 1 the line D H represents the amount necessary to be taken off from the rafter shown. If we construct a cross section in the rafter, as shown by F H K L G, using the lines already described in determining this section, we will obtain lines by which the bevel may be set. This assertion, I think, will not be questioned.

Fig. 2 shows the backing of the hip rafter obtained by this method, the rise of which is 7 inches to 1 foot, and Fig. 3 shows the same, the rise in it being 15 inches to the foot. The dotted lines in each case repre-



Backing Hip Rafters.—Fig. 3.—Elevation and Sectional View of Rafter, showing Backing Lines.—Rise, 15 Inches to the Foot.

sent the backing obtained by G. H. H.'s method, as I understand it, and are introduced by way of comparison. They show that the sharper the pitch is, the further from the truth his results are.

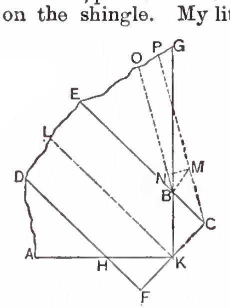
There are a great many different ways of placing the lines to obtain this result. Their number is only equaled by the multitude of ways in which the shape of a hip rafter for a mansard roof may be obtained, which was so thoroughly illustrated in the last number. Fig. 4 shows another plan of doing the same thing, in which B M is the amount of rise and N M is the amount to be taken off square with the edge of the rafter. Every workman feels sure that his plan is the best, but I have never found anything more simple than carrying the line for the foot of the rafter out to its edge, and setting back on this from the corner the proper distance as found on the plan. All this is clearly shown in Figs. 2 and 3 of my sketches. B C was obtained by measuring H F on the plan shown in Fig. 4. In both of these cases C represents one corner of the rafter, and B the point of junction between the foot of the rafter and the face of the plate, or, in other words, B in Fig. 2 and 3 represents the same point as D in Fig. 1. When the rafter is a regular rafter—*i. e.*, when its plan lies at an angle of 45 degrees from both plates, as shown in Fig. 4, the distance, B C, will, of course, be one-half the thickness of the rafter. If the rafter, however, is not regular, as shown in Fig. 5, or if the plates are not at a right angle, it is necessary to determine the distance by the plan.

Fig. 5 shows this method of getting the backing on both sides of an irregular hip rafter. It has been explained by what has been said already, and therefore needs no further attention.

Now, it is true that the triangular strip taken off from a regular rafter in the process of backing (and a regular one only), exactly represents the triangle formed by the run, the rise and the rafter, and figures on the square representing these parts properly placed, will give the bevel for backing. If G. H. H. had said, take the length of the rafter on the blade (which in example Fig. 2 is 13 15-16 inches) the rise on the tongue (which is 7 inches) and apply it to a straight edge, as represented in Fig. 6, this letter would have been unnecessary, and I should have saved my shingles, my postage and my pencils, and would not have been deprived of my nap this noon.

In the language of the lawyers, "our evidence is now in, and we rest our case" while awaiting rebutting testimony. I realize, Mr. G. H. H., that this trial is before a large and intelligent jury. It is probably before a majority of the carpenters and builders of this country, many of whom are experts upon this very subject. The justice of the verdict which it shall render I will never question, whatever it may be.

P. S.—Mr. Editor, please excuse my sending this along on the shingle. My little grand-



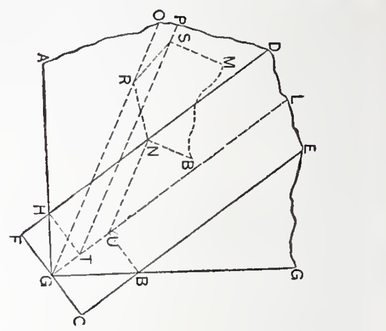
Backing Hip Rafters.—Fig. 4.—Plan Corresponding to Figs. 2 and 3; also Illustrating another Method of Placing the Backing Lines.

daughter, whom I expected to copy this, has gone to see her cousins, and I am afraid if I wait for her return it will be too late for your next paper.

Shingling.

From B. S. T., *Verbena, Ala.*—I have been somewhat amused in reading the opinions of your correspondents upon the subject of shingling. Shingles in most common use in this country are made of yellow pine. They are 18 inches long, and are intended to be 4 inches wide and one-half inch thick. A hand that carries his shingles from the ground up to the roof, say 18 or 20 feet high, and lays 2½ and 3 squares per day of ten hours, is considered a good shingler. It takes about 700 of our shingles to the square when laid 6 inches to the weather. We employ one, two, and sometimes three nails to the shingle. We seldom use sawed shingles, consequently it is often necessary to use extra nails in order to overcome the wind. I prefer a straight edge in laying shingles, from the fact that when using a line I frequently find men who will use only one nail to two shingles. I prefer hammers for driving nails. I have little use for hatchets save for trimming. If some of the correspondents who can put on 4000 shingles per day will come South I think they will be able to get all the shingling to do they want.

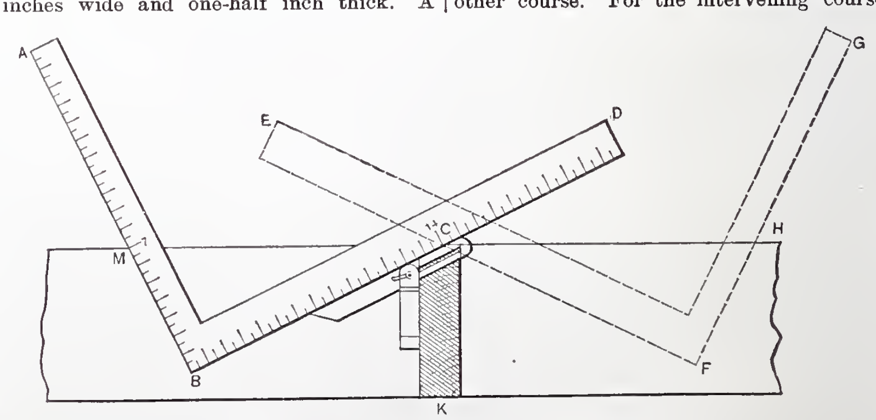
From F. P. G., *Columbus, Ohio.*—In all that has been published upon the shingling question I fail to notice any one making



Backing Hip Rafters.—Fig. 5.—Method of Obtaining the Backing on Both Sides of an Irregular Hip Rafter.

statements concerning how well his shingling has been done. It has been quantity, independent of quality. I have discovered in sawed shingles that rough sides occur where the wood is cut against the grain, and that smooth sides occur where the wood is cut from the grain. A shingle sawed from the grain will last longer than one sawed against the grain, consequently the smooth side of shingles should always be laid to the weather.

From B. BROTHERS, *Carrollton, Ill.*—Let us give our plan for shingling, which, though it may not be new, has not been mentioned by any one as yet in the paper. We use 1 x 6 for sheeting, put on in courses 3 inches apart, which makes 9 inches from the lower edge of one sheeting strip to the lower edge of the next. The sheeting is laid in straight courses by spacing with a rule, or by the use of a block 9 inches long. The strips are nailed at the marks on the outside rafters, and are afterward straightened up when being nailed at the intermediate points; consequently the edge of the strip is straight the whole length of the building. Instead of lining for the shingles, we make the lower edge of the strip answer for a line, and carry 12 or 13 courses of shingles through at once. We always use 16-inch shingles, and always lay 4½ inches to the weather—so we get a line for every other course. For the intervening course we have no line, but with a little practice the eye becomes so accustomed to the space that the shingles are laid just as straight as though a line were struck for each course. Advantages attending this system are plain to be seen. There is time saved by not lining if several men are waiting one on

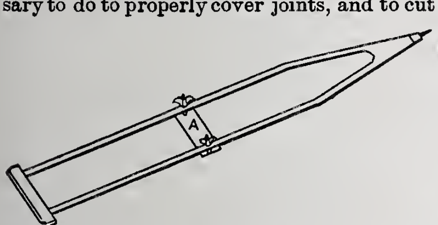


Backing Hip Rafters.—Fig. 6.—W. B.'s Correction of G. H. H.'s Rule.

another to line. We average 3500 without hard work by using this plan. We do not believe in nailing too freely.

From C. E., *Henderson, Ky.*—The suggestions of "Anon" are important and deserve consideration. I give my opinions on the subject, trusting others will do the same. If my opinions seem dogmatic, it is because I wish to make my language concise, and if I am in error, or my statements need modification, it is certainly to my interest to know it.

The pitch of the roof has much to do with the life or durability of shingles. With us in Kentucky the average life of white pine shingles, three-eighth inch thick and 14 inches long, on a roof say one-third pitch, is about 15 years. Yellow poplar (tulip tree) about eight years. Cyprus now in disuse, chiefly on account of their intolerable splitting. Red cedar, in this precise locality, only of recent introduction, but if clear of knots and sapwood, would undoubtedly be much more durable than white pine. Shingles should be laid upon slats 5 or 6 inches wide, placed 3 inches apart, that they may have ventilation beneath. Shingles give way by rotting where covered, consequently would not paint applied after being laid be worse than useless? The durability of shingles would probably be increased 10 or 12 years by dipping in linseed oil or thin paint. (Where roof water is used for drinking purposes, would not white lead as a body to the paint injure it?) Shingles should be dry before paint is applied, otherwise it would tend to promote inward decay. A cheap and effectual means of increasing the durability of shingles is to soak them in lime water. The lime acts chemically on the wood, and not as a covering from the weather, as with paint. Shingles should be laid so as to have three laps. If 14-inch shingles are used, they should show only 4½ inches to the weather; if 16-inch, then 5 inches to the weather. More than one nail should be put in shingles, unless under 3 inches wide. A hatchet should be used in shingling to properly trim the shingles, which it is frequently necessary to do to properly cover joints, and to cut



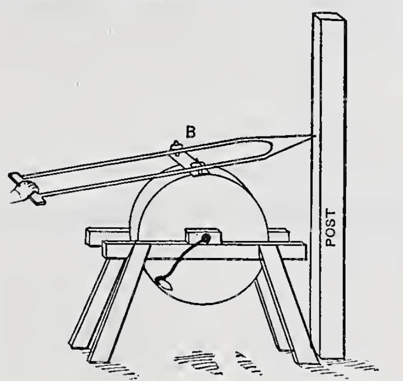
Jack for Grinding Tools.—Fig. 1.—General View of the Jack.

out defective parts of a shingle otherwise good. In shingling, as in all other things, the question most worthy of consideration is, What amount of conscientious painstaking does the work demand? And not so much. How much can a man do in a day? "Anon," or his namesake, has another communication in the last number about a coal-tar composition for a roof paint. I don't like it. In the first place, it is out of the question if any use is to be made of the water. In the second place, it would be apt to drip under a hot sun unless more gravel, slate, or something else of the kind, be put with it. In the third place, coal tar contains a very volatile oil which it is impossible to fix, and consequently it is only a question of time when this oil—which is the life of the mixture—will pass from it by distillation into the atmosphere. The coal-tar walks at the Centennial showed signs of decay before the Exhibition closed.

I think it would be very desirable for the readers of *Carpentry and Building* to discuss the method in common use of sheathing, lining and filling in between the plastering and weather-boarding of frame houses.

Jack for Grinding Tools.

From J. W. L., *Osage City.*—An article appeared in *Carpentry and Building* some time since on grinding tools. I inclose you a rough drawing of what is called in the West a grinding jack, which is used to a considerable extent. This device does away with an extra man for turning the stone, aad further, it enables the operator to do the work much better than he could by hand alone. The man grinding, after fastening his tool in the jack, will stick the spike end in a post or wall, as shown in the drawing (Fig. 2) at such a hight as to give the tool the proper bevel; he holds the jack in the left hand, and turns the grindstone with the right. In size the jack should be about a foot longer than the frame of the grindstone. By its use a man can grind almost any tool commonly used, the only exception being a draw-knife. The cross piece, indicated by A in Fig. 1, should be thicker toward the spike end, so as to throw the tool edge down below the frame, as shown by B in Fig. 2.

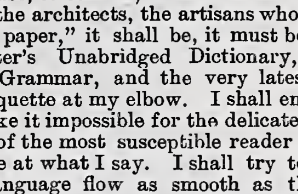


Jack for Grinding Tools.—Fig. 2.—Manner of Using the Jack.

Fig. 3 represents the U-shaped piece of iron, with finger taps by which the tool is fastened.

"Clang, Lang, Slang (?)"

From H. McG. (journeyman carpenter), *Paterson, N. J.*—By perusal of the May number, I was exceedingly surprised and thoroughly pained to note that my beautiful and classically rounded sentences should be coarsely denominated slang. It is a shame to calumniate me in such a barbarous style. Hereafter, when by humble effort I attempt to amuse, to console, or to instruct the artists, the architects, the artisans who peruse "our paper," it shall be, it must be, with Webster's Unabridged Dictionary, Murray's Grammar, and the very latest book on etiquette at my elbow. I shall endeavor to make it impossible for the delicate refinement of the most susceptible reader to take offense at what I say. I shall try to make my language flow as smooth as the current of a deep, calm river, and as soft as the pine shavings thrown from a second fore plane. I will soar for all the big words in the dictionary—for all the architectural ones in the glossaries of Nicholson, Gwilt, Newland, Parker, &c. I will send your readers after the authorities before they can comprehend the ponderous terms, the unfathomable mysteries, the unknowable knowledge contained in them.



Jack for Grinding Tools.—Fig. 3.—Clamp for Fastening Tool to Jack.

"Clang, lang, slang!" I never wrote any; I don't know how. I will bet my bottom dollar that E. A. C. D. can't find it if he tries. It must be that some of "our r aders" are a little "soft behind the ears;" are "too fresh," "too recent," "too much skim milk;" their "skin peels too easy;" they are "too much cream cheese," and never ask the boys to "set them up again."

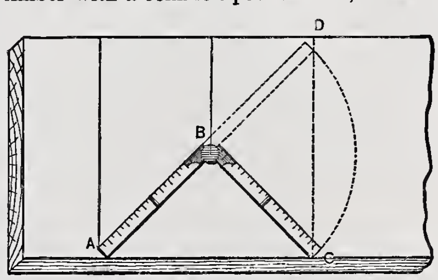
I will bet 40 cents that our Hudson friend can't demolish that brace rule with a column of the "pure, kind, considerate tone" he so loves as effectually as was done by the short squibs I shot at it.

"Our readers" are not calves, nor babies, nor school misses; they have not the mock refinements of "squirts" or "snobs." They are not hunting after fine writing or masterpieces of the English language in a technical paper, more especially in the correspondence columns. Now, is it fair to expect that a man who takes off the journeyman's apron at six o'clock will be able to write an essay by half past seven that will make an Addison, an Everett or a Webster turn over in his honored grave in envy? It is not to be presumed that language from the bench is superior to that of an assemblage of college professors putting on airs in the King's English. Nor should it be supposed that it is equal to that of a Yankee school marm in search of an affinity in Boston. The workman attempting such a style in some shops would get his "snoot busted." He would be asked if it was not a "little thin," or whether he had not gone on a milk diet, or he would be lightly hailed with "What do you take me for?" He would be told that he had a "slate loose," or that a "hole in his tin wanted shingling," or that the insane asylum presented a fine opening for a man about his size. Number O sandpaper can't be applied with good effect to a letter. If letters must be written in a much more pleasing, "pure, kind, considerate tone," I can't do it. In short, I ain't "that kind of a hair pin." I might just as well "dry up" right here.

Now, Mr. Editor, I bid you and "our readers" a sad and long adieu. I weep (with an onion) at the sad thought. When in the course of future events, by the study of the style of E. A. C. D., I learn to "polish my timber" up to the standard, I may again "sling you some ink." Till then, by-by. But I never did use slang, and never will. By-by!

Novel Rule for Squaring a Board or Timber.

From G. P. W., *Atchison, Kansas.*—The rules given by your correspondents in recent numbers of *Carpentry and Building* for laying off an octagon, calls up a method which I have often used for squaring a board or timber with a common pocket rule, a state-



Method of Squaring a Board or Piece of Timber by Use of Pocket Rule.

ment of which may possibly be of benefit to readers of *Carpentry and Building.* I have met with very few mechanics who know of the rule of which I give a sketch herewith. First apply the rule to the board or stick of timber, in the manner shown by A B C, pricking the edge of the board at C. Next holding that part of the rule indicated by A B fast, straighten it out until it is in the position indicated by A B D, and make a point in the edge of the board at D; then a line drawn by a straight edge brought against the points D and C will be at right angles to the edge of the board. It is evident that this method may be employed using the rule at any angle.

Removing Kalsomine.

From L. G. C., *Taftsville, Vt.*—Kalsomine can be removed by dampening the surface with hot water and then scraping off with broad filling knives or cabinet scrapers. If there is not a very heavy coating of kalsomine, or if it is not well bound on to the plaster, it can be washed clean by using hot water and a sponge. For painting walls, some merely use glue size before painting; I prefer to use an oil size, as dampness very often causes the glue size to scale, and this of course destroys the beauty and utility of a painted surface. For an oil size, I use the following recipe: Boiled oil, two pints; copal varnish, one pint; japan, one gallon; turpentine, one-half pint; dry yellow ocher, one pound.

From C. S. P., *New Bedford, Mass.*—In answer to the inquiry of J. H. T., Philadelphia, in relation to removing kalsomine from walls, I would state that quite recently I had occasion to perform that very operation. I found that the judicious application of hot water, afterward wiping the walls with a coarse sponge, was the quickest way. It might be done by the use of hot water, afterward scraping the walls with a sharp scraper or plastering trowel. In preparing walls for painting, it is only necessary to fill in all shallow places with plaster, and then size with strong glue. In answer to G. N. C., of Hancock, New Haven, I would say that most of the cracks in his wall can, in all probability, be filled with kalsomine, or better still, with a good lime wash. In order to make a perfect job, however, a little plaster of Paris, brushed in with a wet brush, should be used.

Experience with Oil Stones.

From S. W., *Maquoketa, Iowa.*—I will state my experience with oil stones. I had one which I had used some five or six years with turpentine. It finally became so hard I was compelled to lay it aside. I bought another and used it with turpentine and kerosene oil, and it likewise was unfit for use. I then struck up a deal with a fellow-workman to take the two stones and boil them in lye made from wood ashes, and return me one stone, which he did. I have used it since that time, a period of five years, with kerosene oil, and it has as good a grit at the present time as when new. I always keep a cloth of some kind on which I wipe my tools after grinding or sharpening, and after using the stone wipe it off clean, and, for this reason, I think it does not harden.

Walnut Stain on Pine.

From X. B., *Matteawan, N. Y.*—Will you please tell me how to finish and stain a pine and whitewood bookshelf? I do not want it as dark as walnut, but do not care whether it is polished or flat.

Answer.—The recipes for staining woods so as to produce various colors, are legion. Pine, however, is one of the woods which does not easily stain, or at least is not as often used for staining as whitewood. To produce a light mahogany color, the wood is brushed over with weak nitric acid. This is followed by the solution given below. Dragon's blood, 4 ounces; common soda, 1 ounce; alcohol, 3 pints. This is allowed to stand in a warm place and is shaken frequently, after which it is strained. This is applied to the wood after it has been treated with the nitric acid. If one application does not produce a sufficient depth of tint, the wash is repeated until the proper color is obtained. When dry the wood may be finished in the usual way, with a French polish or a wax varnish, or with oil.

Practice joined with rules, may carry a man on in his art further and more quickly than practice without rules.

Prices of Building Materials in New York, May 20, 1880.

Blinds.—OUTSIDE.

Per lineal, up to 2 10 wide....$ .... @ 0.24
Per lineal, up to 3.1 wide..... .... @ 0.28
Per lineal, up to 3 4 wide...... .... @ 0.31
Per lineal, paint'd and trim'd 0.45 @ 0.55

INSIDE.

Per lineal, 4 folds, Pine....... .... @ .56
Per lineal, 4 folds, ash or chestnut.... .... @ .90
Per lin'l, 4 folds, cherry or butternut.... .... @ 1.30
Per lineal, 4 folds, bl'k wal't. .... @ 1.30

Bricks.—(Afloat.)

Pale.................℘ M. $4.75 @ 5.25
Jersey.............. 6.00 @ 7.00
Long Island......... " 7.50 @ 8 00
Up-River............ " 7 00 @ 7.75
Havers'aw Bay, 2ds. " 7 75 @ 8.25
Havers'aw Bay, 1sts. " 9 00 @ .....

FRONTS.

Croton—Brown.........℘ M. .... @ $11.00
Croton—Dark.......... " .... @ 13.00
Croton—Red........... " .... @ 13 00
Philadelphia......... " 19 00 @ 22.00
Trenton.............. " 18.00 @ 21 00
Baltimore............ " 36.00 @ 38.00

Yard prices 50c. ℘ M higher, or, with delivery added, $1.50 per M for Hard and $4.00 @ $6.00 per M for front Brick.

FIRE BRICK. (yard prices).

Red Welsh....................$35 00 @ ....
Scotch....................... 30.00 @ ....
English...................... 30.00 @ 35.00
Silica....................... 35.00 @ 45 00
Stourbridge.................. 50.00 @ 55.00
American..................... 32.00 @ 35.00
Afloat, 50c ℘ M less

Cement.—(Cargo rate.)

Rosendale, ℘ bbl............. $ @ 1.10
Portland Saylor's American, ℘ bbl.................. 2.65 @ 3.00
Portland (imported) ℘ bbl.. 2.90 @ 3 15
Roman............. " .. 2.75 @ 3.00
Keene's coarse..... " .. 5.75 @ 6.00
Keene's fine....... " .. 11.00 @ ....
Add 25 cts. to above rates for yard prices.

Doors.—Net to 10 % dis.

RAISED PANELS, TWO SIDES.

2.0 x 6.0	1¼ in.	$1.10	....
2.6 x 6 6	1¼ in.	1.53	....
2.6 x 6 8	1¼ in.	1.58	....
2.8 x 6 8	1¼ in.	1.67	....
2.10 x 6.10	1¼ in.	1.90	...
3.0 x 7.0	1¼ in.	2.00	....

MOULDED.

Size.	1¼ in.	1½ in.	1¾ in
2.0 x 6.0	$1.81	....	....
2.6 x 6 6	2.33	2.68	....
2.6 x 6 8	2.28	2.72	....
2.6 x 6.10	2.32	2.80	....
2.6 x 7.0	2.39	2.91	....
2.8 x 6.8	2.37	2.92	3 56
2.8 x 7.0	2.49	3 03	3 75
2.10 x 6.10	2.61	3.16	3 96
3.0 x 7.0	2.73	3.41	4 20

2nd quality 15 cts. less.

Drain and Sewer Pipe.

Discount 50 to 55 per cent. according to quality and size of order.

Pipe, per foot.	Bends & Elbows, Each.	Branches Sing.	Branches D'bl. & V.		Traps, Each.
2 in..	$ .13	$ .40	$ .48	$ ...	Longer than 1 ft., charged as pipe.	$1.00
3 " ..	.16	.50	.61	...		1.25
4 " ..	.20	.65	.75	1.30		1.75
5 " ..	.25	.85	.90	1.55		2.50
6 " ..	.30	1.15	1.05	1.80		3 50
7 " ..	.35	1.50	1.20	2.05		5 00
8 " ..	.45	2.00	1.45	2.45		6.00
9 " ..	.55	2.50	1.70	2.85		7.00
10 " ..	.70	3.00	2.00	3.30		8.00
12 " ..	.80	3.75	2.52	4.24		10 00
15 " ..	1.25	5 00				
18 " ..	1.60	7.50				

House Branches pr. lin. ft. — 15x6 $1.75; 18x6 2 50
Sewer Branches pr. lin. ft. — 15 in. $2.25; 18 " 3.00

Glass.—(American.)

Prices current per box of 50 feet.

SINGLE.

Sizes.	1st.	2d.	3d.	4th.
6x 8—10x15	$8.25	$7.50	$7 00	$6 50
11x14—15x24	9.25	8 50	8 00	7 25
16x24—20x28	10 75	9 75	8 75	7 75
15x34—24x30	12 25	10 75	9 00	8.50
26x28—24x36	13.00	11 50	9 75	9.00
26x36—26x44	14 50	13 25	10.75	9 50
26x46—30x50	15 00	14 00	11 25	10.50
30x52—30x54	16 00	14 50	12 00	...
30x56—34x56	17 25	15 50	13 50	....
34x58—34x60	18 25	17 25	15 00	....
36x60—40x60	20 75	18 75	17.25	....
DOUBLE.				
6x 8—10x15	$12 75	$11 75	$10.75	$10.00
11x14—15x24	14.50	13.25	12.50	11.25
16x24—20x28	17.25	15.75	14 00	....
15x34—24x30	19 75	17.25	14.50	....
26x28—24x36	21.00	18 50	15 75	....
26x36—26x44	23 25	21.25	17.25	....
26x46—30x50	24.00	22.50	18.00	....
30x52—30x54	25 75	23 25	19.25	....
30x56—34x56	27.75	25.00	21.75	....
34x58—34x60	29.25	27.75	24.00	....
36x60—40x60	33 25	30 00	27.75	....

Sizes above—$10 per box extra for every five inches.

An additional 10 per cent. will be charged for all glass more than 40 inches wide. All sizes above 50 inches in length, and not making more than 81 united inches, will be charged in the 84 united inches' bracket. Discounts: 60@60&10 %

French

WINDOW, PICTURE AND CAR GLASS.

Prices current per box of 50 feet.

SINGLE.

Sizes.	1st.	2d.	3d.	4th.
6x 8—10x15	$8 00	$6 75	$6.25	$5.75
11x14—16x24	8 75	8 00	7 50	7.00
18x22—20x30	11 25	10 50	9 75	8.75
15x36—24x30	12 75	11 50	10.00	.
26x28—24x36	13 50	12 25	11.25	.
26x36—26x44	14 75	13 75	11.75	..
26x46—30x50	16 25	15 00	13 00	....
30x52—30x54	17 25	16 00	13 50	...
30x56—34x56	18 75	16 75	15 00	...
34x58—34x60	19.50	18 00	16 00	....
36x60—40x60	21.00	19.50	18.00	..
DOUBLE.				
6x 8—10x15	$12.00	$11.00	$10.00	$9.25
11x14—16x24	14 75	13 75	12 75	11.75
18x22—20x30	19.00	17.75	16 00	....
15x36—24x30	21 50	19 25	16.50	....
26x28—24x36	23 00	20 75	18.25	....
26x36—26x44	25 00	23 00	19.25	....
26x46—30x50	27.00	25 00	21.25	....
30x52—30x54	28 50	26 00	22.25	....
30x56—34x56	30 00	27 75	24 75	....
34x58x34x60	31 75	30 00	27 00	....
36x60—40x60	35 50	32.50	30 25	....

Sizes above—$10 per box extra for every five inches.

An additional 10 per cent. will be charged for all glass more than 40 inches wide. All sizes above 52 inches in length, and not making more than 81 united inches, will be charged in the 84 united inches' bracket.

Discounts: Single, 50 to 50 & 10.

GREENHOUSE, SKYLIGHT AND FLOOR GLASS

Per square foot, net cash.

⅛ Fluted plate, case 10c; cut to size 14c.
3-16 Fluted plate " 13c. " " 16c.
¼ Fluted plate " 16c. " " 18c.
¼ Rough plate " 16c. " " 18c.
⅜ Rough plate " 21c. " " 27c.
½ Rough plate " 28c. " " 33c.
¾ Rough plate " 45c. " " 55c.
1 Rough plate " 55c. " " 65c.

Hair.

Cattle..............℘ bushel..$ .... @ 0.17
Goat................ " .... @ 0.20

Lath.

Cargo rate............ ℘ M $ 1.50 @ 1.60

Lime.

Glen's Falls, or Keenan's common, cargo rate ℘ bbl.............. .80 @ .85
Glen's Falls, or Keenan's finishing Jointa.......... 1.00@ ....
Rockland, common........... 1.00 @....
Rockland, finishing........ 1.15 @....
Add 25c. to above figures for yard rates.

Lumber.—(Yard prices.)

Pine, very choice and ex.. dry, ℘ M. ft. thick.......$60 00 @ $65.00
Pine, clear.................. 55.00 @ 60.00
Pine, selects................ 45.00 @ 50.00
Pine, selected, box......... 20.00 @ 22.00
Pine, common box........... 18.00 @ 20 00
Pine, common box, ⅝...... 15.00 @ 16.00
Pine, 1¼x10, 13 ft., matched, each.................. .40 @ .43
Pine, 1¼x10, 13 ft.. culls.... .28 @ .30
Pine, 1x10, 13 ft., good matched, each........... ... @ .30
Pine, 1x10, 13 ft., common, matched, each........... .23 @ .25
Pine, 1x4½, clear, match'd, each.................. .23 @ .25
Pine, 1x4½, merchantable, matched, each........... .17 @ .18
Pine, 1¼x4½, cl'r, match'd, each.................. ... @ .35
Pine, 1¼x4½, merchantable, matched, each....... .28 @ .30
Spruce, 1x9, 13 ft., rough... .18 @ .20
Spruce, 1x9, 13 ft. matched, each..................... .20 @ .22
Spruce, 1¼x9, 13 ft., rough. .21 @ .22
Spruce, 1¼x9, 13 ft., matched, each............ .23 @ .25
Spruce, 2x9, 13 ft., rough.. .35 @ ...
Spruce, 2x9, 13 ft., match'd, each.................. .40 @ .42
Spruce, 2x4, 13 ft.......... .14 @ . .
Spruce timber, flat, ℘ M ft 19.00 @ 20.00
Spruce timber, square, ℘ M ft................. 22.00 @ 22.00
Hemlock, 1x10, 13 ft., each. .16 @ .17
Hemlock, 2½x4, 13 ft., each. .14 @ .15
Hemlock, 3x4, 13 ft., each.. .. @ .16
Hemlock, 4x6, 13 ft., each.. .40 @ .43
Ash, good, ℘ M ft........... 45 00 @ 55 00
Oak......................... 45 00 @ 55.00
Oak, quartered .. .. 70.00 @ 90.00
Maple, common.............. 25.00 @ 35.00
Maple, good to 2 in........ 40.00 @ 45 00
Maple good thick........... 45.00 @ 55.00
Maple white................ 55 00 @ 60.00
Chestnut................... 45 00 @ 60.00
Bl'k walnut, good to choice 85.00 @ 100.00
Black Walnut 2d............ 55.00 @ 65.00
Black walnut, ⅝............ 75.00 @ 85.00
Black walnut, selected and seasoned.................. 100.00 @ 120.00
Bl'k walnut counters, ℘ ft. .12½ @ .20
Cherry, wide, ℘ M ft....... 85.00 @ 100.00
Cherry, ordinary........... 70.00 @ 80 00
Whitewood, or Poplar 1 to 1½ inch.................. 40 00 @ 50.00
Whitewood, or Poplar ⅝ in. 30.00 @ 35.00
Whitewood, or Poplar ⅝ panels...................... 35.00 @ 45.00
Shingles, extra sawed pine, 18 in., ... 5.00 @ 6.00
Shingles, clear sawed pine, 18 in., 2 nd............. 4.00 @ 5 00
Shingles, cypress, 7x24.... 14 00 @ 18 00
Shingles, cypress, 6x20.... 12.00 @ 14 00
Shingles, Cedar, 6x24, No. 1 — @ 22 00
Shingles, Cedar, 6x24, A's.. — @ 16 00
Shingles, Cedar, 6x20, No. 1 — @ 12.50
Shingles, Cedar, 6x20, A's.. — @ 10.00
Shingles, Cedar Eastern... — @ 3.50
Shingles, Pine............. — @ 3 75
Shingles, Spruce........... — @ 3.50
Yellow pine dressed flooring, wide, ℘ M ft......... 35.00 @ 37.00
Narrow ditto.............. 35.00 @ 40 00
Yellow pine timber........ 33.00 @ 45 00
Locust posts, 8 ft., ℘ in..... .18 @ .20
Locust posts, 10 ft........ .24 @ .25
Locust posts, 12 ft........ .25 @ .30
Chestnut posts, ℘ ft...... .3 @ .3½
Mahogany, ¼ in. ℘ ft....... .5 @ .7
Mahogany, ⅜ in. ℘ ft....... .8 @ .10
Mahogany, ½ in. ℘ ft....... .10 @ .12
Mahogany, ⅝ in. ℘ ft....... .12 @ .13
Mahogany, ¾ in. ℘ ft....... .14 @ .16
Mahogany 1 in. ℘ ft........ .16 @ .18
Rosewood, ⅛ in. ℘ ft....... .11 @ .15
Rosewood, ¼ in. ℘ ft....... .16 @ .20
Rosewood, ½ in. ℘ ft....... .24 @ .28
Rosewood, ⅝ in. ℘ ft....... .40 @ .45
Rosewood, 1 in. ℘ ft....... .60 @ .75
Satin wood, ½ in. ℘ ft..... .25 @ .35
Satin wood, 1 in. ℘ ft..... .35 @ .50
White holley ¼-inch......... .10 @ .12
White holley ⅜-inch......... .15 @ .18
Cedar (Cuban and Mexican) ℘ ft........................ .10 @ .14
Cedar (Florida)........... @
Less than 1 inch.......... .15 @ .24
1 inch and over.......... .25 @ .30

Moldings.

60c. to 80c. per inch per 100 feet, according to quality.

Paper.

Rope, waterproof building, ℘ lb. .16 @ .17
Rosin Sized Sheating, ℘ lb. .4 @ .5
Dry Sheating ℘ lb.......... .3 @ 3½
Tarred Felt. ℘ lb.......... ... @ .3

Plaster.

Calcined City........Mill rate..$1.25 @ ....

Sash.—Net to 10 % dis.

GLAZED.

Dimensions of windows.	12 Lights. 1¼pl.	12 Lights. 1¼c.	12 Lights. 1½c.	8 L's. 1½c.	4 Lights. 1¼c.	4 Lights. 1½c.
2.1x3.6	$1.12	1.20	....	....	....	....
2.4x3.10	1.28	1.36	....	....	1.52	....
2.7x4.6	1.59	1.67	....	....	1.90	2.?0
2.7x4.10	1.68	1.75	....	....	2.20	2.30
2.7x5.2	....	1.85	....	....	2.28	2.40
2.7x5.6	....	.. ..	....	2.49	2.45	2.60
2.7x5.10	....	....	....	2.54	2.60	2.75
2.10x4.6	1.71	1.81	1.92	....	....	....
2.10x5.2	1.91	2.00	2.16	2.51	2.50	2.65
2.10x5.6	2.05	2.16	2.35	2.?6	2.61	2.83
2.10x5.10	2.35	2.45	2.65	2.69	....	3.05

c. means counted checked—plowed and bored for weights.

Hot bed sash, glazed.................$2.35

HEAD LIGHT.

Two or three Lights, Glazed.

Size.	1¼	1½	Size.	1¼	1½
2.6x1.0 ..	65	75	2.10x1.0..	65	80
2.6x1.6...	75	85	2.10x1.6..	80	90
2.8x1.0...	65	75	3 0x1 0...	70	85
2.8x1.6...	75	90	3.0x1.6...	95	1.05

Slate.

By car load, delivered in New York.

Purple roofing slate, ℘ sq're.$5.50 @ $6 00
Green slate.................... 5.50 @ 6.00
Red slate...................... .... @ 10.00
Black slate, Pennsylvania... 4.00 @ 4.50
Tiles, 1¼ in. rubbed, ℘ sq. ft. .25 @ .28

℘ sup. ft.

Steps and platforms, 1 in. thick........30c
" " 1½ " 40c
" " 2 " 55c
Risers, 1 inch thick.....................35c
Coping, 1½ " 35c
" 2 " 49c

Lineal ft

Window sills, 4x7........................55c
" 3x7........................45c
Window caps, 4x10, plain..............80c
" 4x8, " 60c
" 3x10, " 55c
" 3x8, " 50c

Stair Material.

BALUSTERS.

Black Walnut.	1½ in.	1¾ in.	2 in.	2½ in
Fancy Turned.....	7c	9c	10c	16c
Neck Turned......	9c	10c	12c	19c
Fluted or Octagon	12c	14c	17c	25c

OCTAGON PANELED NEWELS.

Panels Veneered with French Walnut.

8-inch Newels, with Cap............ $6 12
9 " " " 6 88
10 " " " 7.60

SOLID NEWELS, WITH CAPS.

Black Walnut.	5 in.	6 in.	7 in.	8 in.
Fancy Turned....	$1.60	$1.90	$2.50	$3 40
Octagon..........	2.10	2.40	3.00	3.90

STAIR RAIL.

Worked out and finished ready to put up. Easements and cylinders counted double. Price per foot (Newels and Balusters not included).

Black Walnut.	3 in.	3½ in.	4 in.	4½ in
Molded............	40c	45c	50c	53c
Toad Back.........	45c	50c	63c	68c

STAIR RAIL, UNFINISHED.

Price per foot.

Black Walnut.	3 in.	3½ in.	4 in.	4½ in
Molded............	11c	13c	15c	17c
Toad Back	12c	14c	16c	18c

Stone.

Cargo rates, delivered at New York.

Amherst freestone, in rough, ℘ C ft........................$0.85 @ $0.90
Berlin freestone, in rough... 0.85 @ 0.90
Berea freestone, in rough.... .... @ .80
Brown stone, Portland, Ct... 1.25 @ 1.50
Brown stone, Belleville, N. J. 1.00 @ 1.50
Granite rough.................. .50 @ 1.00
Dorchester, N. B., stone, rough...............℘ foot. .... @ 1.00

BLUE STONE

Rubbed hearth, 10 ft. or under........ 25c
Rubbed hearth, 20 ft. or under........ 35c
Rubbed hearth, 30 ft. or under........ 45c
Rubbed hearth, 40 ft. or under........ 50c
Rubbed sills.............................. 30c
Sawed & Planed.......................... 40c
Sills and lintels........ .... @ 18c
Sills and lintels, fine quarry cut sills.............................. @ 35c
Coping, 11 to 18 in. wide.......... 20c @ 24c
Coping, 20 to 28 in. wide.......... 38c @ 60c
Coping, 30 to 36 in. wide.......... 65c @ 80c
Steps, 8 in.......................... .... @ 60c
Steps, 7 in.......................... .... @ 55c
Steps, 6 in.......................... .... @ 35c
Steps, door. per in. wide......... .... @ 3c
Platforms, promiscuous, 4 in... .... @ 32c

Vault Lights.—Nominal.

Platform, sq ft.................... ....$3.50
Step and risers, sq. ft.................. 3.50
Floor light, sq. ft....................... 2.50
Roof light, sq. ft...................... 2.50
Platform, 2d quality, sq. ft........... 2.60

COVERS.

Diameter.	Round.	Hexagon.
14 inch	$3.00	$0.00
16 "	3.75	4.00
18 "	5.50	6.00
20 "	8.00	8.50
24 "	14.00	15.0
26 "	16.00	17.0
30 "	23.50	25.0
36 "	31.00	33.0

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Spires, Bell Turrets and Pinnacles.

The origin of the spire in architecture seems not to be definitely known. Architectural authorities, speaking of the first pointed stone roofs that were placed upon towers, say of them that the external stone work was cut in such a way as to resemble shingles, and from this they judge a wooden spire preceded those of stone. One of the earliest stone spires known dates about the end of the eleventh century, and is upon a tower at Thoan, Normandy. The effect of a spire in architecture was known long before. Egyptian obelisks, Chinese pagodas, both furnish the idea. During the middle ages lofty spires, both of stone and wood, were built, and we find every variation—from the enlarged finial, the pinnacle and the bell-cote, up to spires towering 400 or 500 feet in the air.

As a means of decorating a building or beautifying its outline, the spire and its varieties is unique. When well proportioned and suitable to the structure upon which it is erected, it possesses a beauty and a fascination not to be found in any other architectural feature. We have in spires a great variety. The old English architects made a distinction between those spires which rise from the walls of a tower without a parapet and those which had gutters and parapets. The former style was distinguished by the term broach, which was the old English word for a spit. Next to the spire we have the pinnacle, which is really a small spire, but usually applied in such a way as to have its foundation upon the roof or wall of the building, rather than upon the ground, as was the case with the spire proper. These pinnacles, especially in Continental practice, were freqnently used for hanging bells, and in such cases received the name of bell-cotes, and by easy degrees we have the varieties of bell turrets and bell gables.

Our illustrations represent a series of bell turrets (or bell-cotes) and pinnacles, and they present some of the most beautiful of these structures in existence. Some are in wood and some in stone, and some in both materials combined. Fig. 8, if it did not form a subordinate portion of a large structure, might be almost considered a spire, since its treatment in very many respects is similar to that of an ordinary spire and tower. Figs. 1, 2, 3 and 7 are all examples of thirteenth century work, and are all bell-cotes with pinnacle placed upon the roof. Fig. 4 is placed at the intersection of two roofs. Here it may be noted that these bell turrets with their pinnacles were adopted by many of the religious orders of Europe in their churches, because the regulations did not permit them to build towers. These light structures, however, answered their purpose in the decoration of the building, while their lightness enabled them to be carried by the roof in many instances. This was not, however, always the case, as in Fig. 6, where a stone bell-cote, in a church of Rothbenburg is bracketed out from the

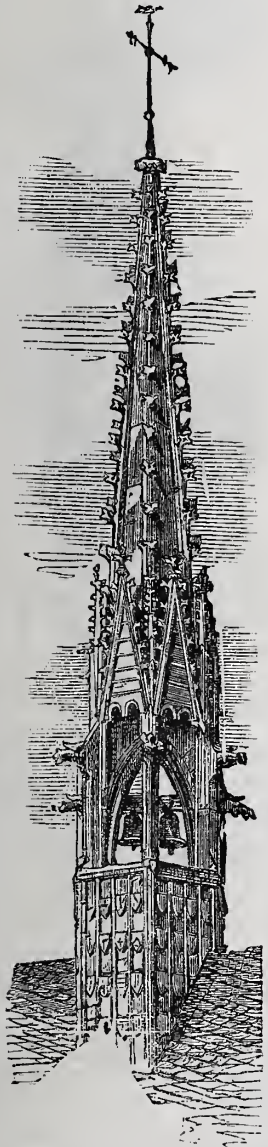


Fig. 1.—Lead-Covered Bell Turret, Minorite Church, Cologne, 14th Century. Crockets of Beaten Lead.

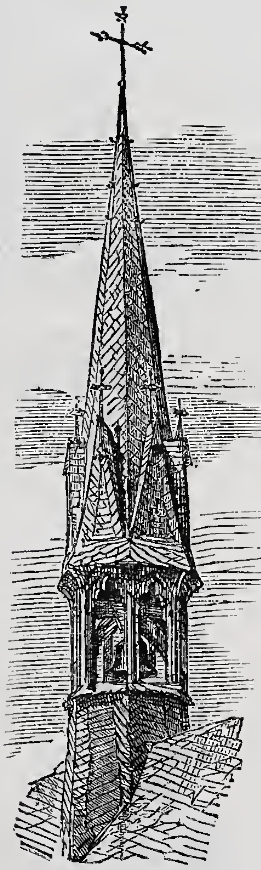


Fig. 2.—Bell Turret from Cassel, 14th Century. Pinnacle and Base Covered with Small Slates.

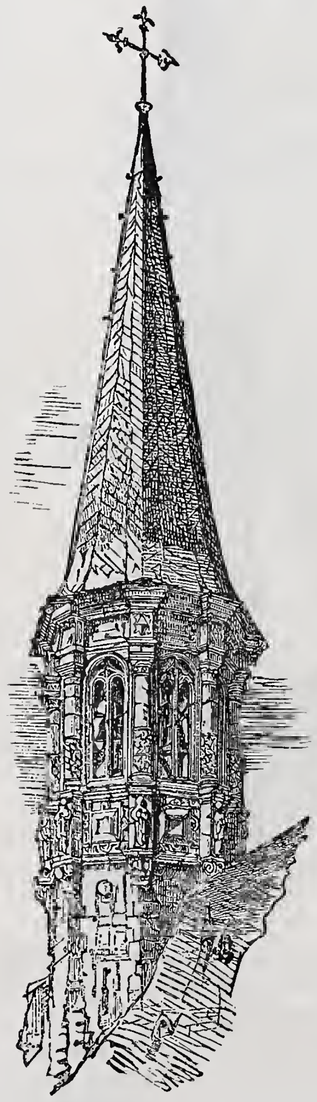
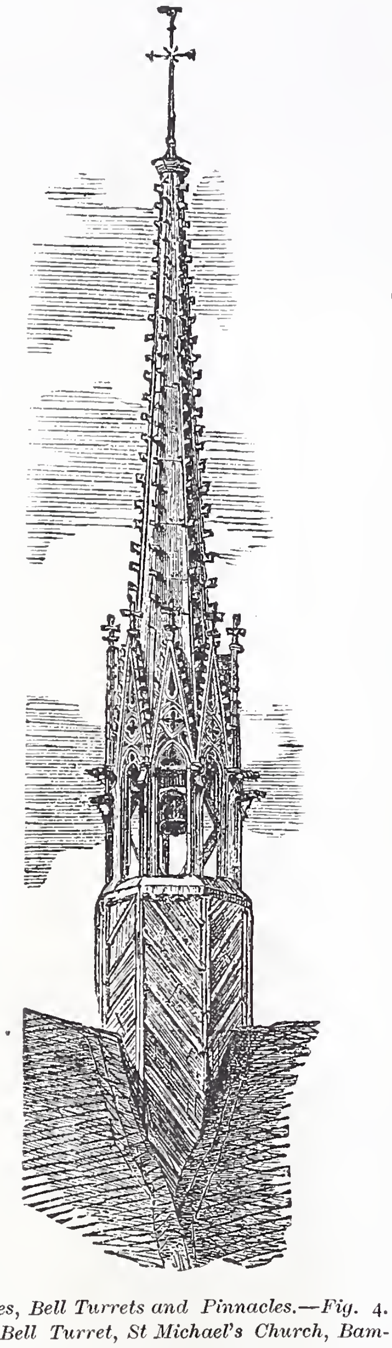


Fig. 3.—Bell Turret of Stone, with Pinnacle of Wood Covered with Slate, 16th Century.

SPIRES, BELL TURRETS AND PINNACLES.

western gable. It carries a single bell. Fig. 3 is a more beautiful and pretentious work. The spire itself is of wood and covered with slate. The shaft is of red stone. Unlike the others that we have mentioned, it is carried down through the church to the ground and forms a very picturesque and singular arrangement. It stands over the center of the nave of the church, and is utilized as a portion of a screen, separating a



Spires, Bell Turrets and Pinnacles.—Fig. 4.—Bell Turret, St Michael's Church, Bamberg—14th Century.

part of the nave from the remainder. Fig. 5 is a bell-cote of timber carrying two bells, and supported on the western end of the gable of the Cathedral of Limberg-on-the-Lahn. The timberwork is exposed below, but the pinnacle is covered with slate.

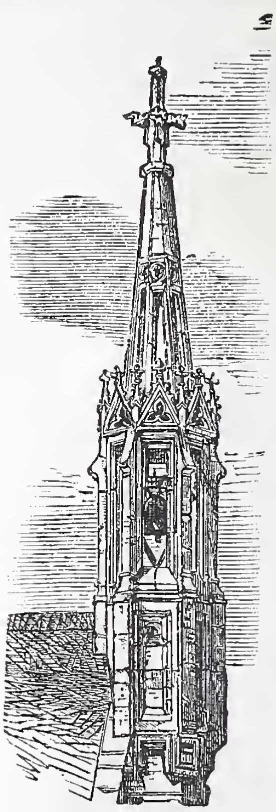
In this matter of covering of spires and pinnacles there was a great difference. Many ancient buildings, for example that shown in Fig. 2, have a pinnacle and base covered with small slates, while in the lower portion the timberwork is left open. In Fig. 1 we have an exceedingly elaborate example from the Minorite church at Cologne. This is entirely covered with sheet lead, crockets and finials being all hammered out of the metal. The base or shaft is covered with a number of small shields, each bearing a heraldic device. Fig. 4 is also covered with lead. The most elaborate of all, however, is the pinnacle shown in Fig. 7, from the Town Hall at Cologne, the whole of which is lead-covered. In Fig. 8 the principal portion is covered with lead, the lower portion of the spire with slate; then the open portion or lantern is lead covered, while the base, which is in the form of a broach spire, is covered with slate, and below we have an oriole window in which is placed an altar.

Few things impart a greater beauty to church architecture than a shapely tower, with a lofty spire well proportioned to its base. Few things, however, are capable of more effectually ruining the appearance of a building than the use of a spire whose outlines or proportion are ugly. At the present time, spires may be said to be almost fashionable, not only for churches, but for a variety of structures. Very frequently it seems that the only idea of the designer is to place a sharp pyramid upon a shaft capable of sustaining it. A greater mistake can hardly be imagined. A number of architects, apparently for cheapness of construction, set the timber forming the principal members of the spire on the walls of the tower, and attempt to give lightness and beauty by adding broad eaves and so curving the spire line outward. The effect produced in this way is heavy, and very frequently the result is an arrow-headed appearance, utterly destructive of beauty. Something of this sort is seen in Fig. 2, where it would be still more manifest if the shaft or tower were longer. In Fig. 8, the principal members of the framing are so arranged that they do not rest on the outer walls at the top (this is seen both in the spire and bell turret), but in the lower portion where the spire joins the square body of the tower. In this case the principal rafter would strike the wall many feet below. Contrasting this with Fig. 2, we find that for the same size of tower this method gives a very much lighter and more pleasing spire. It also has the advantage of giving a sharper spire for a given size of tower. This difficulty is only met in building a broach. It is hardly possible, in designing spires or turrets, to obtain a good effect unless the angle is sharp. No matter how graceful the external lines may be, or how beautiful the tower itself, if the width at the base is large there will be a certain bulkiness of appearance displeasing to the eye and generally unsatisfactory. This is well illustrated in Fig. 3, which would be much more pleasing could the diameter of tower and spire be considerably reduced.

The broad, flat finial in Figs. 1 and 4 greatly injure their appearance, while the awkwardness of Fig. 2 is in a great

Spires, Bell Turrets and Pinnacles.—Fig. 5.—Bell Cote of Timber, Amberg, Bavaria—16th Century. Roof Covered with Slate.

degree removed by its pointed and delicate top. Fig. 6, in the same manner, is robbed of much of its beauty by the heaviness of the stone cross by which it is surmounted; at the same time its spire is somewhat too slender for the body. It would be improved, considered simply as a spire, by an increase of hight or by an increase in the diameter. This suggests a curious fact connected with the design of all tapering objects. With a given hight and diameter at the base, we find that a certain angle gives the most pleasing results, but when we come to double the size, increasing diameter and hight, we are met with the fact that our angle no longer produces the most pleasing effect upon the eye, and that with the other dimensions we are also obliged to change the angle of the taper. If we were to take these bell turrets which we have illustrated, copy them upon paper and then draw the side or elevation of a church, using them as spires, we should find that their proportions were no longer satisfactory, but would of ne-



Spires, Bell Turrets and Pinnacles.—Fig. 6.—Stone Bell Cote of the 15th or 16th Century.

cessity have to be changed in order to harmonize with their larger scale.

It will be noted, in looking at the designs in several of these spires, that the covering, whether of slate or shingles, is not put on with strict regularity, and the shingled or slated surface, by various devices, is broken up for the purpose of interrupting the uniformity of the sides. Whatever covering is adopted, means should be taken to render it fireproof and also to protect it on the inside from fire. Usually the tower of a church is so lofty as to be beyond the convenient reach of streams from fire engines, yet by their very construction they are peculiarly liable to be fired from sparks or brands from burning buildings.

When wooden churches and wooden spires were more common in cities than they are at the present day, there was frequently great rivalry between the different congregations in regard to the hight of the spires. Sometimes this rivalry was carried to extremes, and the spires seemed more like needles than solid frameworks of wood. In Europe, not a little feeling of emulation exists in this same matter among the various cities. The towers of Cologne Cathedral are now the highest in the world, the hight they have attained being 5 feet greater than the tower of St. Nicholas' Church in Hamburg, which has hitherto been the highest edifice. Ultimately they will be 51 feet 10 inches higher. The Cologne *Gazette* gives the following as the hights of the chief high buildings in the world:

"Towers of Cologne Cathedral, 524 feet 11 inches from the pavement of the cloisters, or 515 feet 1 inch from the floor of the church; tower of St. Nicholas, at Hamburg, 473 feet 1 inch; cupola of St. Peter's, Rome, 469 feet 2 inches; cathedral spire at Strasburg, 465 feet 11 inches; Pyramid of Cheops, 449 feet 5 inches; tower of St. Stephen's, Vienna, 443 feet 10 inches; tower of St. Martin's, Landshut, 434 feet 8 inches; cathedral spire at Freiburg, 410 feet 1 inch; cathedral of Antwerp, 404 feet 10 inches; cathedral of Florence, 390 feet 5 inches; St. Paul's, London, 365 feet 1 inch; ridge tiles of Cologne Cathedral, 360 feet 3 inches; cathedral tower at Magdeburg, 339 feet 11 inches; tower of the new Votive Church at Vienna, 314 feet 11 inches."

A lofty and graceful tower, surmounted by a tall and well-proportioned spire, adds greatly to the beauty of a church. As they are commonly built, however, the tower would be greatly improved by the omission of the spire, which is usually too short and too ugly to be even tolerable. The weight and cost of a stone spire is so great that it can rarely be built high enough to be ornamental. Generally the money expended upon these spires would produce better results in carrying the tower to a greater hight and finishing it with pinnacles. Indeed, though many people will object to such a fraud as a wooden spire

Spires, Bell Turrets and Pinnacles.—Fig. 7. —Pinnacles from the Town Hall at Cologne, 14th Century. Entire Covering Material Lead.

upon a stone church, we think that the beauty resulting therefrom will justify the addition of a slender timber spire to stone churches in general, instead of the awkward pyramids which are frequently placed upon their towers.

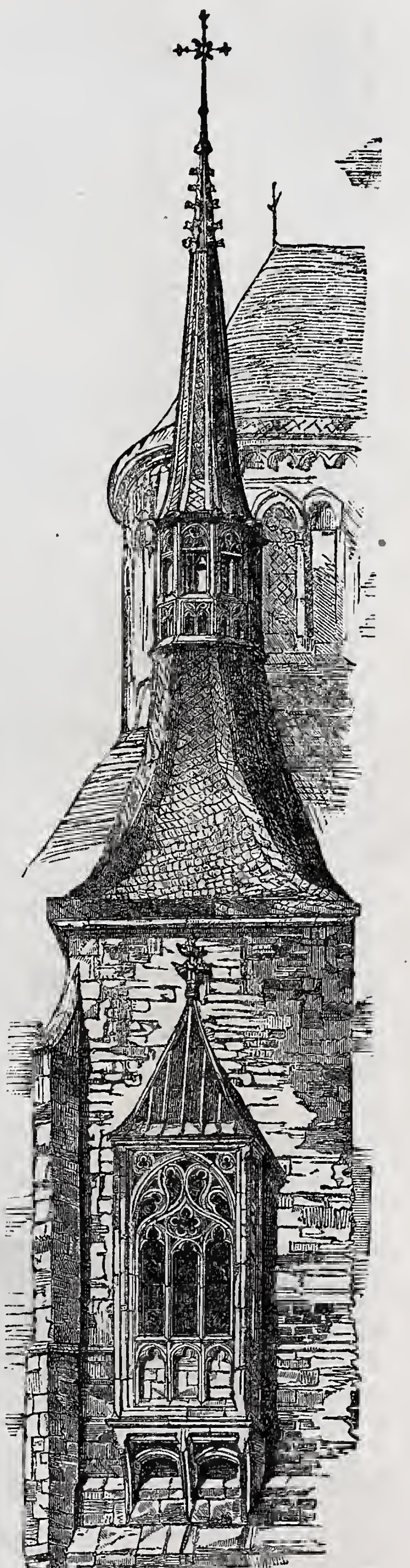
Making Glue Waterproof.—The best substance is bichromate of potash. Add about one part of it, first dissolved in water, to every 30 or 40 parts of glue; but you must keep the mixture in the dark, as light makes it insoluble. When you have glued your substances together, expose the joint to the light, and every part of the glue thus exposed will become insoluble and therefore waterproof. If the substances glued together are translucent like paper, all will become waterproof; if opaque like wood, only the exposed edges will become so, but they also protect the interior—not exposed parts—against the penetration of moisture.

Hardening Paper.

Our recent French exchanges speak of a novelty in the way of treating paper which they call hardening it. It seems, according to the description, that the paper treated in this way becomes extremely hard and tenacious. It is treated by means of chloride of zinc, and is then submitted to strong pressure, assuming the appearance of tough wood or hard leather. This material is proposed as a covering for floors, a substitute for leather in coarse shoes, the material for whip handles, mountings of saws, buttons, combs and various other purposes. This item, which has been copied into several papers on this side of the water, describes a process well known in this country. The product here is generally sold under the name of vulcanized fiber. The process is an interesting one, since it is really a part of several similar processes or forms a series with them.

Our readers will understand that wood fiber, cotton, hemp and, of course, paper are largely composed of a vegetable material called cellulous. Although found under so many various forms and conditions, it is at the base chemically the same. When this material is immersed for a short time in strong acids, it undergoes a series of remarkable changes. By the action of sulphuric acid and suitable treatment after immersion, cotton may be so changed in its chemical stability as to become one of the most explosive substances with which we are acquainted. Paper may, in the same way, be rendered explosive, and so can linen and wood fiber. If we change the character of our acids, mixing, for example, nitric and sulphuric together, and expose the paper to it for a proper length of time, in some cases only a few seconds, the paper undergoes a very peculiar transformation, and at the close of the treatment seems more like a piece of skin than paper. It is by such treatment as this that the parchment paper is made. Before undergoing this process the paper was readily wet by water, and when wet, it entirely lost its strength. After having been converted into this parchment-like substance, it withstands the action of water for a long time, and is in fact water-proof. Although it swells like a piece of skin, its strength has been very greatly increased, and its general characteristics are quite similar to those of parchment, although, we believe, it does not boil up into a size like parchment. When this process of transforming paper was first discovered it was hoped that the new material would be of immense value in the arts. Unfortunately it has two characteristics which have prevented it from taking the place that it seemed likely to fill. The first of these is that it absorbs moisture readily from the air, and expands and contracts very much in consequence. The second one is that it becomes brittle, and seems more like a cheap quality of leather. It is, however, gradually making a place for itself in the arts, and is much used for covering the stoppers of bottles instead of skin.

Not long ago it was discovered that, by submitting paper or paper pulp to the action of chloride of zinc, a transformation took place very similar to that of the mixed acids which we have described, the resulting substance, however, was quite different, and appeared more like leather than parchment. After the pulp has been treated with the chloride it becomes soft and pasty, and is then subjected, as described in the French paper, to a very heavy pressure, which condenses it into a substance resembling both wood and leather. It can be made very hard, so that it cuts with almost as much difficulty as boxwood, or it can be made so soft as to resemble hard leather. Like parchment paper, it expands or contracts when wet, but is entirely water-proof. It resists grease to perfection, and forms excellent washers. Altogether it is a very useful, though peculiar material, and is finding many applications in the arts. It can replace red and black hard rubber for many purposes, and it is useful when made in thin sheets as linings for roofs, and, we believe, has been used as the tongue in the tongue and groove joint. In addition to the methods we have described, there are several others by which cellulous can be converted into a leather or parchment-like substance. In all cases the paper or wood which is used must be without size or gum, which would prevent the acids from acting. One of the latest improvements in the process has been filling the paper with alum by passing it through a solution of alum water, and then drying it. When this is passed through the sulphuric-acid bath there is less danger of the acid attacking the paper in such a way



Spires, Bell Turrets and Pinnacles.—Fig. 8. —Pinnacle and Bell Turret from Cologne. The Top of the Pinnacle Covered with Lead, the Base with Slate, and the Bell Turret with Lead.

as to destroy it, and it is said that the resulting parchment does not grow stiff as soon as the common kind.

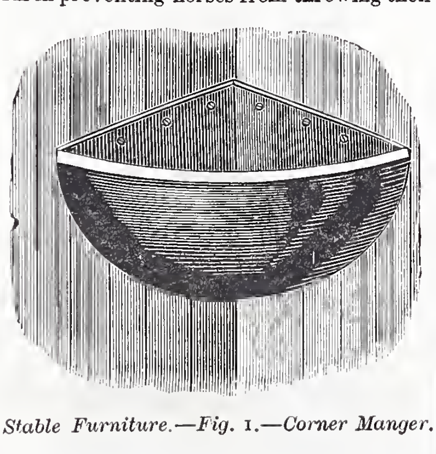
One very useful and curious application of these processes was to form the paper into rolls or sheets suitable for packing, and then, when in the pasty state, sprinkle plumbago upon it, and, by strong pressure, thoroughly incorporate the pulp and plumbago together. The resulting compounds are found to make a most excellent packiug for steam engines and pumps.

Stable Furniture.

Although most of the carpenters and builders in the neighborhood of the large cities are familiar with the improved fittings for stables which of late years have been brought out, we believe that many of our readers are unacquainted with them, and that a brief descriptiou of what is made and sold in the market for this purpose will not be without interest. The range of articles coming under the head of stable furniture is so large that we cannot, at this time, do much more than notice some of the most prominent articles of each class. An exhaustive list and description would occupy far more space than is at our command for the purpose.

The well-known habit of many horses of gnawing or biting at whatever woodwork may be in reach is a fruitful source of expense, as it necessitates replacing wooden mangers and the top boards of stall partitions very frequently. It seems to have led manufacturers to the invention of iron stable fittings. Fig. 8, for instance, of the accompanying illustrations represents a nibbling roller. Such an article placed in front of a horse addicted to this habit should, we think, in the course of time lead to a reform. In sheer disgust, the animal would be disposed to let alone the fittings of his apartment.

Figure 1 represents the ordinary pattern of corner manger, fastened in place against the walls of the stall by screws, as shown in the engraving. Figs. 2 and 4 represent an improved form of corner manger, the improvement consisting in its being reversible. Fig. 2 shows it in the ordiuary position for feeding, while Fig. 4 shows it inverted for emptying. A cast-iron hay rack is also shown in the corner of the stall in Figs. 2 and 4. Fig. 3 represents a common form of hay box and manger fitted in one plate, extending across the end of the stall. Fig. 10 shows a little different form of the same thing, the hay rack in the latter case, however, being of wrought iron. In Fig. 3 is shown a halter to which a weight is attached, the weight being placed in the box-guard provided for the purpose. An arrangement of this kind is found quite useful in preventing horses from throwing their

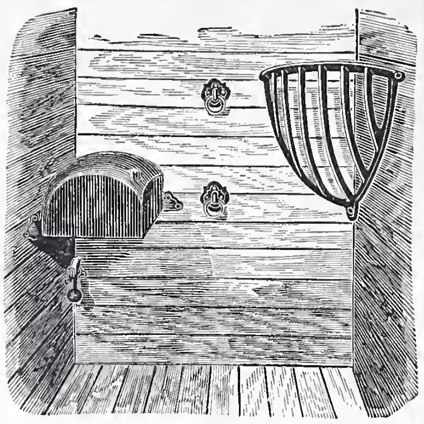


Stable Furniture.—Fig. 1.—Corner Manger.

fore feet over the strap while in the stall. In Fig. 10 a similar provision is shown without the box-guard.

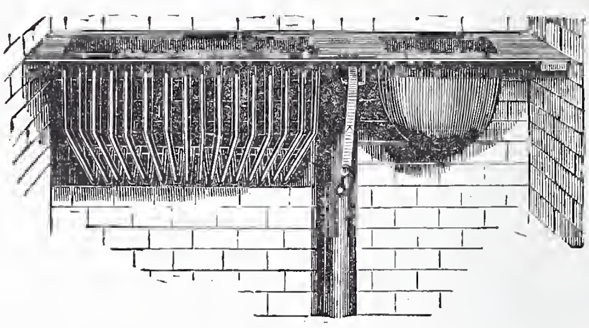
The various manufacturers of stable furniture have taken care that all parts of the stable shall be provided with appropriate fittings for the purposes to be subserved. Accordingly, with all manufacturers, gutters, gutter plates, cesspool covers, stench traps, &c., will be found. Fig. 5 shows a stench trap of a construction in common use, while Fig. 9 shows the same thing applied to a stall gutter plate.

The construction of wall partitions has been most carefully considered. Accordingly, we find stall posts, not only of the character shown in Fig. 7 of the illustrations, but of a construction adapting them to be set directly in the ground, instead of screwed to the floor. They are of various styles, many of them being far more elabor-



Stable Furniture.—Fig. 2.—Reversible Corner Manger.—Manger in Position for Feeding.

ate than the one we have selected for illustration. These stall posts are rabeted upon one side, in order to receive the end of the partition planking. Corresponding to the stall post is what is known as a wall strap, a representation of which is shown in Fig. 6. This, as its name indicates, is placed against the wall and receives the opposite end of the partition planking. A cap



Stable Furniture.—Fig. 3.—Hay Box and Manger, with Halter Weight Guard Box Attached.

piece, also of iron, surmounts the top of the woodwork of the partition, while stall guards in various ornamental patterns of cast or wrought ironwork contiuue the divisions between the stalls still higher, but without restricting light or ventilatiou, and at the same time adding materially to the general appearance of the whole.

Besides the items of furniture above described, which in their use are applicable to stalls of ordinary construction, there is made a full line of fittings designed especially for box stalls, among which may be mentioned guards for the sides and rear, guards for the heads of stalls, with feeding doors, hinges for doors, locks, racks, &c. In still another class of furniture is to be found troughs for cut feed, soap boxes, sponge racks, salt dishes, brush boxes, match boxes, &c. There are also brackets and rollers for blankets in various patterns. Brackets for oiling and washing harness, lantern brackets, carriage pole brackets, and sets of brackets especially adapted for hanging up harness in a manner calculated to preserve it when not in use. Various plain and ornamental patterns of tie rings and name plates, hitching posts and iron caps for wood posts, whip racks, window guards, ventilators, &c., are also manufactured and carried in stock by the various firms engaged in this line of industry.

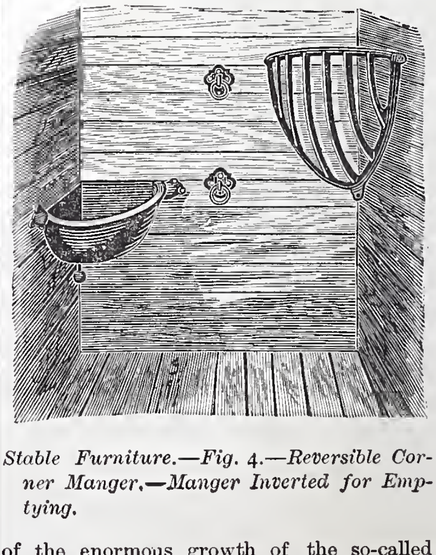
We are indebted for the cuts used in illustrating this article, and also for much information, to S. S. Bent & Son, 72 Beekman street, New York. The senior member of this firm was one of the pioneer manufacturers of goods of this kind, if not the first to suggest the idea of cast-iron stable furniture. The improvement shown in Figs. 2 and 4 represents one of the many novelties which this concern has been instrumental in bringing out and adding to the line of articles specially calculated for use in and about stables.

We suggest to our readers, especially those who are building or are about to build stables, that there are many features connected with iron stable furniture with which it is to their interest to be familiar. It is commonly supposed, even by those who know of the existence of stable furniture of this kind, that the articles are of luxury rather than of utility, and that the prices preclude their employment in any but the stables of wealthy men. We think this, in the main, is a mistake. While prices for many articles, especially those of fine finish and of handsome design, are somewhat high, the leading and staple articles are offered at prices so low as to bring them within the reach of all who intelligently study the subject of economy. We have known of instances where it was necessary to replace wooden mangers with great frequency, and where the cost thus made was considerably in excess of the price of an iron manger which, once in place, would have lasted indefinitely.

Many of the goods above described are finished in various ways, some styles being really very handsome. Plating is employed in some cases, bronzing in others, while varnish and paint add materially to the appearance of the commoner goods.

Boxwood.

Boxwood, on account of its great value in the arts, might almost be termed a precious wood. Its beautiful color, close grain, great hardness and durability, render it applicable to a vast number of purposes for which no other wood is so suitable. For the engraver, boxwood as a material is unrivaled, and up to within a few years all the better class of work was done upon blocks of boxwood. The best engraving of the present time for illustration of books and magazines is upon boxwood, and more of it is probably used to-day than at any former time, in spite

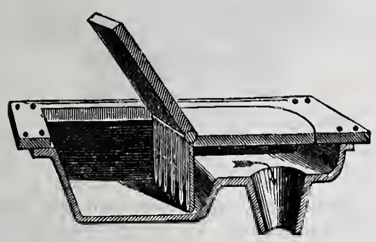


Stable Furniture.—Fig. 4.—Reversible Corner Manger.—Manger Inverted for Emptying.

of the enormous growth of the so-called photo-engraving and other "process" work. As a material for the artistic engraver, nothing except steel or copper at all approaches it.

From costing a few ceuts per square inch twenty years ago, the price of the best wood has gone up until now a really first-class block may cost as high as 25 cents per square inch. Some engravers say that really good wood is no longer to be found in the market, and cannot be obtained at any price.

For making tools, screws, for turning and for rule making, boxwood has no peer. It is almost equal in its toughness and fine grain to ivory, and it stands rough usage vastly better. Apple or pear wood is sometimes substituted for it, and fine pieces of beech are often found wh ch are quite as good as poor boxwood, but its best qualities are not approached by any of the woods



Stable Furniture—Fig. 5.—Stench Trap.

mentioned. Many tropical timbers are harder and tougher, but none of them combine so many advantages as the boxwood. There are two varieties of box belonging to the botanical family of *Buxus*, which is a subdivision of the *Euphorbia* family. The box is remarkable from the fact of growing further north, in a wild state, than any other of the *Euphorbias*. *Buxus sempervirens* is found as far north as the middle of England. It is a tree that reaches a hight of 30 feet or more. Its wood is heavier than any other known *Euphorbia* wood, and, though it grows well in the

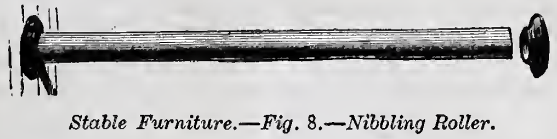
Stable Furniture.—Fig. 6.—Wall Strip Rabbeted to Receive Partition Planking.

Stable Furniture.—Fig. 7.—Stall Post Rabbeted to Receive Partition Planking.

northern climate, reaches its best development in Spain, Portugal, Turkey and other more southern countries. This tree produces the best quality of boxwood.

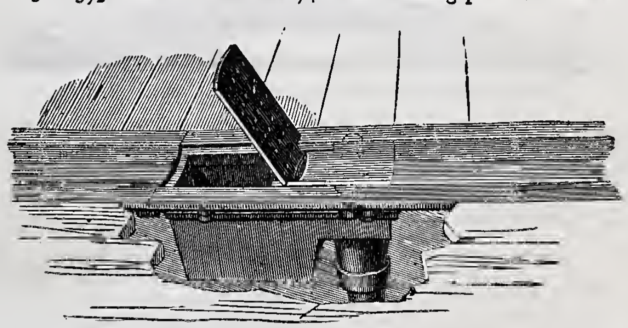
The *Buxus Balearica*, or *Minorica box*, grows in many cases to a much greater hight and size, bears the frost better and has much larger leaves. This comes from Turkey and the East, and is frequently imported as the best quality. English writers, however, say that it is decidedly inferior to the *sempervirens*, probably because it is of somewhat quicker growth.

The box has been grown in considerable



Stable Furniture.—Fig. 8.—Nibbling Roller.

quantities in England, and it is on record that in Surrey, in 1815, boxwood to the value of $50,000 was cut. Although this wood is exceedingly valuable and very scarce, it is rarely planted for any but ornamental purposes, on account of its slow growth. From 50 to 100 years are required to obtain a tree of from 5 to 8 inches in diameter. This, however, is not any longer than is needed for any ordinary timber tree to reach maturity. A 5 or 6 inch log of boxwood is of very fair diameter, and a 7 or 8 inch is fully as large as the largest ordinarily found in the market. The dwarf box found in our gardens is a variety of the *semper virens.* It sometimes, in favorable locations, abandons to some extent its dwarf habit, and reaches the hight of 4 or 5 feet. We have seen in sheltered locations on Long Island, boxwood trees nearly 5 feet high, with stem from 3 to 3½ inches in diameter,



Stable Furniture.—Fig. 9.—Stall Gutter Plate, showing Connection with Stench Trap.

and we have heard of instances where stems were so large that small planes were made from them. If either of the dozen varieties of boxwood were planted in favorable situations in this country, they would no doubt prove a source of revenue when the timber reached maturity. In the meantime the trees would form a most beautiful shade. Being evergreens and having a very thick foliage, box is very ornamental.

Boxwood is usually brought to this country in the shape of rough, irregular logs, about 6 inches in diameter and from 3 to 4 feet in length. Formerly the most of it was brought as ballast in ships coming from the East, and, consequently, it was with difficulty that the better classes of wood could be obtained in this country. The greater supply of boxwood for many years came from Turkey, where the forests belonged to the government. Like most government matters in that unfortunate country, the protection of these forests was placed in the hands of Providence, and the most wasteful destruction has taken place. First-class wood, it is said, is no longer obtainable, and the timber has been not only cut off, but the forests ruined by the utter destruction of the young trees as well. Consequently, as there has been no provision made for planting, we must look for our future supply to other sources.

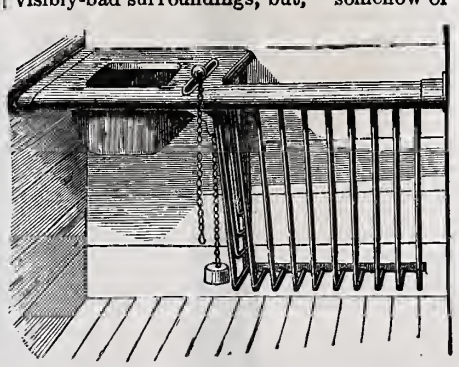
Just at present a great deal of boxwood is coming from the Caucasus by way of Tiflis, whence also there is exported a good supply of walnut burls. We may note, incidentally, that an immense supply of walnut timber exists in the mountains of the Caucasus, but, owing to the condition of the roads, is unavailable, transportation of timber being out of the question when the backs of animals are only available for the purpose. The greater portion of the marketable boxwood has been stripped from the forests of the Caucasus, and only one or two government reservations remain. The terms demanded for the right of cutting are ridiculously high. A great deal of boxwood is now exported from the port of Rostov. Some of this, if not the greater portion, comes from the Persian provinces on the Caspian Sea, though it is generally supposed to be Caucasian wood. As boxwood comes in comparatively small sticks, it can be transported on the backs of animals, so that as long as any forests exist they will be available for use; unless, however, new forests are discovered or substitutes found for this wood, it will be but a few years before its price will be enormously increased. At the present time the destruction of boxwood forests, both in the Caucasus and Persia, is going on so rapidly that the known sources of supply will be exhausted within the life of the present generation.

Homes—Semi-Hospitals.

Too much cannot be written or printed to impress the conviction upon the minds of owners and tenants of houses, that the preservation of their own and their children's health depends largely upon the manner of the construction and the appointments of their dwelling places. There is no speculation in the statement that thousands of cases of sickness occur from defects in these connections.

It is a well-assured fact that if every building in this city was subjected to an examination by a board of competent medical and scientific gentlemen, who would enter fully into the work, and furnish a full statement of the sanitary conditions as discovered by them, a very large number, if not more than one-half, the buildings would be pronounced unhealthful, and many of them as mere disease-breeding habitations.

Scores of families occupy places of residence which are good in appearance, convenient in arrangement and free from visibly-bad surroundings, but, "somehow or



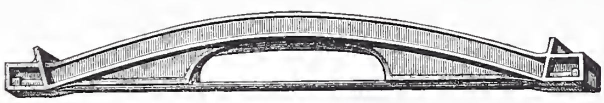
Stable Furniture.—Fig. 10.—Wrought Iron Hay Rack and Manger.

other," some one or more of the members are always complaining, and the doctor's services nearly constantly in demand. Sometimes people remove from certain localities and denounce them as unhealthful, while, in fact, the conclusion reached may be entirely erroneous. It matters not how elevated and splendidly located a building may be, if the building itself is not properly constructed, and its appointments of sewer, pipe and plumbing work perfect, healthfulness is out of the question.

These facts are beyond dispute or doubt, and have so often been related that every owner and occupant of buildings should regard them with deep interest and concern. But a peculiar indifference seems to prevail among those most seriously affected, and but little notice is taken of the most startling and authentic statements made, although health and life are involved in the issue.

There is no architect or plumber of any considerable practice or experience who has not been called in, or had occasion to visit buildings, where the strong smell of sewer gas has been plainly discernible in almost every apartment under the roof. Perhaps the foul-air leakage may have been in connection with the pipes in the bath-room, kitchen, water-closet or some particular wash-basin ; but the poisonous vapor being once introduced within the walls of the building, it finds its way, by its equalizing and permeating forces, into the common atmosphere of the edifice. Sometimes the offensive smell is so great that carbolic acid, chlorides, &c., are used as neutralizing and counteracting agencies ; but such remedies are like placing the lion's skin upon the ass ; the skin may cover the carcass, but never changes the nature of the beast.

Hence the great necessity on the part of owners to exercise the utmost caution, and to some extent, at least, consider the advantages to be secured by employing the most skillful and competent architect, and the most qualified mechanics in all the branches of mechanism, as economies in this connection seldom compensate for the serious consequences which attend the opposite course.



Recent Novelties.—Fig. 1.—*Improved Arch Girder.*

Recent Novelties.

The Etna Iron Company, of 104 Goerck street, are manufacturing an improved arch girder, a representation of which is given in Fig. 1. By inspection of the engraving it will be seen that, in addition to the usual arch-shaped casting, this girder is made with supplementary webs on the under side. The lower edge of these webs is so made that the wrought-iron tension-rod lies in the casting. In case the arch casting becomes broken, for example, in the center from an excessive weight above, the casting, in consequence of the supplementary webs, will continue to sustain the load as long as the rod holds. By this it will be seen that the supplementary webs practically reduce the bearing points from the end abutments to a span of considerably lessened distance. This girder has great additional strength over an ordinary girder, for the reason that the depth of web is greatly increased, the combined upper and supplementary webs being really the depth for the greater part of the span of the girder. By its shape the casting is better able to withstand a cambering strain from too light a rod. It is also better able than the ordinary arch girders to sustain a load when the rod is too long.

Recent Novelties.—Fig. 2.—*Improvement in Iron Columns.*

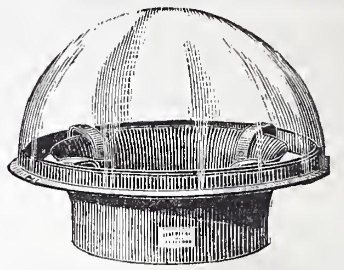
The same company are manufacturing cast-iron columns made with internal webs running vertical their entire length, a cut of which is shown in Fig. 2. The effect of these vertical webs is to divide up the interior of the columns into separate cells or spaces. By this construction it is claimed that the columns will resist fire to almost any degree. It is a well-known fact that ordinary cast-iron columns, when exposed to fire and water, as in a burning building, are very liable to snap and give way without a moment's warning. Columns made with interual webs will stand and sustain their load, even when the outer shell becomes stripped and cracked. The webs secure rigidity and prevent twisting, bending or breaking. By examination of the engraving, it will be seen that the webs are made slightly curved. Their shape is determined by two facts. First, in casting, the outer portion or shell of the column cools first, and the inner parts cool more slowly. The curved shape of the web allows the slower cooling and shrinkage to take place without straining the casting. Second, in a burning building the shell will be heated and slightly expanded, while the webs will be comparatively cool and unaffected. The webs being curved, are simply drawn down somewhat straighter as the outward shell expands. A special advantage of the web is the great addition to the bearing strength of the column.

We understand the Etna Iron Company, besides manufacturing these goods for the trade, are granting licenses to iron founders and others, upon reasonable rates of royalty, to manufacture both of these articles, thus putting them within the reach of every one who may be inclined to employ them.

Figs. 3 and 4 represent recent improvements brought out by S. J. Pardessus & Co., of No. 9 Park Place, New York city. The first is a glass-top ventilating cap, the usefulness of which will be perceived at a glance. The cylinder is made of galvanized iron, the dome being of glass and connected with the metal part by a cement joint. Fig. 6 represents a ventilating socket hood for a hipped skylight. It will be seen that sockets are provided for the bars, and also openings are left for receiviug the upper ends of the glass forming the skylight. A damper operated by a cord is placed in the cylinder, thus allowing a free passage of air or closing of the opening at pleasure. The glass-top ventilating cap shown in Fig. 5 may be placed above this opening, the cylinder of the one slipping over the other. The advantages of the socket hoods for skylights are so apparent upon examination of the engraving, that we think extended description unnecessary.

One of the most useful articles in the way of carpenters' tools which has recently been brought before the public is known as the "Backus Bit Brace." In this brace simplicity of construction is a notable feature. A tapering square hole, which is entirely filled by the shank of the bit, is provided, which is adjusted or closed upon the bit by revolutions of a sleeve or ferrule. There is nothing loose which can fall out or be lost, and ample strength is provided in all the parts. Figs. 5 and 6 represent an adjustable socket wrench, in which some of the features peculiar to the brace are employed. This wrench is so constructed that it may be used also in any ordinary brace. It fits nuts and bolts of any shape, and in size from ¼ to 1¼ inches. By using the wrench in a brace it can be turned with great rapidity without removing it from the nut. Fig. 6 represents the wrench closed, and Fig. 5 the same open. Fig. 7 shows the same article with a ratchet attachment, which adapts the tool to use where the nut or bolt is close to a projection, and where the bit stock cannot make an entire revolution. The shank of this wrench, as with the common form, fits into any ordinary brace. It is so constructed as to ratchet either to the right or left or to stand rigid.

In our notice of Hobart B. Ives' Improved Door Bolt in the last number, we stated that the bolt was let into the door by the use of a 13-16 inch bit, which was a mistake. We are informed by Mr. Ives that his new bolt is adapted to the use of a ¾-inch bit. We take pleasure in making this correction, for it is of considerable importance to the trade, in buying articles of this general description, to know that they are suited to the use of tools common to every carpenter's kit.



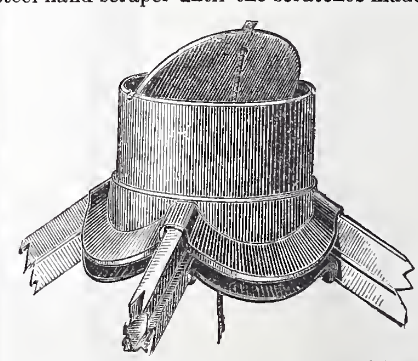
Recent Novelties.—Fig. 3.—*Pardessus' Glass Ventilating Cap.*

Smoothing and Polishing Wood by Machinery.

Since the death of Zera Colburn there has been no English writer on mechanical subjects whose works have been at once so pleasing in style, so interesting and so full of valuable information as those of Mr. John Richards, of London. His book upon woodworking machinery is a classic and will be a standard authority for years to come. One of the last articles from his pen was on the subject of smoothing polishing wood by machinery, and was published in London *Engineering* a short time after his death.

The article takes up the question of finishing wood for the varnishing after it has been shaped and finished to dimensions. He says :

"For very hard or irregular grained wood, such as is made into veneers or employed for the finer kinds of work, the cleaning-off process consists first in planing the surfaces with a toothed plane, having a serrated edge like a comb, this tool scratching away the high places and leveling the surface without pulling or splintering the wood, as a common knife will do unless very carefully adjusted and worked. After tooth-planing, the surfaces are scraped with a steel hand scraper until the scratches made by a tooth plane are removed, and the surface is then finished by rubbing with glass-paper of different finenesses.



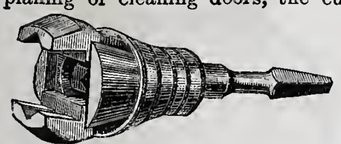
Recent Novelties.—Fig. 4.—*Pardessus' Ventilating Socket Hoods for Skylights.*

"Straight-grained hard woods can be cleaned off by planing with a common smoothing plane, and then scraping and rubbing them with glass-paper. Soft wood requires only careful planing and glass-papering, but if scraping is omitted great care must be taken in planing, or else the planing marks will show by reflection when the surface is polished, varnished or painted.

"Cleaning off being an expensive process, there has naturally been much effort made to construct machines to take the place of hand work, and the machinery is made to imitate hand operations. Cleaning off, for example, consisted of planing, scraping and sand-papering. The machines applied to the purpose are planing machines, scraping machines and sand-papering machines. Planing machines which will produce a surface ready for sand-papering without scraping have been made, and are in common use for certain purposes, but as a rule the three old processes must be followed in the case of working hard or irregular grained wood."

No man was more familiar with American practice than Mr. Richards, and in many branches of woodworking he considered the Americans to be far ahead of all other nations. On this account his remarks have an especial value and interest in this country. In regard to American planing and smoothing machines, he says:

"In America during recent years, there have been made quite a number of machines for planing or cleaning doors, the cutting



Recent Novelties.—Fig. 5.—Backus' Adjustable Socket Wrench, Open.

cylinders being set diagonally to the course of the lumber. On the whole, however, it may be claimed that for the better class of work, and for hard woods, scraping is indispensable. More than 20 years ago Mr. B. D. Whitney, an American engineer well known for various inventions in wood converting, conceived the idea of applying scrapers by powers, the edges of the scrapers being long enough to cut a shaving the whole width of the lumber at one operation. He began by preparing narrow machines, and gradually extending their width and capacity, adding one improvement after another, until a width of 32 inches was reached. At first the machines were worked on maple, walnut and other native straight-grained woods, but the capacity of the machines, like their dimensions, was increased until the South American and other hard woods were treated successfully.

"For 20 years this power scraping has been going on successfully, and from experiments witnessed by the writer, who has recently visited Mr. Whitney's works to examine into the matter, there seems to be nothing wanting to insure permanent success on hard woods of all kinds, including some kinds of veneers. To quote from a circular of the maker, 'these are not planing machines, nor intended to take the place of planing machines, but are for smoothing or finishing hard wood surfaces after such surfaces have been prepared on a planing machine, doing the work heretofore done only by hand labor, and in a more satisfactory manner and at much less expense.'

"With these machines the wood is smoothed by a blade having a turned edge like a hand scraper. This blade or scraper is held in a suitable stock, over which the lumber is fed by means of rollers. This stock or plane, as it may be called, is pressed against the bottom side of the lumber by means of springs, taking a thin shaving from the surface of the wood, leaving it glossy and per-

Recent Novelties.—Fig. 6.—Backus' Adjustable Socket Wrench, Shut.

fectly smooth. The grain of the wood is not disturbed, and, after scraping, the surface is ready for varnishing without further treatment. This last statement will seem extraordinary to any one acquainted with wood cutting, because of the difficulty of keeping knives of any kind in such order as to leave surfaces smooth enough for varnishing; it must be remembered, however, that the knife here employed is a scraper, and less liable to be nicked or injured by grit than one set in a common planing machine."

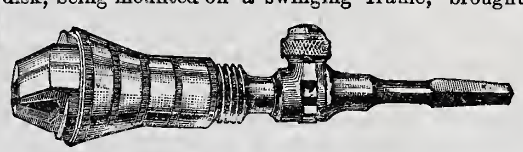
In another portion of the same paper, when discussing the question of sand-papering, he has the following very suggestive remarks:

"In respect to sand-papering by machinery, the attempts have been many and more diversified, and there are many reasons for believing that, with improvements in the means for holding or carrying the abrading sand or other material, much more can be accomplished than at the present time, not only in polishing and smoothing surfaces, but also in shaping the more friable kinds of woods.

"In treating metals, for example, it is not long since emery was mounted or carried in the same manner that quartz or glass sand is now employed for woodworking—that is, on belts, buffing wheels, or sheets of cloth or paper. Emery is now molded into solid wheels, cemented by glutinous or silicious substances, which do not materially interfere with the cutting action of the grains, and it is probable that with some research, such as has been devoted to making emery wheels for metal cutting, similar wheels of quartz or glass sand could be made for wood cutting.

"The history of the matter thus far, however, points to one difference, namely, that in all successful attempts to sand-paper by power, the plane of rotation of the polishing surfaces has been parallel to the face of the boards or pieces. We do not in this remark include what are called buffing wheels or cases where light pieces are held on the periphery, and where such pieces are small enough to vibrate with any irregularities of the surface coated with sand; in other words, we refer to cases where, by reason of weight or the mode of holding, the wood cannot yield, and is ground or cut away to positive dimensions.

"In America the most successful type of machines has been those wherein a small disk of 10 or 12 inches diameter is faced with strong, specially prepared sand-paper. This disk, being mounted on a swinging frame,



Recent Novelties.—Fig. 7.—Backus' Adjustable Socket Wrench with Ratchet Attachment.

is moved irregularly over the surface of the wood by hand, as the roughness may require. The sand used is made from a species of quartz found in Nova Scotia, and the paper from manilla grass, with, perhaps, other fibrous material intermixed; two webs are joined together so as to cross the fiber and add strength. Fine, strong glue, which will, so far as possible, resist heat and moisture, must be used in fixing the quartz. For machine purposes this sand-paper is made in continuous webs or sheets of any size if specially ordered, so that taking into account the number of machines made and the quantity of machine paper manufactured, there can be no doubt at this time of the permanent success of sand-polishing machines for woodwork."

Transmission of Heat.—A Useful Fact to Remember.

Heat passes through water in a peculiar manner. The particles are individually heated, and then, being lighter than the surrounding particles, rise to the surface and allow the other particles to come in contact with the source of heat. Thus, when we apply heat to the side of a vessel all the particles of water along that side are forced upward by the heavier particles beyond, which, in turn, striking the hot side, rise. A hot particle of water does not impart its heat to another particle. This fact is a very important one to be borne in mind in all experiments where water is to be heated, and, in fact, in all operations where it is necessary to use hot water in any way. To show this fact clearly, a gentleman made the following experiment: He took a cylindrical glass little more than 4 inches in diameter and about 14 inches high, and fitted into it a circular cake of ice about 3½ inches thick. When the cake of ice was ready he poured into the jar a little more than six pints of boiling hot water. The ice was then gently lowered into the hot water and was entirely melted in two minutes and 58 seconds. In this case the hottest particles of the water rose to the top, and parting with their heat to the ice, caused it to melt, and then being cooled, they fell along the sides of the glass to the bottom, forcing up a stream of hotter particles through the center against the ice. When this experiment was finished, another one was tried in which the conditions were exactly reversed. The cake of ice was fitted into the vessel as before, but, instead of being allowed to float upon the water, was fastened at the bottom. A circular piece of writing paper was laid over the ice to protect it while the jar was being filled. The boiling water was then poured into the jar until it was full, and the writing paper removed gently by means of a string which had been attached to one side of it. The jar was then put in a position where it could be carefully observed. Instead of melting entirely in less than three minutes, the ice did not show any appearance of melting in six or seven minutes. Its surface was smooth and shiny, and the water immediately in contact with it was perfectly at rest. Even when examined by a magnifying-glass, the edges of the ice seemed sharp, and there was no signs of melting. After the water had been in the jar some little time a thermometer was plunged into it, and it was found to be at 180 degrees. One inch above the surface of the ice it was 169 degrees, yet, at one-quarter of an inch above the surface of the ice the temperature was 40 degrees. In 20 minutes the general temperature of the water was 160 degrees, in 35 minutes 149 degrees, and after two hours the heat in the middle of the jar, at only an inch from the surface of the ice, was found to be 108 degrees; and then the experiment was brought to an end by pouring off the water, when it was found that only 5 ounces of the ice had been melted during the two hours which it had been confined beneath the surface of the hot water. By calculation, it was found that less than one-eighth part of the heat lost by the water had been communicated downward to the ice.

Another very interesting experiment is sometimes performed to show how very slowly water communicates heat downward. A thermometer is fastened under water so that its bulb comes within a very small fraction of an inch of the surface. Ether is then poured upon the water and set on fire, and, though it burns with a strong flame, the thermometer will not show any increase of heat. These experiments teach us that if we wish to heat a body of water, the heat must be applied at the bottom and a free circulation of the particles allowed, so that all may have an opportunity to become heated. It has also been found, though we have not time to describe the experiments here, that a great advantage is gained in a boiler of any kind, whether an open vessel or an ordinary steam boiler, in using a small quantity of water A small steam boiler, when filled two-thirds full, will not generate steam more than one-fourth as fast as it will when it is but one-third full of water.

In the sphere of what is called industrial art, use and beauty are, in theory at least, closely associated; for not only has the humblest article of manufacture, when honestly designed, a picturesque interest of its own, but no decorative feature can legitimately claim our admiration without revealing by its very nature the purpose of the object which it adorns.

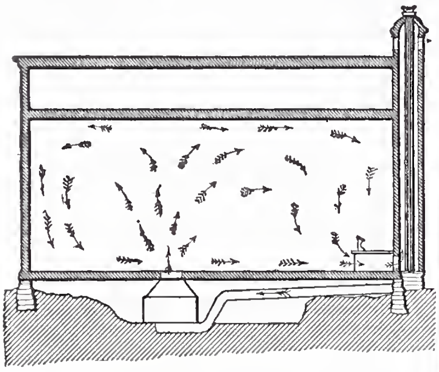
Monotonous uniformity acts discordantly on the feelings and sentiments of persons possessing artistic taste. Every household object, however simple or cheap, involves taste, and graceful forms in limited variety are not beyond the reach of the poorest among us.

It is not work that hurts men. It is the corrosion of uncertainty; it is the acrimony of fear; it is the anticipation of trouble; it is living in a state of painful apprehension. Therefore we should endeavor to rise out of the atmosphere of gloomy forebodings.

The Ventilation of Churches.

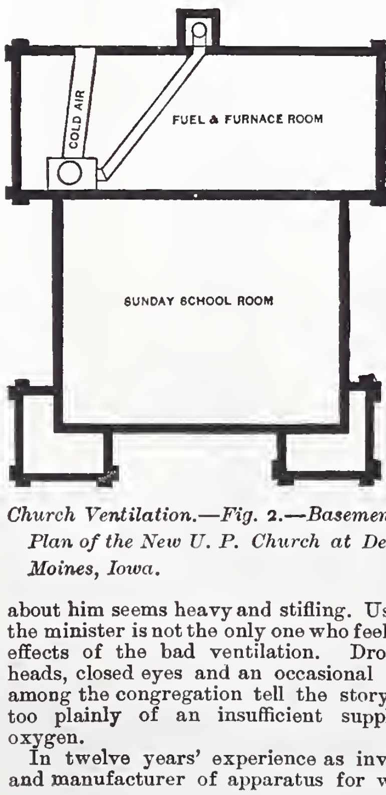
BY J. LOUIS PFAU, JR.

The rapid progress made by this country in the character of her architecture within a comparatively recent period is astonishing; and among the most creditable monuments of the genius of our architects are the churches, whose beauty and grandeur are a credit to the liberality of our citizens. There is scarcely a village or hamlet in the country which does not boast of one or more churches, even though they be plain structures without tower and bell. In the older and more populous cities we find the different denominations vieing with each other in the cost and elegance of their church buildings. While in many respects they are admirably adapted for the uses to which they are put, we find that one very important subject, viz., that of ventilation, is almost



Church Ventilation.—Fig. 1.—Longitudinal Section through a Church 50 by 60 Feet. with 25-Foot Ceiling.

entirely overlooked. The architect when spoken to upon this subject, replies: "Oh, yes, we shall have splendid ventilation—all the windows are operated with cords and can be regulated with ease," and this is too frequently the extent of his knowledge of ventilation. The arrangements for heating are usually put off until the last moment, and when the building committee happen to have money enough left they purchase a furnace, usually the cheapest that can be obtained. If the funds are low a few stoves are put up, and in the winter the minister wonders that he cannot preach the sermon with his accustomed ease. His lungs seem to be affected, and when only half way through with his discourse the words are brought forth with an effort and the air



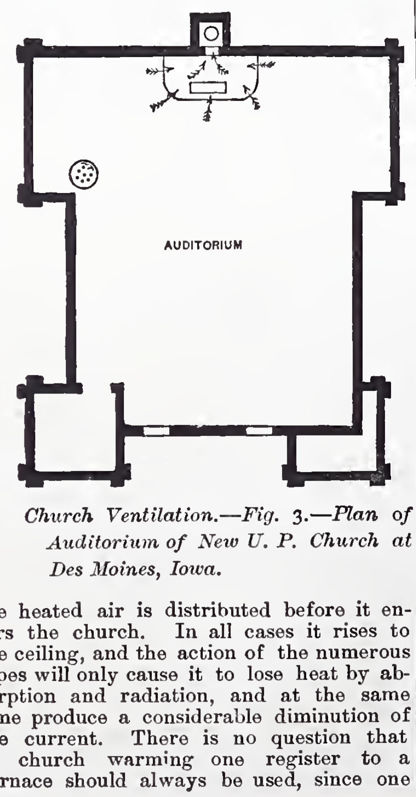
Church Ventilation.—Fig. 2.—Basement Plan of the New U. P. Church at Des Moines, Iowa.

about him seems heavy and stifling. Usually the minister is not the only one who feels the effects of the bad ventilation. Drooping heads, closed eyes and an occasional snore among the congregation tell the story only too plainly of an insufficient supply of oxygen.

In twelve years' experience as inventor and manufacturer of apparatus for warming and ventilation, I have found that less than 5 per cent. of the fine churches in our cities have practicable plans of ventilation. In almost every denomination some clergyman is found who claims to know just how to arrange for heating and ventilation of churches and Sunday school rooms, and his suggestions are often followed, with the usual results of partial or total failures. The The ventilation of a large building is not a matter which can be carried out by one who has only theoretical experience or whose ideas have been gained by the inspection of a few church buildings working in a barely endurable manner.

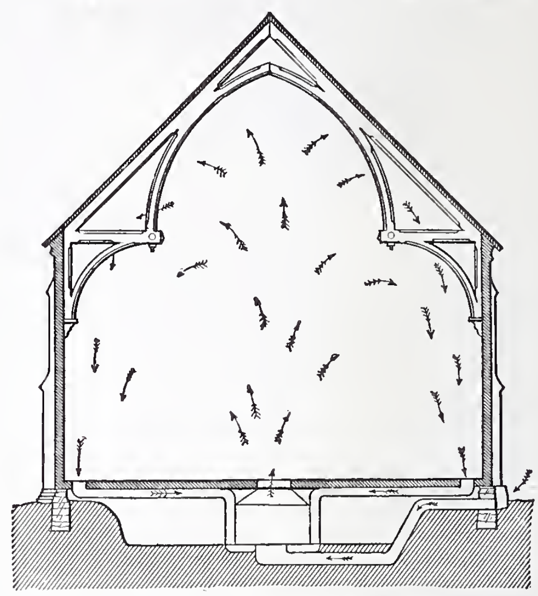
Ventilation requires the removing and replacing of large bodies of air. This cannot be accomplished without the exertion of a suitable amount of force. In the plans which I describe below I illustrate a method in which, by means of proper flues, the requisite force or power for moving large bodies of air is easily obtained. Much attention has been of late years paid to ventilation of schools and dwellings, but the plans used in them are not applicable in churches or public halls, where the mass of air to be moved is vastly larger and the obstacles to be overcome so much greater. In fact, the ventilation of churches and public halls presents so many difficulties of a peculiar character, that this branch of the subject may almost be considered a specialty. On this account I feel no hesitation in offering the results of a long experience.

A church audience room contains a very large body of air, which must, in order to be warmed or ventilated, be entirely displaced, and to do this, much more efficient means must be adopted than are required in smaller buildings. Instead of having a number of hot-air pipes radiating from the furnace to different parts of the auditorium, the furnace itself should be placed in some convenient spot directly beneath the center aisle, and a large register should be provided immediately above the furnace. This register should be supported upon the brickwork of the furnace, which is built up through the floor of the auditorium for the purpose. By this construction there is no danger of fire from the woodwork coming too close to the hot-air pipes. This arrangement enables us to get the heat directly from the furnace into the church. The leading column of heated air always moves at once toward the ceiling, no matter among how many pipes



Church Ventilation.—Fig. 3.—Plan of Auditorium of New U. P. Church at Des Moines, Iowa.

the heated air is distributed before it enters the church. In all cases it rises to the ceiling, and the action of the numerous pipes will only cause it to lose heat by absorption and radiation, and at the same time produce a considerable diminution of the current. There is no question that in church warming one register to a furnace should always be used, since one can be made to answer much better than two or more. The majority of readers will at once ask how it is possible to obtain an equal temperature throughout a church of, say, 50 x 90 feet, when there is but one register placed at one end or even in the center of the floor. Without ventilation this could not be done, but with ample ventilation it is quite simple. In Fig. 1 I show a section of a small church of, say, 50 x 60 feet, with a 25-foot ceiling. This will contain about 75,000 cubic feet of air. At the rear of the church I build an exhaust stack, to which I have alluded, and whose action was explained in a communication published in *Carpentry and Building* for June. This smoke-stack is

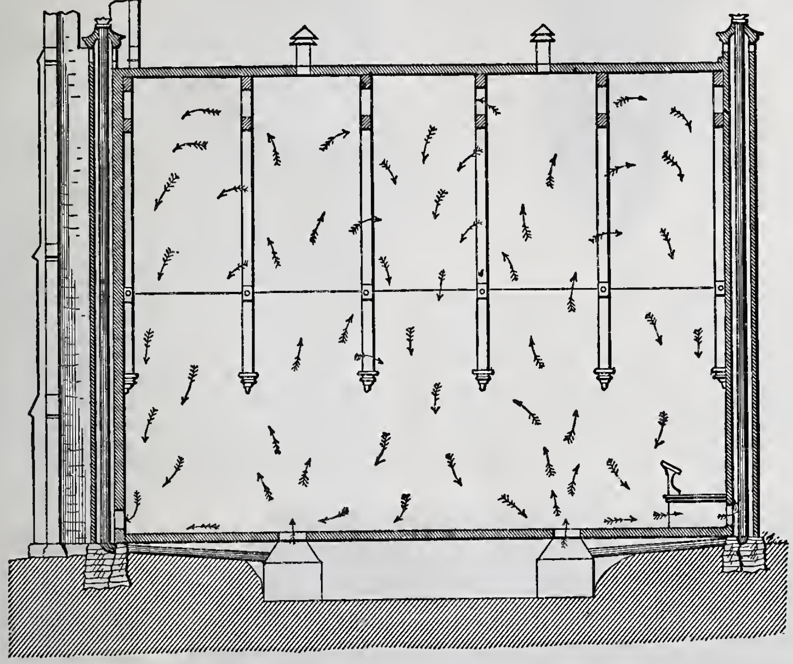


Church Ventilation.—Fig. 4.—Transverse Section through Church 70 by 100 Feet, 40-Foot Ceiling.

arranged with a ventilating shaft outside of it. The furnace is placed in any convenient position under the center aisle. It should not, however, be located too far from the smoke stack, for fear of retarding the draft too greatly. The front and sides of the pulpit, and the open space beneath the platform, are filled with registers which are connected with the ventilating shaft. The waste heat from the furnace, passing through this ventilating stack, raises the temperature of the air surrounding the smoke-flue, and creates a strong upward current which exhausts the air from the floor of the church, and in this way removes an immense volume. As fast as the heated air is thrown into the audience room from the furnace, the cooler air near the floor is exhausted by the ventilating stack.

By using a furnace of 100,000 cubic feet capacity, the temperature can be raised to about 70 degrees by two hours' firing when the thermometer outside stands at zero. This is winter ventilation. In the summer time I make use of a large ventilating pipe placed in the roof, which is supplied with valves so that it can be tightly closed in winter. For a church of this size I think better results cannot be obtained than follow upon this plan.

Figs. 4 and 5 represent a very much larger church, say 70 by 100 feet, with a 40-foot ceiling. Such an audience room will contain 280,000 cubic feet of air. For warming such a church, two furnaces of at least 175,000 feet capacity each will be required. The plan here employed is similar to that shown in Fig. 1, except that it is doubled and an exhaust ventilating shaft is placed at each end of the church. In addition, what may be called circulation is introduced. This consists in simply placing large registers in the side aisles. These are connected by tight air boxes leading to the cold-air reservoir of the furnace. By means of these registers the supply of fresh air for the furnace is taken from the church direct, instead of from the outside air. This circulating arrangement is intended to operate only before the time of service, and by its use the body of the air within the church is passed continually through the furnace, so that none of the heated air is wasted by being thrown out of the exhaust flues while the audience room is empty. This, of course, causes a very rapid heating of the air within the audience room. About the time the congregation arrives the valves in this circulating set of pipes are closed and those in the fresh-air boxes are opened, so as to take the supply of air exclusively from the outside, as is shown in Fig. 1. This may be called warming and ventilation brought to perfection. Churches so arranged are scarce indeed. Of the 16 handsome church buildings in the city of Quincy, Ill., only a single one can justly lay claim to any system of ventilation, and the few others for which such claims are made are ignoble failures, requiring from 10 to 12 hours' firing in extremely cold weather to make them comfortable. In fact, 10 or 12 hours of firing is the rule with most of the churches in our large cities when the weather is cold.



Church Ventilation.—Fig. 5.—Longitudinal Section through Church 70 by 100 Feet, with Ceiling of 40 Feet.

Figs. 2, 3 and 6 are plans and section of the Sabbath school room and auditorium of the new U. P. Church of Des Moines, Iowa, which is built upon a plan that is becoming quite popular. The Sabbath school room, furnace and fuel room are placed in the basement, with the auditorium above. The whole is warmed by a single apparatus placed in the furnace room.

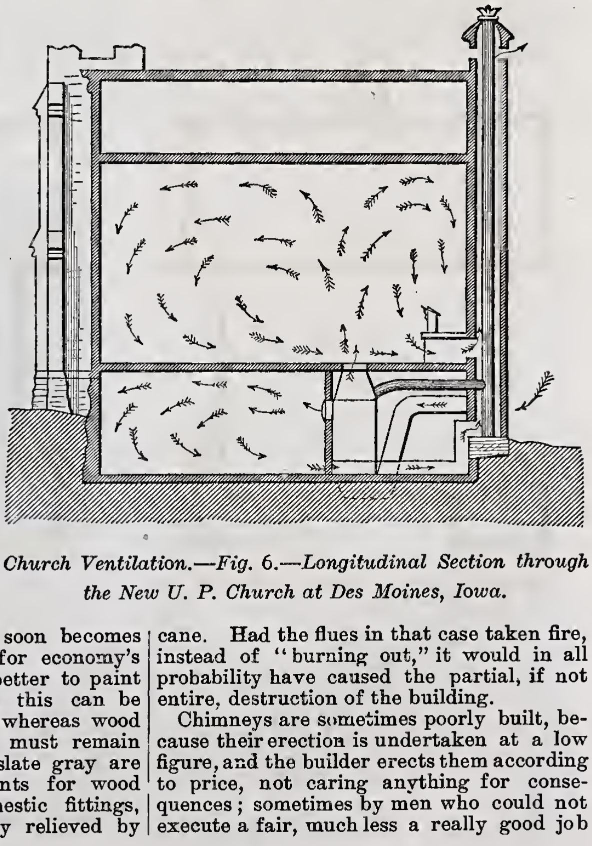
When this church was erected we submitted a plan for warming and ventilating which we found to be against the convictions of not only the pastor, but a portion of the building committee. It was considered impossible to warm the front end of the church by a furnace so placed that its register was in close proximity to the preacher. It was claimed he would certainly be roasted, while the people near the door would be suffering with the cold. The architect, however, declared that our plan and theory were practical, and as we took the responsibility upon our own shoulders, the majority of the building committee finally adopted our suggestions and contracted for the apparatus, although with some misgivings. The following winter was intensely cold and gave the apparatus a very complete test. One day we received a letter from the chairman of the building committee, who stated that the previous Sabbath had been a fit day for testing the apparatus; the results had been eminently satisfactory; the thermometer had stood at 35 degrees below zero; other churches warmed by steam were so cold, owing to an inability to supply sufficient heat, that the congregations were necessarily dismissed. In this church thermometers had been hung on each of the four walls, and the temperatures shown were from 68 to 70 above zero. The variations in the different parts of the church were only two degrees. A better showing or a more severe test could hardly be imagined. The basement is warmed by throwing the air into the room near the ceiling, and to equalize the temperature a strong exhaust is maintained at the floor.

A practical engineer examining these sketches will readily understand not only the theory, but the general method of carrying it out. Yet when planning such a work it is always necessary to consult a man who has had experience in these branches, since the size and location of the different openings have very much to do with the success of the apparatus. Our attention has frequently been directed to churches, where, at a great expense, the objects we have named were sought, but where, through some apparently trifling blunders of architect or carelessness of workmen, the apparatus was entirely useless. One thing is certain, a large church with a high ceiling can be comfortably warmed and ventilated. Up to the present time we have yet to meet with our first failure, although we have rearranged a large number of old churches in accordance with the plan illustrated. In such cases this principle should always be adhered to, with only such changes and divisions as the nature of the particular buildings require. It cannot, however, be too strongly impressed upon the public that this class of work should not be left to men who are not capable of doing it. Nor can too much care be taken in selecting the men who are to be trusted with such work.

Unpolished mahogany acquires a good color with age. It also looks very well stained black and covered with a thin varnish. Stained deal, as a cheap substitute for oak, may answer in places where it is not liable to be rubbed or handled; but for library wear it cannot be recommended, since it shows every scratch on its surface and soon becomes shabby with use. When, for economy's sake, deal is employed, it is better to paint it in flatted color, because this can be renewed from time to time, whereas wood once stained and varnished must remain as it is. Indian red and slate gray are perhaps the best general tints for wood when used for ordinary domestic fittings, but these may be effectively relieved by patterns and borders of white and yellow. Sometimes a mere line introduced here and there to define the construction, with an angle ornament at the corners, will be sufficient. In all chromatic decoration, bright and violent hues *en masse* should be avoided.

Defective Chimneys and Flues.

Many millions of dollars' worth of property has in time been reduced to ashes, and thousands of human lives been sacrificed by fires originating from defective flues. Still, these facts fail to arrest any special attention, and thousands of chimneys are built every year in this and other cities with the same defects which have resulted in conflagrations and so often caused destruction of property and loss of life. There is no necessity for this dangerous condition of things in this connection. Chimneys and flues are indispensable, at least in dwelling houses, and if not properly built they are dangerous to the safety of buildings from fire. Too generally they are built of soft salmon bricks and bats by men who are "chimney builders"—*i. e.*, men of inferior qualifications as mechanics in the more comprehensive sense, and who possess but a limited understanding of the principles and necessities involved in chimney building. The bricks should be of good quality, laid in good mortar, with every joint and interstice well and carefully filled, so as not to permit a hole of any size in any part of the work. The inside of the flues should be well pargeted or plastered, and to render security complete, the small additional expense of plastering the outside of every stack, particularly the back, is fully justified by the advantages gained. Too much care cannot be practiced in having flues smooth and of equal capacity from bottom to top, for when "choked"—made smaller in some parts than in others—the draft is never perfect, and a "smoky house" is classed with a "scolding wife," as being one of the most disagreeable things on earth. Very often the foundations are not sufficiently large or solid to secure good results and prevent settling and cracking. Architects who have had an opportunity to examine the backs of chimneys after they have been used for a time, have seen their dangerous character illustrated. In one case coming under our special notice, where the siding had been removed from the wall, no less than 13 holes and badly filled joints were discovered through which the smoke had percolated, some of them being large enough to admit a large-sized walking cane. Had the flues in that case taken fire, instead of "burning out," it would in all probability have caused the partial, if not entire, destruction of the building.

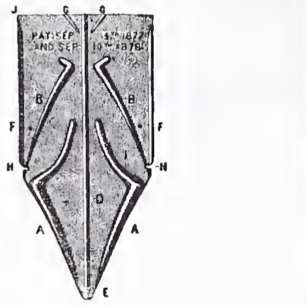


Church Ventilation.—Fig. 6.—Longitudinal Section through the New U. P. Church at Des Moines, Iowa.

Chimneys are sometimes poorly built, because their erection is undertaken at a low figure, and the builder erects them according to price, not caring anything for consequences; sometimes by men who could not execute a fair, much less a really good job of chimney work, if paid the weight of every brick in gold for their work. And sometimes chimneys are improperly built in the spirit of ugliness, and defects intentionally incorporated in their construction, particularly if the architect happens to find fault or criticise the character of the work done. In all fairness, considering the value of good chimneys and the dangers imminent from defective flues, great care should be practiced in all cases.

Metallic Shingles.

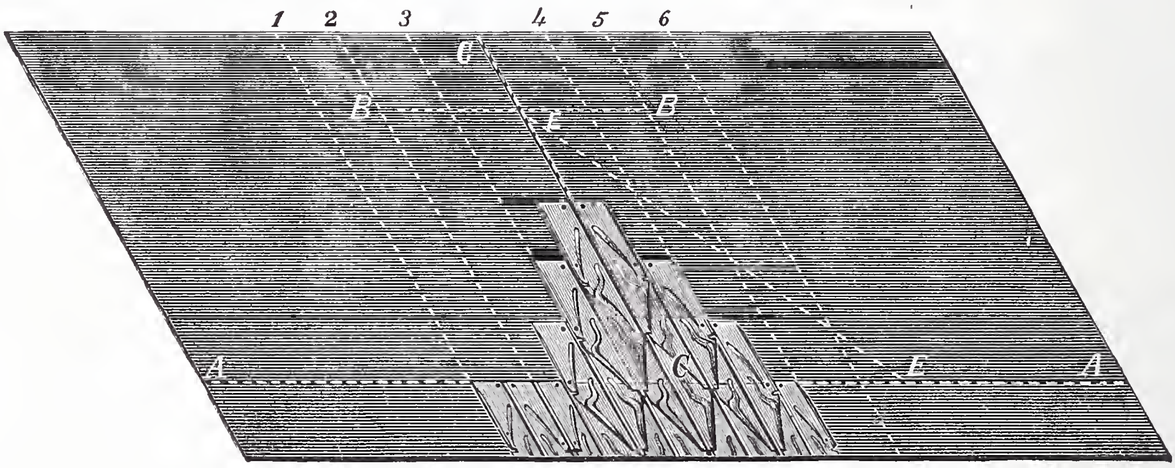
One of the most desirable forms of iron roofing is illustrated in the accompanying cuts. Metallic shingles, or metallic slates, as they are sometimes called, are laid in courses over sheeting boards or lath, in a manner very similar to that of ordinary shingles, and are so constructed as to be adapted to use by any who are accustomed to shingling or slating. Fig. 1 of our illustrations shows the construction of the shingle. The size is 8 7-16 by 16 inches. When laid, the point E is held firmly and tightly to its place by passing under the slots H H of the shingles in the next course below. The use of the several corrugations shown in the shingle is, in the first place, to stiffen and strengthen it, but they also serve other purposes. When the shingles are on the roof, the corrugations B B fit closely under those marked A A of the next course above, and the corrugations G G fit under other forms of roofing as claimed by the manufacturers. Compared with slate, it is claimed, first, that they are much lighter—or, speaking more definitely, that they weigh less than one-fourth as much as slate, and therefore admit the use of much lighter roof timbers, and produce much less strain on the walls of a building. The actual weight of metallic shingles is only about 130 pounds to the square when laid. Another advantage in point of weight is the saving in freight



Metallic Shingles.—Fig. 1.—General View of Shingle, showing Ribs, Construction, &c.

where they are to be transported long distances. In a metallic shingle there is no liability of breakage—a source of great loss with slate. Being of wrought metal, they readily adapt themselves to the formation of the roof, and by their peculiar construction leaks by expansion and contraction are obviated, as each shingle is laid and fastened by itself, and is at liberty to expand or contract without in the least affecting the quality of the roof. As metallic shingles require no solder in laying, there is no solder to melt, thus loosening the roof in case of heat from adjacent burning buildings. Metallic shingles are free from the common objections raised against tin roofs. There are no seams to break through the action of contraction and expansion. Being thoroughly protected on both surfaces, as we shall describe below, rust or corrosion cannot take place from the under side, as is common to tin roofing, and, being of double thickness, metallic shingles are not liable to be pierced by any of the unavoidable accidents which frequently occur to tin roofs.

In comparing metallic shingles with wooden shingles, manufacturers call attention to the fact that they do not shrink or warp, the tendency of wood shingles to do both being a prolific source of leaks. They are fire-proof, and are vastly more durable than wood shingles. Comparing metallic shingles with the ordinary forms of sheet-iron roofing, the first feature deserving notice is that while ordinary iron roofs are of single thickness of sheet iron, and laid in large sheets, the metallic shingles constitute a double thickness of metal and are of a pattern that is quite ornamental. By its construction a roof covered with metallic shingles is not nearly so liable to get out of order as a common sheet-iron roof.

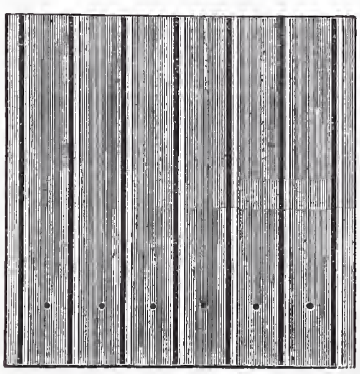


Metallic Shingles.—Fig 2.—Diagram Illustrating the Method of Laying the Shingles on a Roof.

those marked B B of the next course above. The sides F F being turned up, fit under the central rib or corrugation D of the course above, all of which makes the roof storm-proof, and forms a covering of two thicknesses of iron. In laying, the nail holes F F come exactly over the nail holes of the course below.

The diagram in Fig. 2 represents the manner of preparing the roof for laying the shingles. The manufacturers furnish an eaves course of short shingles, which are simply the regular shingles with the points cut off so as to make an even edge along the eaves. The line A A, drawn parallel with the eaves, represents the upper holes of this course of shingles. Through the center of this line, at right angles to it, C C is drawn from the eaves to the ridge of the roof. From either side of C C, by the use of dividers or with a gauge constructed for the purpose, step off spaces equal to the width of the shingles, or 8 7-16th inches, and through these points draw lines parallel to C C. By this means the roof is mapped off in such a way that it is easy to determine whether or not each shingle is occupying its proper place. It also renders it possible for several workmen to be engaged upon the same roof at one time. After the eaves course is placed, the full-sized shingles are commenced by placing the central rib, or corrugation D, as shown in Fig. 1, exactly over the center line C C. If the lines parallel to C C, which we have above described, are drawn correctly, the nail holes in the shingles will always fit over each other.

We will call attention briefly to some of the advantages of metallic shingles over rlay much tighter than it is possible to make slates lay, and therefore are more thoroughly storm-proof than slates. The nail holes in metallic shingles do not become worn from any cause, and they will not crack by the action of frost, while exactly the reverse is the case with slates. The manufacturers further claim that metallic shingles are more



Metallic Shingles.—Fig. 3.—Corrugated Sheet Iron Siding, used for the Walls of Buildings in Connection with Metallic Shingles.

nearly fire-proof than slates. If slates are heated by a fire from an adjoining building, they are liable to crack and fly in pieces, especially if subjected to a stream of water, leaving the building exposed. This objection does not apply to metallic shingles, which cool quickly, without breaking, when water is thrown upon them. Comparing metallic shingles with ordinary tin roofs, it is claimed that all dangers of

The metallic shingles which we have above described are manufactured by the Ironclad Manufacturing Company, of New York, and are furnished to the trade in boxes containing 250 shingles each, the quantity which will cover one square of surface. They are manufactured of two general styles, one of which is known as painted shingles, and the other as calamined shingles. It is stated that iron coated by the calamine process has been tested by the side of galvanized iron, tinned iron and leaded iron, and in every instance has been found superior to all of them.

Fig. 3 of our illustrations represents a corrugated sheet-iron siding, manufactured by the same company, in sheets of exactly one foot square. This is a very desirable article for use on the sides of buildings in connection with metallic shingles. In laying the siding, the lower end of each sheet is lapped over the upper end of the sheet below about 1 inch; the nailing is done with one row of nails, about 1 inch above the lap, or in the position indicated by the dots in the engraving. This siding, like the shingles, is furnished either calamined or painted.

To Remove Old Paint.—Slake 3 pounds of stone quicklime in water, and add 1 pound pearlash, making the whole into the consistence of paint. Lay over the old work with a brush, and let it remain for from 12 to 14 hours, when the paint is easily scraped off.

A middling-sized boy, writing a composition on "Extremes," remarked that "we should endeavor to avoid extremes, especially those of wasps and bees."

CORRESPONDENCE.

The volume of correspondence in the past four weeks has been considerably less than during any similar period for a long time. We attribute this not to flagging interest in the paper or in the subjects under discussion, but to the hot weather and to the fact that this is the busy season for carpenters and builders all over the country. We are able to present the usual amount of correspondence this month, because for some time past we have been receiving more letters than we were able to use. This little lull, therefore, gives us the opportunity of catching up, but it will not do for our correspondents to neglect us long if they want this department to continue to be what it has been in the past.

We suggest that our friends improve their moments of leisure and write their favors at noon time, and, if necessary, on shingles, as did "Wood Butcher" in his last, or upon such scraps of paper as are handy. Let the interest in the correspondence department of the paper be maintained, that it may go forth each month laden with practical ideas for all who examine it.

Problems of Equal Areas.

From F. E. K., *New York.*—The following is the solution asked for by T. V. D. in the May number. Draw the diagonals (Fig. 1) A D and B C. Lay off on D A the distance D E equal to A H. Also lay off C F equal to B H. From F draw a line to the center of E H, and from E a line to the center of F H. The intersection G is the center of gravity of the figure, and the horizontal line drawn through it divides the figure into two parts of equal area. This can be proved by drawing the figure to a scale and calculating the areas, when they will be found to be equal.

From A. J. Z., *Jersey City, N. J.*—In a recent issue I read a correspondent's request to know how to divide graphically a board shaped in the form of a trapezoid. I will give him one way. Let A B C D be the board. Join C and B with the centers of the opposite sides. Divide these lines in three equal parts, as indicated by the stars. Join the two nearest the opposite bases, G and H, as shown in Fig. 2; also join the centers of the opposite bases, E and F. A right line drawn in any direction whatever through the intersection I in the figure will divide the trapezoid in two equal parts.

Analytically the distance

$$I\,F = \frac{E\,F}{2}\left(1 - \frac{1}{3}\,\frac{C\,D - A\,B}{C\,D + A\,B}\right)$$

The principle involved is that of finding the center of gravity of a trapezoid by dividing it into two triangles, and that all lines passing through the center of gravity necessarily divide the figure equally, for it is the point around which the surface will balance.

Note.—Both of the above correspondents are in error, as their methods produce results at variance with well-established principles of geometry. A. J. Z. says that analytically the distance

$$I\,F = \frac{E\,F}{2}\left(1 - \frac{1}{3}\,\frac{C\,D - A\,B}{C\,D + A\,B}\right)$$

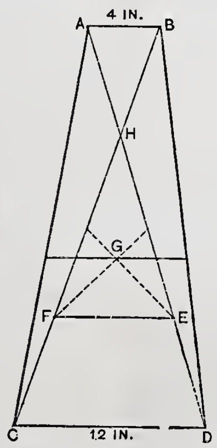
or, reduced to figures, I F (Fig. 2) equals 10. This is manifestly incorrect, for the distance I F can be clearly proven to be 9.1672. Assuming that 10 is the hight I F, then the hight E I is, according to the conditions given, 14 inches. As 192 square inches is the area of the whole trapezoid, 96 must be the area of either section made by the line drawn through "I" parallel to the base. To find the length of this line, divide 96 by 10, which gives 9 6, and multiply this by 2 and subtract 12, which leaves 7.2, the required length of the line drawn parallel to the base. Now, as 7.2 is the base of the upper section of the trapezoid, to ascertain its area we add to it the upper base, which is 4, and divide by 2, which gives 5.6; this, multiplied by 14, gives, for the area of the upper section, 78.4; but, as 96 is the area of half the trapezoid given, 78.4 is evidently incorrect.

We fail to see, as A. J. Z. states, that "the principle involved is that of finding the center of gravity of a trapezoid by dividing it into two triangles." We would like to know how a straight line can be drawn through the center of the given trapezoid so as to divide it into two triangles. But as this may not be the meaning of our correspondent, we should be pleased to learn what *any* two triangles have to do with the solution of the problem.

As communications from other correspondents are at hand, arriving too late for engraving for this number, we will return to this subject at another time.

Tempering Small Tools.

From R. J., *Waynesburgh, Ohio.*—A correspondent in a recent number of *Carpentry and Building* asks for directions for tempering small hand tools, such as punches, chisels,



Problems of Equal Areas.—Fig. 1.—Solution Proposed by F. E. K.

drills, &c. I have carefully noted your reply, which is very good, but years of experience have taught me, I think, a more ready way and quicker one, and I think one quite as good. To be uniformly successful in tempering, a man should know how to make and dress the tools he is using.

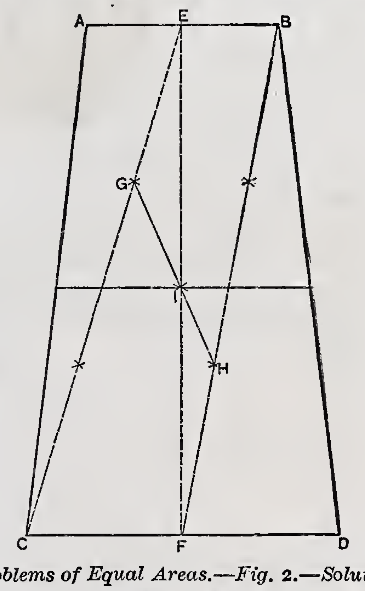
The steel should never be heated beyond a bright cherry red. Let the last hammering be invariably on the flat sides and at a very low heat, the tool meanwhile being held fairly on the anvil, and the blows struck squarely with the hammer. This closes the grain of the steel, and is technically called hammer hardening. Next heat the article slowly and evenly to cherry red about 1½ inches. Have ready pure cold water, sitting still, immerse edge first, holding the tool steadily at that point until the red above the water has become quite dull. Brighten the tool slightly by rubbing on a stone or by other convenient means, and watch the changes of color which occur. First it will be blue next to the body of the chisel, then probably brown, then dark straw color, afterward light straw color, and at the edge bright. Heat from the body of the tool will greatly change the location of these colors. The bright edge will assume a light straw color, then will follow straw color, orange, brown, purple and finally blue. A tool to cut hard cast iron should be straw color or sometimes light straw color; for soft cast iron it should be dark straw color; for wrought iron, purple, or, if the iron is quite soft, blue may be found hard enough. A chisel thus treated will wear well and will not easily break. In grinding a chisel great care should be exercised to have both sides beveled alike and very slightly rounded at the corners. In using a chisel take care to hold it always at the same angle. Workmen often break chisels by striking a blow with the tool at a certain angle, and drive the chisel in, thus pinching off the edge. Drills may be hardened in the same way as named above. In my own practice I leave them a shade harder than is required for a chisel to work in the same material. On the other hand, punches may be softer for the same work.

Objections to Use of Slate Answered.

From Roofer, *Montreal, Canada.*—In the November number of *Carpentry and Building* of last year there appeared an article headed "Objections to the Use of Slate for Roofing Purposes." As I am a strong advocate of slate for roofing, the article was read by me with a good deal of interest. While I cannot deny that one or two of the objections brought forward by your correspondent have some weight, I am still persuaded that these are not of sufficient importance to overbalance the many advantages that slates have as a roofing material.

In the first place, there is no material that can compare with slate in point of durability. I think your correspondent will admit this. I may safely say that a good shingle roof may be laid side by side with one of slate, and even though the shingles when worn out are replaced by a galvanized-iron roof, and this in turn, when destroyed by the weather, replaced by tin, and at the expiration of its life the roof again covered with black iron painted—when all are worn out the slate roof will be found still good and sound. An instance, by way of illustration: In 1851 I was at work in Boston, and examined a building upon one of the principal streets being taken down to give place to a structure of more modern improvements. The building had been erected 65 years, and was covered with Welsh slate, yet when these were taken off they showed so little wear that they were deemed suitable for covering the new building. I doubt not that the roof made of these slates is perfectly good to-day.

In the next place, there is no roofing material that can compare with slate in appearance. What is there that gives such a fine finish to almost any kind of a building as the rich color of slate? To my mind, certainly nothing else. Third, what other roof is equally fire-proof? That we must judge by the rates at which insurance companies take risks; the answer must be known. Your correspondent says that the third drawback is the difficulty of repairing slate roofs or replacing broken or cracked slates.



Problems of Equal Areas.—Fig. 2.—Solution Proposed by A. J. Z.

Now, permit me to say, and I do it with all deference to your correspondent, believing in all probability that he has carefully studied the subject, that a little practical experience will show that this is a mistake. From an experience of 35 years in the roofing business, during which time I have handled slate, galvanized iron, tin, painted black iron, felt, composition and gravel and even shingles, I am fully convinced that none of the above named roofs can be as easily and as surely repaired as a slate roof. It is a very easy and simple thing to take out any slate on the roof and replace it by another and make the job perfectly weather-proof.

Your correspondent says that the slate roof is colder in winter. I cannot assert that such is not the case, but I am inclined to the opinion that a tight slate roof laid over a layer of saturated felting—and all properly-made roofs now have felt under the slate—will be very much warmer in winter than the shingle roof may be without felt. With regard to the slate roof being warmer in summer, I will say that heat will not penetrate a slate roof as rapidly as some others; but slate, when once heated, does not cool off so soon when a change takes place in the temperature. Sliding of the snow from a roof is, by some people, considered an advantage rather than an objection, especially in climates where large falls of snow occur, as in this. By the snow sliding off, the timbers of the roof are relieved of long-continued strain from accumulations of snow. Should a building be so situated as to make a snow-slide dangerous, the danger can be easily prevented by a guard of snow irons, which will retain the snow on the roof.

Now, perhaps your correspondent will say that I am biased in my opinions because I am in the roofing business, but I protest I am giving only what are my convictions, based upon a long and extended experience. I am not disposed to reiterate by insinuating that perhaps somebody has a shingle mill to serve by the objections he raises to slate roofs. We will admit that shingles make a very good roof, barring the danger from fire and their perishable nature. I think all disinterested people must admit that they are not to be compared with slate in point of safety from fire, durability, appearance, warmth, &c.

Design for Store and I. O. O. F. Hall.

From G. G. T., *Washington.*—In the March number of *Carpentry and Building* one of your correspondents requested a design for a two-story building, suitable for an Odd Fellows' hall above and a business room below. I inclose a hastily prepared sketch which may answer the purpose. As your correspondent did not specify for what particular line of trade the store was to be used, I have designed something more especially suited to the dry-goods business. The show windows, it will be seen, are of ample size, thus fitting the room for any line of trade which requires space for a display. This construction of the front, however, requires a girder to carry the wall above, as the door posts set back, as may be seen by examination of Fig. 3. The small room back of the store, designated as a room suitable for use of the lodge, would do as a fuel room or, in the event of a large business being conducted in the store, might be used as a counting room, suitable windows and a connection with the store being supplied. The stair platform is of sufficient depth to admit of a small ante-room upon it. Any of your readers who chance to be Odd Fellows will understand the arrangement shown in the lodge room. A platform extends around three sides of the room, and is to be placed 8 inches above the floor. It should be wide enough for one row of seats. The several chairs for officers are marked. A small room opens from the rear of the lodge room on the left, and is suitable for regalia.

As the floor of the store should not be over 8 inches above the sidewalk, I would build the cellar or foundation walls the same hight; joists to be built in the walls and the sill 4 x 8 put on top. Put stone bedded in cement mortar under the sill, to prevent dampness. Decayed joists can be remedied

Fig. 1.—Elevation.

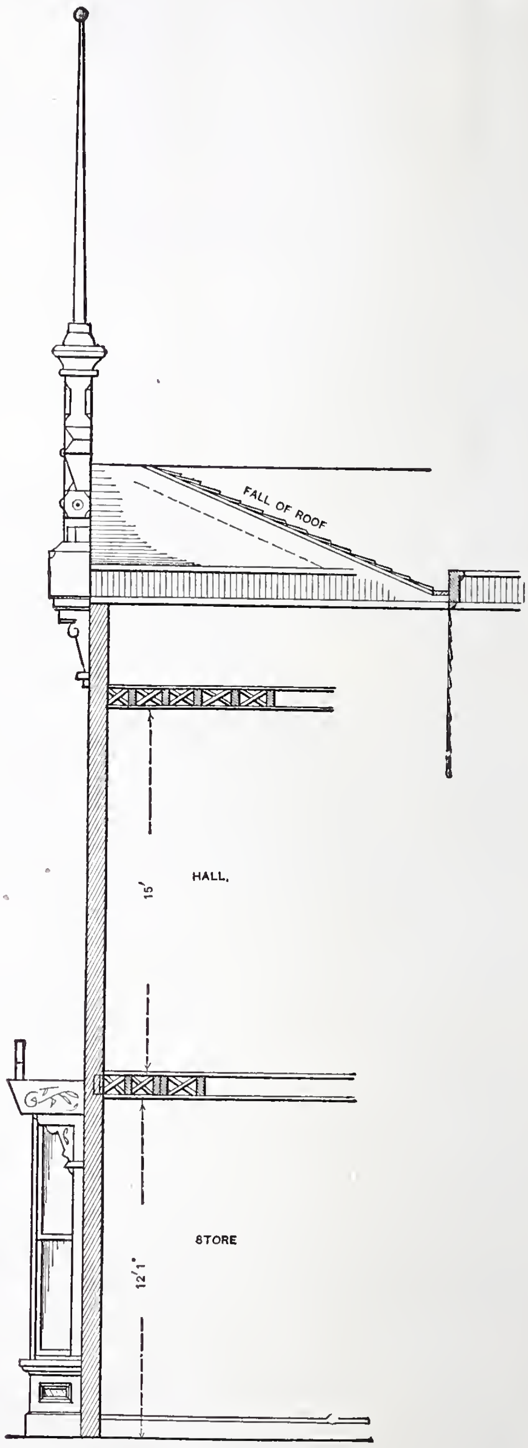


Fig. 2.—Section.

Design for Store and Odd Fellows' Hall.—By W. G. P.—Scale, ⅛-Inch to the Foot.

without injury to sill or frame. If no cellar is required, I would put in concrete as follows: Fill up with dry clay or gravel to within about 5 inches of where the top of the floor is to come; ram and roll this bed solid and on it put about 2 inches of concrete, pitch or gravel. Then put down 2 x 4 Georgia pine sleepers, 18 inches apart; fill up level with the top with fine hot concrete, and then lay the floor with 1¼-inch Georgia pine. Constructions of this kind will keep out dampness and will effectually prevent annoyance from rats. I suggest 3 x 6 for outside studding, 3 x 12 for second floor joists, to have two rows of lattice bridging. I would use 2 x 10 ceiling joists, and 2 x 8 rafters. First floor joists may be 2 x 10 or 3 x 8, with sill on piers through center, or if to extend across in one piece, use 3 x 12 of joists and studs, to be 16 inches between centers and to be thoroughly bridged.

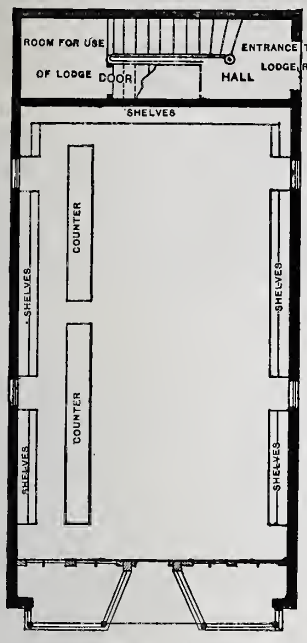


Fig. 3.—Floor Plan of Store.

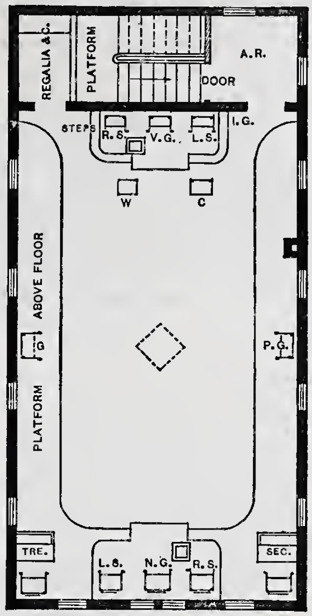


Fig. 4.—Floor Plan of Lodge Room.

Design for Store and Odd Fellows' Hall.—By W. G. P.—Scale, 1-16-Inch to the Foot.

The Force of Gravity.

From L. B., *London, Ontario.*—With your permission, I wish to ask a question through the columns of *Carpentry and Building.* What I wish to know is how far a ball, weighing 5 pounds, will have to fall to double its own weight? My reason for asking is that a man fell from a scaffold where I was at work and received severe injuries. Some one remarked he must have fallen very heavy by the time he reached the ground. I said that every inch he dropped doubled his weight.

Answer.—Our friend evidently does not mean exactly what he says. This will be plain enough by taking the case of a man weighing, say, 160 pounds, and supposing him to drop 6 inches, he would, according to the statement, weigh at the moment of striking 1920 pounds. This calculation supposes that only the doubled weight, 320 pounds, is added each time. If the statement is taken as meaning that at each inch the weight at the inch before is doubled, the weight at the sixth inch becomes something like 20,000 pounds, or 10 tons. A moment's thought will convince anyone that this cannot be so, because if either of the calculations was correct, no man could safely drop a distance of even 6 feet. A fall of a foot would give a man a shock like laying a ton weight upon him. What our correspondent does have in mind is that the speed with which a falling body moves is increased very rapidly with the distance fallen. Bodies fall with a constantly increasing speed or velocity. Thus, in the first second, they fall 16 1-12 feet; at the end of the next second the distance is 64⅓ feet, and the speed is doubled; at the end of the third second the speed is three times as great as it was at the end of the first second, and so on. At the end of the first second the velocity is at the rate of 32 1-6 feet per second; at the end of the next second the speed has increased to 64⅓ feet per second; at the end of the third second it is 96½ feet, while at the end of the fifth second it has reached 160⅝ feet. It will be seen from this how our correspondent got the idea of an increase of weight, from the fact that the velocity increases with such rapidity. The following table gives an idea of the distances which a body will fall in a given length of time, and the speed which it will have at the end:

Time of falling in seconds.	Hight fallen in feet.	Veloc. acquired in feet per second.
½	3 1-12	16 1-12
¾	9¾	24⅛
1	16 1-12	32 1-6
1½	36 1-16	48¼
2	64⅓	64⅓
2½	100 25-48	80 5-12
3	144¾	96½
4	257⅓	128⅔
5	402½	160⅝

The weight of the body has nothing to do with the rapidity with which it falls, unless its shape be such as to offer great resistance to the atmosphere. In general, the resistance of the atmosphere is not taken into account.

Straight Edge in Shingling.

From E. S. C., *Springfield, N. Y.*—My way of using a straight edge in shingling is so simple that it requires very little explanation. The accompanying sketch shows it in all essential particulars. Make a parallel straight edge of the width the shingles are to be laid to the weather. Attach two wires, about 20 inches long each, looped together near the middle, and having a loop at each end. Put a screw through one loop into the board, bring the lower edge of the board even with the butts of the last course, tack a nail through the upper loop hole into the roof board, and you have a line and staging suitable for use both for rain and snow. At the last course on the ridge, tack the nail through the middle loop. If only two are shingling, go up by sections the length of the straight edge.

Straight Edge in Shingling, as Employed by E. S. C.

Notching Joists by Gas Fitters.

The following letter, from a well-known correspondent of this paper, recently appeared in *The Metal Worker.*

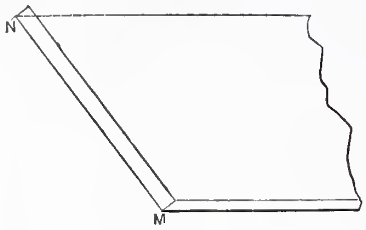
From Alexander Black, Architect, *Keokuk, Iowa.*—As *The Metal Worker* is read by many gas fitters, I wish to use its columns to disseminate among them a needed warning against the very pernicious and widespread practice of notching joists on their upper edge through the middle of floors, in order to make short cuts for laying pipes to drop lights. This custom is very common, especially in the West. In my own practice I have had immunity from this vexation for several years, as the established gas fitters in this vicinity know I will not permit notching at a greater distance than 2 feet from bearings. This week, however, I encountered the same old annoyance. A new man had been put to work in a building under my charge without my knowledge, and, before my daily visit, had notched down 1½ inches into all the joists across the middle of the floor. On being questioned if he was aware of the injury he had done, he replied that such a small notch could not weaken the joists much, and that he and all other gas fitters with whom he was acquainted had always notched across the middle of floors to reach drop lights. He could not realize it when I explained that the 1½ inch had not only reduced the effective vertical depth of 12-inch joists to 10½-inch—or, in other words, had diminished their vertical depth one-ninth part—but that their stiffness or strength to resist bending or sagging was really reduced one-third part; that is, the notched joists only retained two-thirds of the stiffness they possessed before being notched in the middle of span. Of course such a large decrease of strength could not be permitted, and must be restored by the simplest means. Accordingly, as the top part of the joists is in compression, I directed that the notches be carefully filled with hard wood, tightly wedged, and I presume that the contractor will allow the gas fitter to reap the benefit of the lesson he made for himself.

It is essential that gas fitters—indeed all building mechanics—should know that the stiffness or resistance to sagging within an elastic limit varies directly as the cube of the vertical effective depth, the length and breadth of the beams of the same materials being alike in the different pieces compared. That is, if one joist be two or three times as deep as the other, the breadth and span being alike, it will be eight or 27 times (cubes of 2 and 3) as stiff as the other. In the instance cited above, the cube of the depth, 12 inches, is 1728, and the cube of 10½ inches, the effective depth to which the 1½-inch notch in the middle reduced the 12-inch joist, is 1157.625; subtracting this latter figure from the former we find the reduction equal to 570.375, which in even figures is one-third of 1728—the sum representing the original. By elastic limit in the above description is meant that condition of beams when their deflections begin to increase more rapidly than their loading increases for each equal addition to the load. The beam or joist may be considered as beginning to break when this limit is reached.

The stiffness, which is the esssential condition of floor joists, must not be confounded with their ultimate strength or resistance to breaking; the extent to which sagging or bending of floors may be permitted without being prominently noticeable or causing plaster ceilings to crack, is one-fortieth of an inch per foot of span. Joists usually are made crowning to this extent, in order to compensate for sagging. I may note that the ultimate strength of beams of same materials and of like length and breadth, but of different vertical depths, varies directly as the squares of their effective depths.

Hopper Bevels.

From E. W. C., *Randolph, Mass.—Carpentry and Building* is to me a most agreeable

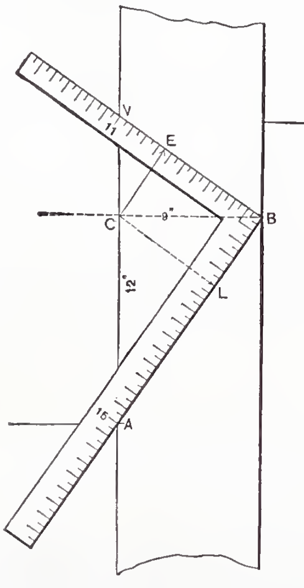


Hopper Bevels.—Fig. 1.—*E. W. C.'s Rule.—Section through Hopper.*

companion, giving me useful information, advice and amusement. I take great delight in the criticisms which appear, and I recommend it to all my brother carpenters.

Perhaps J. L., of Dubuque, has received a satisfactory answer to his question concerning hopper bevels, but I have a method somewhat peculiar to myself, which I have worked out from geometrical principles by the use of the steel square. I find the bevel using the board square edge. I inclose sketches illustrating it.

Fig. 1 represents a section through the hopper. First, take a board 12 inches wide, joint one edge, and draw a line of the side elevation according to the requirements. From this proceed to make a draft with the square 1 inch to a foot. Take 12 inches on the blade, hold 12 at A, and by it find how many inches rise the given inclination is to a foot. Draw a line by the tongue, as shown by B V, Fig. 2. At B, draw square with A C, and again square on line A B through C, as shown by C L. From V B erect a perpendicular also to C, cutting V B in the point E. By these several operations we have a complete draft by which to solve the prob-



Hopper Bevels.—Fig. 2.—*E. W. C.'s Rule.—Drafting the Hopper by use of the Square.*

lem. A B is the given slant, and has 9 inches rise to a foot. A C is 12 inches, and C B is 9 inches. The length of A B, as indicated by the figures on the square, is 15 inches. Fifteen inches, therefore, is the width of the board required to cut the hopper.

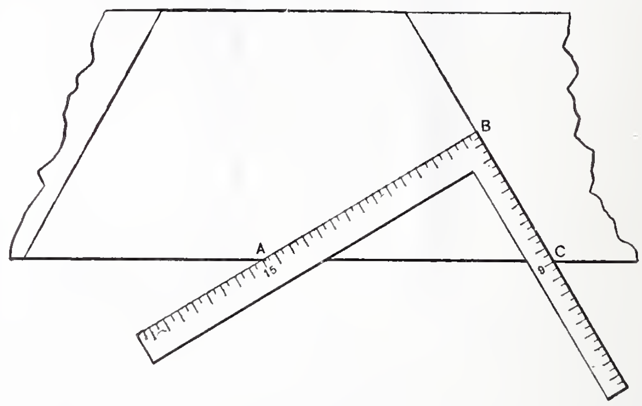
Use the foot-draft of the hopper as follows: Take on the blade A B, and on the tongue C B and apply the square to the board, as shown in Fig. 3. Mark on the tongue, which will give the down-cut bevel.

For a butt joint, take E C on the tongue and C A on the blade and apply it as shown in Fig. 4. Mark on the square edge of the board E C.

If a miter is wanted, take C L on the tongue and C A on the blade and apply it as shown in Fig. 5. The edge being square, this application of the tool will give the exact miter.

The above principles will give the manner of backing a hip rafter. Suppose that A C, Fig. 2, were the seat of the hip rafter, and A B the length of the hip, by taking C L on the tongue and C B on the blade, marking on C L and setting the bevel by that line, the exact backing of hip will be obtained. The handle of the bevel is to be square across the hip rafter, as shown at C L in Fig. 2.

From J. O. B., *Brooklyn, N. Y.*—I send you herewith my method of finding the bevels for a hopper. First draw the square A B C D, as indicated in Fig. 1. Through C draw the line C E, making its angle with B D the same as the side of the box with its base line. In other words, if B B be considered the base line, C E represents the flare of the box. From D let fall a perpendicular to C E, thus obtaining the point F.

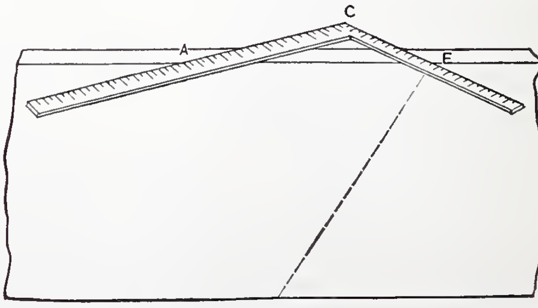


Hopper Bevels.—Fig. 3.—*E. W. C.'s Rule.—Manner of Placing the Square to Obtain the Down Cut Bevel.*

With C as center and C F as radius, describe the arc F L, thus obtaining the point L. Draw L A, then the angle L A B, as indicated by the bevel drawn therein, is the bevel for the miter at the ends. Next, with D as center and D F as radius, describe the arc F K, thus obtaining the point K in the line C D. Draw K B, then the angle K B A will be the bevel for the down or cross cut. To get the bevel for the butt joints from E, draw E H parallel with C D; with E as center, and radius E F, describe the arc F I, thus obtaining the point I in the line B D. Connect I and H, then the angle A H I represents the bevel for the square cut at the ends.

From T. A. B., *Philadelphia, Pa.*—I have read with pleasure what has already appeared on the subject of bevel hoppers. I take great pleasure in sending my solution of the problem, and I shall endeavor to state it without as many A B C's as some use. It is not complicated.

The inclosed sketch gives all particulars. First, lay down the size and flare of the hopper; then draw A C of the diagram at right angles to A B, making A C in length equal to A B. Connect B and C; prolong



Hopper Bevels.—Fig. 4.—*E. W. C.'s Rule.—Manner of Placing the Square to Obtain a Butt Joint.*

the base line until it meets B C in the point D; then the angle A D B is the bevel for the butt joint. It is to be applied at right angles with the butt. To a mechanic no further explanation is required.

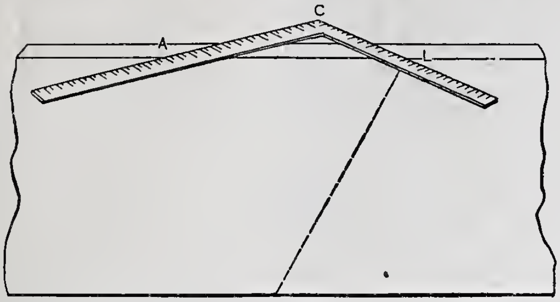
Note.—No doubt many of our readers will be interested with this explanation of the problem on account of its brevity. It is to be noted, however, that our correspondent gives but a very small part of the problem. There are several important steps to which he pays no attention whatever. We shall not enter into a discussion of the accuracy of his rule, but, for the interest involved, we will simply say: If so, why so? We shall be pleased to have T. A. B. go into the philosophy of the rule and tell us why it is correct; shall also be pleased to see his method of performing the other steps in the construction of the article named.

From T. S. V., *Bentonville, Ark.*—I noticed an inquiry some time ago for the method of finding the cuts on mill hoppers or other boxes having flaring sides. Seeing that *Carpentry and Building* has already given one, I will venture to send my rule. If it does not work, please brand it. I think it is all right—at least it has never failed me yet.

Draw line A B as indicated on the inclosed sketch, Fig. 8. Then, for an imaginary flare for the hopper, draw C D. Then draw a line at right angles to A B from E, intersecting C D at F; next draw a line at right angles to C D from G, the point of intersection between C D and A B. From E as center describe an arc which shall touch G H, thus obtaining the point N. From N draw a line to F as indicated. Next E as center describe an arc which shall touch C D, and continue the same around until it meets A B in the point L. From L draw a line to F as shown. All this is easy if you once see through it.

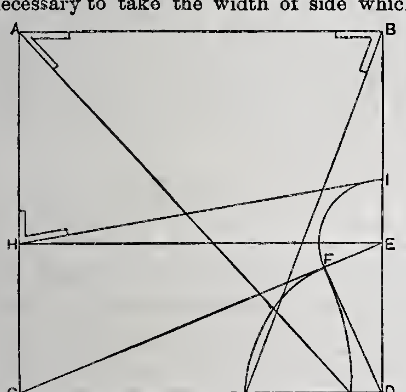
Note.—Concerning this correspondent's last remark we have not the least doubt, and we think enough of our readers will see through it to apply the proper brand to the rule. It occurs to us, without entering into extended criticisms at this time, that T. S. V. has gone a long way around to obtain his lines and angles. There are some features of his demonstration which are very pretty, but, as in another instance, we are disposed to refer the question back to him, asking the reason for each step performed. The philosophy of the thing is of more interest to the readers of *Carpentry and Building*, we believe, than any arbitrary rule. It seems to us no mechanic should allow himself to take any step in the demonstration of a problem if the reason is not apparent in his mind; accordingly, further explanation of this problem from its author or from others will, we think, be of special interest to our readers.

From W. C. M., *Birmingham*.—After reading the March number of *Carpentry and Building*, I came to the conclusion that I was liable to be set down as one of the dead-heads. As I have derived a great deal of pleasure and much benefit from the paper, perhaps I had better contribute something in order to save my reputation.



Hopper Bevels.—Fig. 5.—*E. W. C.'s Rule.—Manner of Placing the Square for a Miter Joint.*

There appear to be a great many methods of obtaining the bevels of roofs and hoppers; the principles involved, though, are identical in all the methods. The system which I learned some years since suits my case the best of any I have ever seen; therefore I shall venture a description of it, introducing such modifications as my experience has shown to be desirable. First, to lay off a hopper, find the width of side, as shown in the March number of *Carpentry and Building*. Take width of side on blade of square and the run on tongue; then the tongue will give the cut for a butt joint. Take the width of side on the blade and half the run on tongue; then the tongue will give the cut across the edge of board for a miter joint. Take the width of side on blade and rise on tongue; then the tongue will give the cut. Now, it frequently happens that a kitchen sink needs a hopper bottom, and very often sinks are not square. In such cases it is necessary to take the width of side which



Hopper Bevels.—Fig. 6.—*J. O. B.'s Rule.*

you are cutting and run of side against which it abuts in order to get the cut. It cost me considerable study to discover that part of it

Fitting and Hanging Doors, with Notes on Building Estimates.

From E. G. H., *Ossian, Iowa*.—The inquiry of G. N. G., in the February number, Vol. II, as to what is a day's work on "hanging and trimming doors," leads me to refer to my first communication to *Carpentry and Building* on the necessity of a uniform rule in estimating builders' work.

Already, it seems to me, has the columns of your journal disclosed one source from which spring many of the wild, and often ruinous, estimates that are made, more or less, everywhere among the building trades. As a case in point, I may mention the wonderful performances of some of your correspondents in shingling. If men, in making competitive bids for building construction, calculate the whole work in a proportionate ratio to throwing from 5000 to 7000 shingles on a roof per day per man, is it any wonder that we have a surfeit of buildings standing under daily condemnation, because of their wretched construction? Then we have some more somersaults in workmanship, a sort of wholesale hanging of doors.

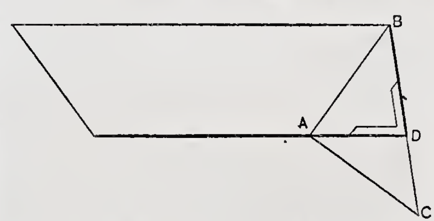
Provided a few men may be found in this world who can accomplish these remarkable feats in shingling and door work, the fact does not offer any reliability upon which to base estimates, even of this particular work. Taking the average workman throughout, one who is conscientious, aims high, and has a justifiable pride in making his work as near perfect as possible; not one-fourth as many doors will he fit and hang as the one your correspondent states. When a man hangs 20 doors in a day there is a "nigger in the fence" or a "screw loose somewhere." A contract has been underestimated, and "cut and slash," "paint and putty" are to make a pretense of respectability, or the trade is turned into a circus, and the praise of the performance rests on the quantity, rather than quality, of work. One of your correspondents thinks "we have had enough of the shingling business." But how are we to discuss the value of a day's work or arrive at a correct standard of estimates without these comparisons? If there is any one need above another of the carpenter and joiner, it seems to me that need is a uniform system of estimating work and putting that system into universal practice.

It is well for every carpenter and joiner to learn all the mathematical rules connected with the trade; to learn the reading of drawings readily and correctly, and in the matter of design, the study of the subject will improve the workman's taste, even if he leave the responsibility of drawings to the architect; but above all, I think we should learn and practice a safe, sure and uniform rule of value for our labor. That is the way other kinds of business are conducted—upon some recognized system by which profits are known in advance. If every journeyman, as well as contractor, was well acquainted with and persistent in the practice of a uniform price, the value of labor would rise 50 per cent., and quality of work in proportion. The workman and the owner would then be alike benefited. Let journeymen learn this fact, that the ignorant competitor on a contract not only injures himself, but indirectly the competent builder, and oftentimes the owner or proprietor.

It is certainly evident to any one who will give it a thought, that in making a safe and profitable estimate (and by the word profit we ought to remember it as the basis of calculation in all successful business), after we have allowed a maximum in time for the performance of work, we are not to forget the incidentals. Many moments of time are consumed every day, either in sharpening tools, moving lumber or other preparation for work. The time for building scaffolds must be taken into account. Allowance of time ought to be made for the cuttings for the various artificers about a building. The carpenter or joiner will have frequently to remove or alter woodwork for gas pipes and sewers pipes, make changes for pipes or flues in connection with heating and ventilation, make centers for arches, patterns for mason, plasterer, turner and iron workers—not all trifles by any means, but in the end aggregating a large amount of time.

Architects' specifications usually include all this incidental work as obligatory upon the contractor. Hence the necessity of a careful consideration of all these matters in making an estimate, and not for profit alone, for that builder who can finish his work satisfactorily without extras will advance his own reputation. It is reasonable to suppose that if rules can be made for the calculation of solids and superfices, and for the velocity of machinery and what it may accomplish with a given force, so rules may be made for manual force and what it can perform within a given time. At all events it has been done, and from two works on valuation of prices in my possession, one published in 1871, known as "Vogde's Architets and Builders' Companion," based on a collation of the experience of many builders through long years of practice, a system has been devised that is as reliable as anything yet published, so far as I am informed.

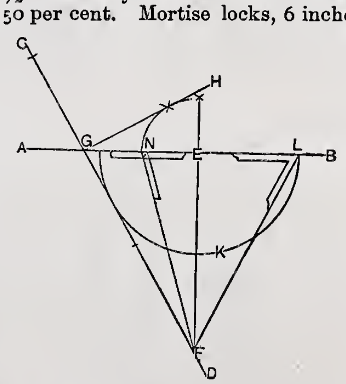
An average day's work is taken as a mean between extra fast and very slow workmen. Of course, only first-class workmanship is the consideration, such as will not need to be done over again. Two dollars per day, as the average wages of journeymen, is the amount fixed upon to base the per cent. of valuation of every detail of construction. If journeymen's wages are $2.50 per day, add 25 per cent.; if $3 per day, add 50 per cent., &c., to your estimate. The prices are for work only, and do not include any materials. It is supposed to be comparatively easy to estimate materials, as the quantities can be taken from plans and specifications. The greater difficulty is to compute the time and labor required on the work. As an illustration, and in answer to G. N. C., I quote from the price book the



Hopper Bevels.—Fig. 7.—*T. A. B.'s Rule.*

article "panel doors:" "Fitting ready for hanging machine-made doors, 1¼-inch thick, per foot, superficial, ½-cent.; and for each ⅛-inch thicker, add per foot, superficial, ⅛-cent. For fitting and hanging any of the above doors above the first story, add for each 10 feet in hight, per foot, superficial, ½-cent. For hard wood, add one-third; or, if finished for varnishing, 50 per cent. to above prices. Octagonal work, charge two prices; circular work, charge three prices; and for elliptical work, charge four prices. If doors are curved on base line, add three prices to any of the above rates."

The following is quoted from the same book, article "hardware." "Small iron bolts, screwed on, 5 cents; do. brass, 6 cents. Large iron bolts, 12½ cents; do. for large doors with chain and plates, 25 cents. Any of the above let in the woodwork, add 50 per cent. Small closet or drawer locks or latches, screwed on, 10 cents. Common rim or knob locks or knob latches, screwed on, 20 cents; 6-inch or larger rim or knob locks, 25 to 37½ cents. Any of the above let in the wood, add 50 per cent. Mortise locks, 6 inches or



Hopper Bevels.—Fig. 8.—*T. S. V.'s Rule.*

under, 37½ cents; over 6 inches, 50 to 75 cents; plated fronts and fittings, add 50 per cent. Locks of any kind with rebated fronts, add 25 per cent. Hinges, 1½ x 1½ inches or less, per pair, 12½ cents; 2¼ x 2½ inches or less, per pair, 15 cents; 3½ x 3½ inches or less, per pair, 18¾ cents; 4 x 5 inches or less, per pair, 25 cents; 6 x 6 inches or less, per pair, 31 cents. Plated hinges double price."

I am not "drumming" for this book; have no special interest in its success or failure, financially, to its projector. I have used it nine years, and value it for its reliability in estimating work. Any other system that will secure the confidence of builders will be welcome, only so that all adopt it in practice.

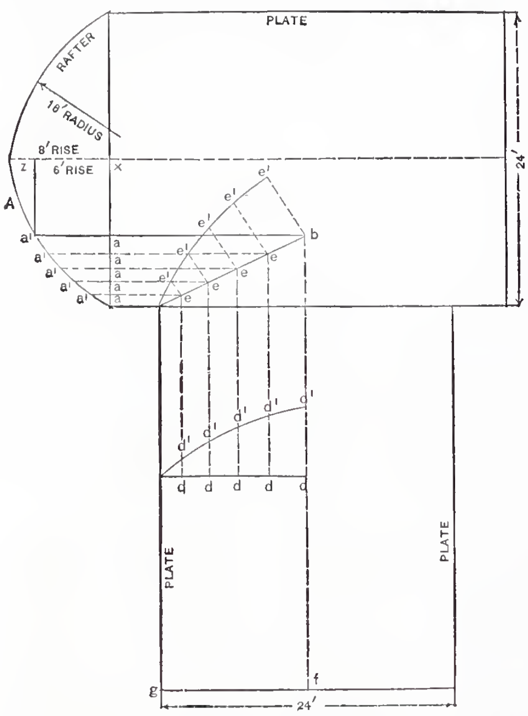
Apropos to the value of work in hanging and fixing hardware to doors, it may not be amiss, since inquiries have been made in your columns, to notice the general way it is performed. It is customary to set the upper end of upper butt from 5 to 8 inches from the end of the door, and the lower end of lower butt from 9 to 12 inches from bottom end of door. Some workmen take a line from the under edge of top rail and upper edge of bottom rail as a point for the outermost ends of butts. It is evident the butts cannot be placed beyond these points without driving the screws in the tenon or mortise. When a door reaches 7 feet in hight, it is usual to have three butts. As there is a reason, or ought to be, for all things, so a mortise lock should be let in between the inner edges of the double tenon of lock rail. If it is placed higher or lower, it will cut off one or the other of these tenons, and weaken the connection between stile and rail. The position of a rim lock to the strength of the doors is not so important, since only the knob spindle and key-hole pass through the door. As a matter of taste, joiners usually place the center of a rim lock over a horizontal line midway between upper and under edges of lock rail. This secures a rim lock with its knob and furniture in about the same position as a mortise lock.

With the risk of prolonging this article to a wearisome length, I would like to add an observation on fitting doors ready for hanging. Many workmen joint the edges (English term "shoot") of the door and offer it up to place, perhaps, half a dozen times before a fit is gained. A better way, where several are to be hung, is to provide two light rods of wood a few inches shorter than the length of the door, and two others shorter than the width. With these rods the space the door is to occupy may be measured across top and bottom, and also the length each side, and transferred to the door. With a straight-edge and a sharp pencil or steel point, the door can be marked off to fit the opening, judgment being used in marking as to the amount of play room allowed to avoid friction, and the amount ought to be enough to insure the free working of the door after the painter has finished it. With this method and a little practice, a proper fit can be acquired at once.

A volume might be written upon the subject of doors alone. The variety of styles and construction, the character they are to have in design for the different places they occupy, and many other requirements will suggest themselves to the attentive designer or workman.

Valley Rafters Between Curved Roofs.

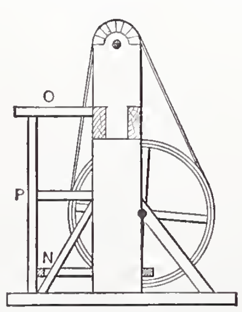
From A. M, *Baltimore, Md.*—M. W. C., in his question in the May number gives the radii for the rafters of both main part and wing of his conservatory, which is not correct, as for such a roof we must assume one radius, and from rafter laid off by that radius develop the shapes of both valley and wing rafters. In sketch inclosed, which is similar in plan to the one submitted by him, we have the given rafter A with a rise of 8 feet. The first step is to find the seat of the valley rafter. As the hight of the wing is 6 feet, lay off 6 feet from *x* to *z*; draw *z a'* perpendicular to *z x*, cutting the given rafter in *a'* from *a'* parallel to *z x*; draw *a' b*, cutting the line *b f* in *b*; draw *b c*, which is the seat of the valley rafter. To find the shape of the valley rafter from *a' a' a'*, &c., draw lines, cutting the line *b c* in *e e e*, &c.; at right angles to *b c* draw the lines *b e'*, *e e'*, &c., producing them indefinitely. Make *b e'* equal to *a a'*, and each of the several spaces marked *e e'* equal to the spaces marked *a a'*. Through the points *e e' e' e'*, &c., trace the shape of the valley rafter. The shape of the wing rafter is found by drawing lines from *e e e*, &c., parallel to *c g*, intersecting the seat line in *d d d*, &c., making each of the several spaces marked *d d'* equal to like spaces marked *a a'*, and through the points of intersection marked *d' d' d'* tracing the shape of therafter.

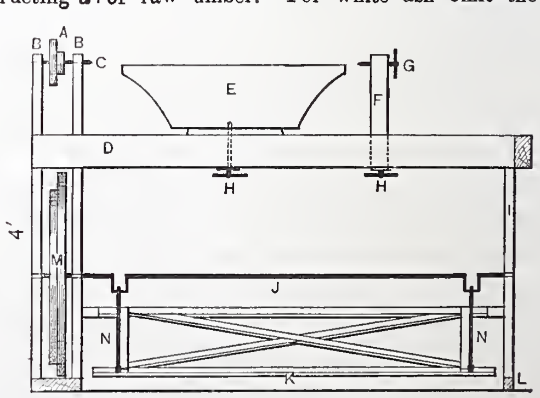


Valley Rafters between Curved Roofs.—From A. M.

Wood Turning Lathe.

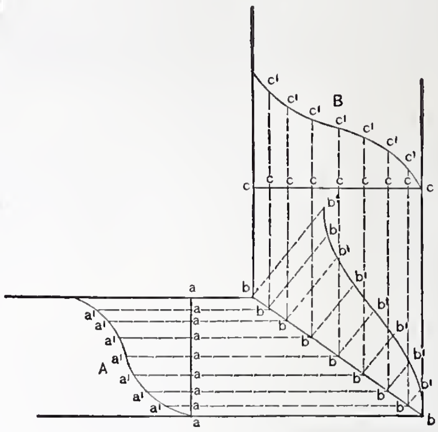
From J. F. W., *Danville, Pa.*—I inclose a rough diagram of my plan of constructing a wooden turning lathe. B is the upright, 4 feet from bottom to top, and made 3 x 9 in size. D represents the ways, the full length of which is 6 feet, and the section of which is 3 x 6 inches. C is the shaft. From center of shaft to top of ways measures 10 inches. A represents the pulley, the larger part of which is 6 inches in diameter and 2 inches face, the smaller part being 4 inches in diameter and 4 inches face. G is the tail screw provided with thread. E is the rest, bolted down between the ways as shown. H is the arm to hold the rest and tail stock. J is the shaft which runs the full length of the lathe, and in which are placed two cranks, having a 4-inch sweep. It is made of 1¼ inches round iron. K is a treadle. L is the bottom piece made 3 x 12 for one end, and 3 x 3 at the other. M is the driving wheel, with two changes of speed. The larger part is 24 inches diameter with 2-inch face, and the other 22 inches diameter with 2-inch face. P is the back part of the lathe showing the bracing. O represents the top of the lathe.


Wood Turning Lathe.—Fig. 1.—End Elevation.


Wood Turning Lathe.—Fig. 2.—Side Elevation.

Hip Rafters for O. G. Veranda Roofs.

From A. M., *Baltimore. Md.*—I hope the inclosed sketch will be of some help to J. A. E. in regard to laying off hip rafters for O. G. veranda roof where one side is wider than the other. Let *a a* be the seat of the given rafter; A *b b* the seat of the hip rafter, and *c c* the seat of the rafter B, required for the wide side of the veranda. To find the shape of the hip rafter from any points on the given rafter A, draw the lines *a' b*, *a' b*, &c., parallel to *a b*, and cutting the seat of the hip rafter in *b b b*, &c. At right angles to the seat of the hip rafter *b b* draw lines, producing them indefinitely. Upon these lines make each of the several spaces marked *b b'* equal to like spaces marked *a a'*. Through the points *b' b' b'*, &c., trace the shape of the hip rafter. To find the shape of the rafter B from the points *b b b*, &c., on the seat of the hip rafter, draw lines parallel to *b c*, producing them indefinitely, and cutting the seat line of the rafter B in *c c c*, &c. Make each of the several spaces marked *c c'* equal to like spaces marked *a a'*. Through the points *c' c' c'*, &c., trace the shape of the required rafter B.

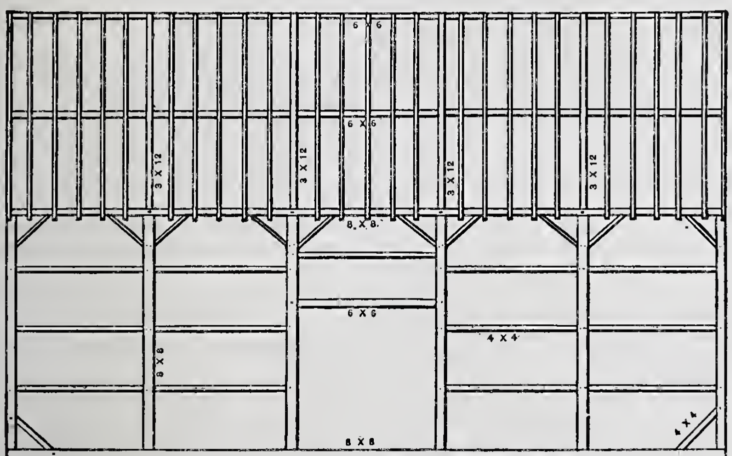

Hip Rafters for O. G. Veranda Roofs.—From A. M.

Stain for Pine.

From L. GODEFROI CADIER, *Taftsville, Vt.*—To stain cherry color use burnt sienna ground in oil, and thinned down with turpentine. It must be used very thin. As there are two well-known varieties of oak as well as ash in common use, different stains must be used for the different varieties. For oak, raw sienna mixed as above; also equal parts of raw and burnt siennas. Burnt umber and a trifle of French yellow is also used. French yellow and a little India red may also be used. For brown ash, one part Vandyke brown, two of raw sienna and four of raw umber. For white ash omit the Vandyke. A number of other stains may be used, but these are the ones mostly in use. The color should all be ground in oil and thinned in turpentine. They can be finished in oil as follows: One-fourth pound white wax melted in turps, one quart turps, one-half pint best hard-drying coach varnish, one-half pint boiled oil, one gill japan. Apply as for hard wood. The above stains will give the natural hard-wood colors, but no one can be deceived by them, as the grain of pine is so different from that of the other woods. Oak especially is different, as, in addition to its handsome growth, it posseses beautiful flaking. On this account it can never be imitated by staining.

Framing a Bank Barn.

From C. E. R., *South Acton, Mass.*—In the January number of *Carpentry and Building* I notice a query from W. A. McC., with regard to framing a bank barn without using cross-timbers between floor and roof.



Framing a Bank Barn.—Fig. 1.—*Side Elevation of Frame.*

Thinking I might give him some information on the subject, I inclose herewith roof drawings of a frame which I recently erected, and which has given entire satisfaction. I have omitted plans of basement, not knowing what kind of stabling would be used. If it is to be employed for dairy purposes, it should have two rows of stanchions running lengthwise of building. Leave ample room in front—say 5 feet—for mangers and feed-box, leaving passage through center wide enough for driving a team. I would give about one foot pitch to the gutters behind the cattle. The roof should be well bolted together, and the truss rafters should be well secured to wall plates and thoroughly fastened together at ridge, as shown in diagram.

Lack of Inducements for Young Men to Learn Trades.

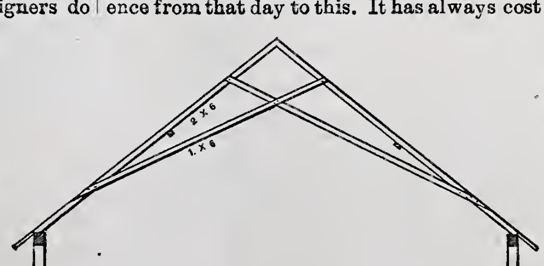
From R. S. T., *New York City.*—I have often heard the fact stated, and I have noticed it myself when looking through some of our workshops, that the mechanics' places in this country, in nine cases out of ten, are filled by foreigners. The building trade seems to present no exception to this general rule. Very naturally the question arises, Why don't our American youths learn trades? Some blame it to idleness, but I think that is not a satisfactory explanation. Others say the boys prefer to measure tape, and appear to better advantage than they would as professors of carpentry or knights of the trowel.

There is one thing certain, foreigners do not make any better mechanics than our own countrymen. Our boys are no less ambitious to-day than they were 40 years ago, but still the fact remains that they are turning their backs on trades. I propose to try my hand at a solution of this problem, leaving the readers to judge whether or not I am right. I propose for illustration to take my own trade, one which, had *Carpentry and Building* been printed 20 years ago, would have had thousands of better posted men in it than it contains to-day.

I do not think I am far astray in making the assertion that to learn the carpenter trade thoroughly, from the geometrical lines which form its foundation to the most intricate work which many are called upon to perform, requires fully as much time and practice and study as any mechanical pursuit, and probably as much as many of the professions which pay a great deal better. Right here I think lies the trouble. Of course we have poor men that are paid all they earn, so has any business, but just so long as the ambitious and worthy men are on a level with the poorer ones financially, and mechanical labor is no better paid than at present, our bench room will not be filled by American youths, for their ambition ranges higher than a hard-earned living and a living only. Another thing which is overlooked by many is this, that after 25 or 30 years of hard work and exposure, spectacles have to be used in order to see the gauge line that but a short time before could be seen 5 feet away. Carpenters, after passing a certain age, are no more the useful mechanics they once were. As the quantity of work diminishes their wages are reduced—well, I will go no deeper into the subject, the idea alone is sufficiently suggestive.

It is quite probable that American youths do not take all this into consideration themselves. But their fathers help them out, and how often do we hear our bench men remark: "My son shall never learn this trade, if I can help it." Can we blame the carpenter for such a decision? He is to a certain extent responsible for his boy's hereafter, and he speaks from a personal experience which only years of hard work can give to any man. It is not hard work to which he objects, but it is the emptiness of pocket against which the hard work provides no remedy, and which renders the prospect of his old age gloomy and altogether uncertain.

He cannot help thinking of the home he left in the country years ago, when he was young and ambitious, to come to the city in order to try his luck. He remembers how he fell into the same groove that ninety-nine out of every hundred mechanics fall into, and how he has led a plodding existence from that day to this. It has always cost him the full amount of his earnings to live, hence it has been impossible to retrace his steps, or to place himself where surrounding circumstances would be more favorable.



Framing a Bank Barn.—Fig. 2.—*Manner of Trussing Rafters between Bents.*

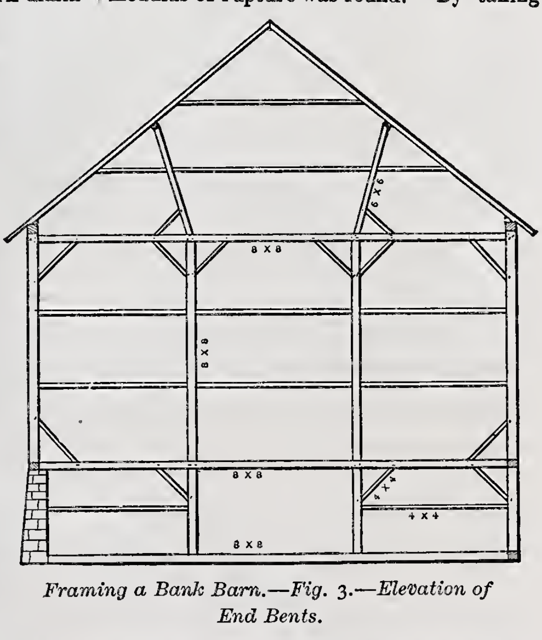
Have I drawn the picture correctly? I leave my fellow readers to judge. The question is, Where is the inducement for an ambitious young man to learn a trade? Financially the carpenter's trade is a failure; mechanically it is second to none. Of course some succeed and accumulate property, but the majority cannot soar and must grovel along.

Difference in the Bearing Strengths of Woods.

From F. E. Kidder, *New York City.*—In reading several articles lately on the bearing strength of timber, the writer has noticed that only one constant was given for determining the strength of a wooden beam, as though there were no material difference in the strength of different woods. Now, this is not so, and the difference in the strength of some kinds of wood is of a considerable amount. In a rule or formula for determining the strength of a beam there must always enter in a constant number, varying for different materials.

That those who are interested in this subject may know whence these constant numbers for wooden beams are derived, I will give a short description of the process by which they have been obtained.

In the first place, the numbers given in ordinary rules are derived from what is known by engineers as the modulus of rupture. The value of the modulus of rupture for different woods has been obtained in the following manner: Different persons, prominent among whom are Barlow, Tredgold and Hatfield, have taken perfect, well dried pieces of different woods, from 1 to 3 inches square and from 2 to 4 feet long, and subjected them to gradually increasing loads until the pieces broke. Then, by substituting the dimensions of the piece and the breaking weight in a simple formula, the modulus of rupture was found. By taking



Framing a Bank Barn.—Fig. 3.—*Elevation of End Bents.*

the mean of the results of several sets of experiments, the values now considered most reliable have been obtained. Still there are several American woods of which we have no satisfactory values of the modulus of rupture, and more experiments are needed. The following values are an average of those obtained by Tredgold, Barlow, Hatfield and others. The values for yellow and white pine are the result of very careful experiments made by the writer, and of which a full account was published in *Van Nostrand's Engineering Magazine* for February.

VALUES OF THE MODULUS OF RUPTURE.

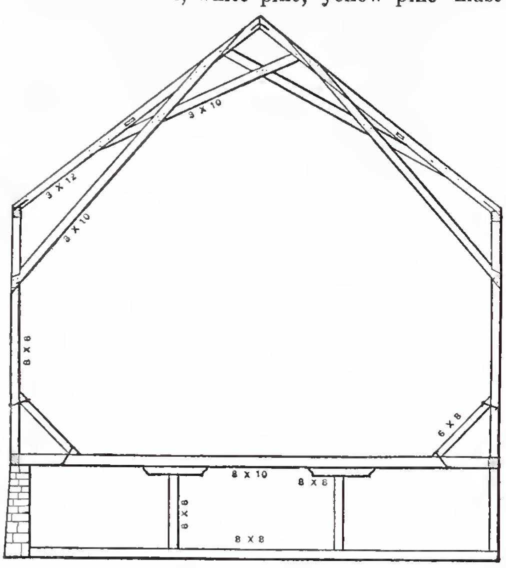
	Lbs.		Lbs.
American Ash....	10,680	New England Fir.	6,612
Amer. Black Ash.	5,166	Amer. Hemlock..	6,852
Amer. Red Beech	10,430	Amer. Hickory...	12,774
American White Beech..........	9,642	Amer. Red Oak..	10,122
American Yellow Birch...........	8,000	Amer. White Oak	10,458
American White Cedar....	4,596	American Yellow Pine..	13,000
Amer. Chestnut.	10,660	Amer. White Pine	8,300
		Amer. Spruce....	9,900

To obtain the bearing strength of beams supported at both ends, one-eighteenth of these values is taken for the breaking weight, and for a safe dead load one-fifth of this, or one-ninetieth of the modulus of rupture. This would give the values of the constants for safe loads as follows :

VALUES OF CONSTANT FOR BEAMS SUPPORTED AT BOTH ENDS.

	Lbs.		Lbs.
American Ash	118	American Hemlock.	76
American Black Ash	57	American Hickory .	142
Amer. Red Beech...	115	American Red Oak.	112
Amer. White Beech.	92	Amer. White Oak...	116
Amer. Yellow Birch	89	Amer. White Pine..	92
Amer. White Cedar.	51	Amer. Yellow Pine.	144
Amer. Chestnut ...	118	Amer. Spruce.......	110
New England Fir...	73		

Now let us compare the safe loads of a beam of hemlock, white pine, yellow pine



Framing a Bank Barn.—Fig. 4.—Manner of Trussing Center Bents.

and spruce, 4 inches wide, 8 inches deep and 10 feet between supports, and see how they will compare with each other. The rule for the safe load in this case is :

$$\text{Safe load} = \frac{\text{breadth} \times \text{square of depth} \times \text{constant}}{\text{length of span in feet.}}$$

Then for the hemlock beam :

$$\text{Safe load} = \frac{4 \times 8^2 \times 76}{10} = 1945 \text{ lbs.}$$

For white-pine beam :

$$\text{Safe load} = \frac{4 \times 8^2 \times 92}{10} = 2355 \text{ lbs.}$$

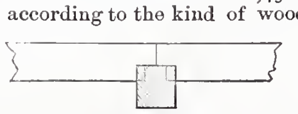
For yellow-pine beam :

$$\text{Safe load} = \frac{4 \times 8^2 \times 144}{10} = 3686 \text{ lbs.}$$

For spruce beam :

$$\text{Safe load} = \frac{4 \times 8^2 \times 110}{10} = 2816 \text{ lbs.}$$

Thus we see that, for the same size of beam, the safe load varies from 1945 to 3686 pounds, according to the kind of wood, and



Framing a Bank Barn.—Fig. 5.—Manner of Gaining Floor Joists.

the larger the beam the greater this variation would be.

We also observe that two beams of yellow pine would carry a load that would require three beams of white pine to support it and nearly four of hemlock ; so that if we used an average of these values, the beam would be too weak for white pine and hemlock, and there would be more material than was needed in the yellow pine and spruce beams.

Now, it seems to the writer that where there is such a difference in the bearing strength of different woods, a beam should be calculated accurately for the kind of wood intended to be used, thus insuring perfect safety and no waste of material.

Measurement of Stone.

From D. H. J., *Danielsville, Conn.*—I notice that the answer to N. P. E.'s question concerning the measurement of stone by a correspondent is very different from the practice in this locality. With us, 30 feet of stone measured in the wall, or 32 cubic feet measured on the wagon, constitute a cord. I have bought a great many cords for cellar walls by these measurements. It is customary for masons to measure one-half of all openings for all kinds of work.

Calculating the Bearing Strength of Timber.

From P. D., *Wallingford.*—I always feel great interest in the correspondence department of *Carpentry and Building.* I must say, too, that the paper all through is conducive to information to all its readers, both in a theoretical and practical point of view.

I have seen Prof. Carpenter's rules for finding the bearing strength of timber, but having looked them over only in a cursory manner, I did not put the rules to the test, as I felt quite satisfied with other methods I already had on the subject, and which I considered concise and comprehensive enough. I saw at a glance that his rule (fourth) obtained the same result as I did by a formula which I may here give. It may be considered interesting to some of the many readers of *Carpentry and Building.*

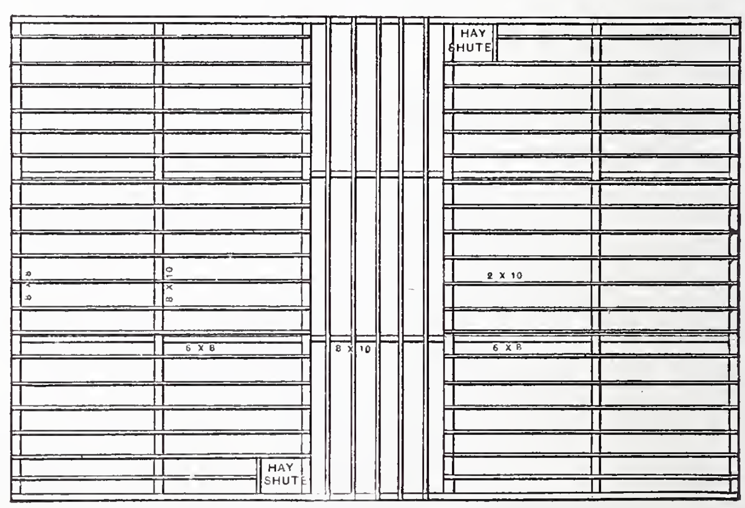
As regards Rule 6, I did not go into it in detail (of course I knew it to be the converse of Rule 4) until I read the letter of C. B. R., Los Angelos, Cal. ; then I saw the error, and would have commented on it in some of the succeeding numbers of *Carpentry and Building*, agreeably to his solicitation, but I thought it better to leave the matter open for the professor himself to make the correction. Seeing he has not done so, and knowing the great necessity for correcting seeming errors, which can be easily accomplished by many of the talented correspondents and contributors to your valuable monthly publication, I therefore deem it quite proper to, at least, keep ventilating such important subjects as this till fully discussed and left no longer in doubt. I admire the system adopted by the proprietor of the paper for affording such facilities for corresponding, because the mere fact of reading over the communications of others urges and prompts the general reader to follow up by research and study many subjects that would otherwise, without such an incentive, remain for ever in the background. The especial opportunity afforded the young man cannot be too highly appreciated; it will ultimately tend to the greater development of his mental faculties.

The following formula will, I fancy, clearly prove the professor's 4th rule, which I find correct. It may seem interesting to some readers to see how he gets the multiplier 90, 120, &c. At all events the reason or proof of a rule is acceptable to the inquisitive mind. It may be seen that they are found from contraction or cancellation in this formula.

It is well known that the strength of an oak stick 1 inch square and a foot long is estimated at 600 lbs., the stick being horizontally supported at its ends, and the weight resting upon the central points. White pine of the same size, 540 lbs., and so on, according to the material used. The numbers the professor gives in the July number of 1879 seem to be according to very good authority ; yet some treatises on mechanics give for pine a higher coefficient—600.

I may at once, without further demonstration, give the formula. In general $N\left(\frac{b \times d^2}{\text{length}}\right)$ expresses the strength of any beam in pounds and all the magnitudes in inches ; N representing the numerical coefficient, b breadth and d depth. As this expression gives the breaking load, 1-5th of it will be the safe load. Now, take the professor's example and substitute the numerical values in the formula, all as in inches ; the length will therefore be multiplied by 12, but only indicated to facilitate the cancellation. From No. 1 we get $5400\left(\frac{4 \times 36}{12 \times 12}\right) = 5400$ lbs., the breaking load. No. 2, or $450\left(\frac{4 \times 36}{12}\right) = \frac{90 \times 4 \times 36}{12}$ after taking 1-5th of 450. Take 1-5th of the coefficient and we get, after cancellation, the number 90 ; therefore, we may go by the above, for No. 1 is five times the safe load, and 5400 lbs. multiplied by 1-5th = 1080—that is, 1-5th of the breaking load is the safe load, so that the safe load may be found by either of the above ways. Another example : What will be the center safe load of an oak beam 10 feet long and 6 inches sq. $6000\left(\frac{6 \times 36}{120}\right) = 600\left(\frac{6 \times 39}{12}\right)$ = breaking strain. Take 1-5th of this and the safe load is found thus : $1\text{-}5 \times 600\left(\frac{6 \times 36}{12}\right) = \frac{120 \times 6 \times 36}{12} = 2160$ lbs.

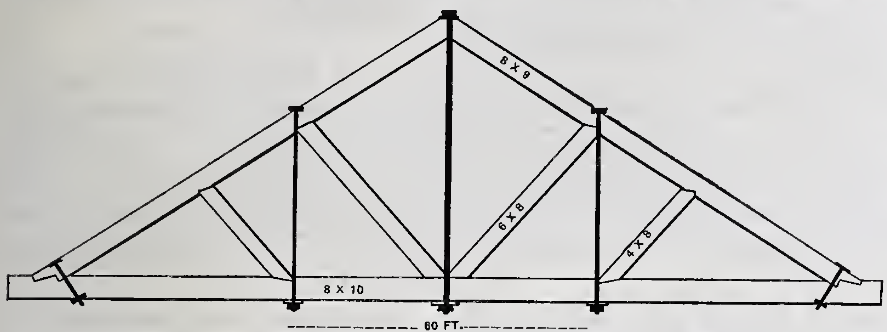
Now, to prove Rule 6, or make it what it ought to be, and perhaps what it was intended to be. We have seen from the foregoing that $1\text{-}5 \times 450\left(\frac{B\ D^2}{12}\right) = 1080$ lbs. $= 90 \times B \times D^2 = 12 \times 1080$. Now, divide the equation off by the coefficient of $B \times D^2$, and we get $B \times D^2 = \frac{12 \times 1080}{90} = 144$. Assume D = 6 inches, and divide by D^2 ; then $B = \frac{144}{36} = 4$ inches, or if B, breadth, be assumed, depth can be found ; thus $B \times D^2 = 144$; divide by B assumed (4 inches) and $D^2 = 36$. Extract square root and D = 6 inches ; that is, the section of the beam is 4×6 inches. To comply with part of the rule,



Framing a Bank Barn.—Fig. 6.—Plan of Floor Timbers.

1080 might be divided by 90, and the quotient multiplied by 12, the length.

This is exactly where Rule 6 errs, by not multiplying by the length of the beam ; this omission leads to the fallacy. If it be at all advisable to give a rule like the 6th, it should run thus, as may be gleaned from the formula : Multiply the safe load in pounds by the length in feet, and divide by the number 90; then, after assuming the depth, divide by its square ; the quotient is the breadth, or if the breadth be assumed, divide



Roof Truss.—Contributed by T. S. McV.

by it. Extract the square root and we get the depth.

I may take, for example, that given by C. B. R. in the January number ; then 1-5th $\times$ $450 \left(\frac{B \times D^2}{16}\right) = 1000$ lbs. $= \frac{90 \times B \times D^2}{16}$ $= 1000$ lbs., and $90 \times B \times D^2 = 16 \times 1000$. Divide by 90 and we get $B \times D^2 = \frac{16000}{90}$ $= 177.77$ inches. Assume depth and divide by its square and $B = \frac{177.77}{64}$ inches $= 2.777$ inches. The beam is, therefore, 2.777 inches $\times$ 8 inches in section. If B be assumed, then the depth is found by dividing by it and extracting the square root, as before.

Roof Trusses.

From T. S. McV., *Philadelphia.*—As I am not one of those who are disposed to get something for nothing, I will endeavor to contribute to the interests of the correspondents' department of *Carpentry and Building.* Inclosed please find a truss for roof, which I think preferable to that of R., of Buffalo, N. Y., published in a recent number. From experience with this kind of work, I would make the rafter 9 inches deep, and would not part the struts or braces in center on tie-beam. With regard to those braces in E. H. C.'s truss, I do not think them of any benefit whatever.

From W. V. H., *Sandy Grove, N. C.*—I inclose you the design of a roof truss, representing a construction of great strength and durability. So far as experience goes in this locality, it is second to none. We use it for factories, mills, ships, and in fact for all wide spans. The top purlins are to be mortised on to the top of the king-post. The purlins are bolted to the truss, as clearly shown in the cut. The king-post is tenoned and mortised on the cross-beam, and a key 2½ inches thick is driven through under the beam. It is not necessary for me to particularize further, for any one conversant with framing will understand the whole matter on inspection of the engraving.

Criticisims on E. H. C.'s Truss.

From T. V. D., *Royal Grove, N. Y.*—The design of truss by E. H. C., published in the February number, is one of the most uncommon pieces of foolishness I ever saw in the way of truss-work. It looks to me like the attempt of a novice, and puts me in mind of the man who, in trimming the tree, cut off the limb between himself and the trunk. He speaks of his braces as a great improvement. Now the facts are that if he will apply the force midway between the wall and king-rod, he will discover that the brace is of no account. Instead of adding strength it weakens the truss. Your correspondent's mode of framing the bearings does not evince strong reasoning powers. Altogether, I advise him to drop the truss business, before he injures the lives of more valuable men than himself.

"Clang, Lang, Slang."

From E. A. O. D., *Hudson, N. Y.*—Judging by the howling of H. McG., I am led to believe that his is a case in which the shoe pinches, and that a corn on his foot is rubbed in each of the illustrations he has used. Surely he has "put his foot in it," but if he will only take it out I will offer him my hand in good-will and call it quits. In my original communication I did not refer to correspondents by name, but the Editor made references in his comments. The word "lang" is an abbreviation for language. This much explanation I deem due to the readers of the paper. I trust the present communication is worded to the liking of H. Mc.G. I hope, therefore, he will be satisfied and accept my proffered hand. In return for the space I have consumed in my recent letters, I shall shortly send a budget of reliable matter for *Carpentry and Building.* I have an article on the construction of the stair, which, I think, will please your readers, and which I will send if it is wanted.

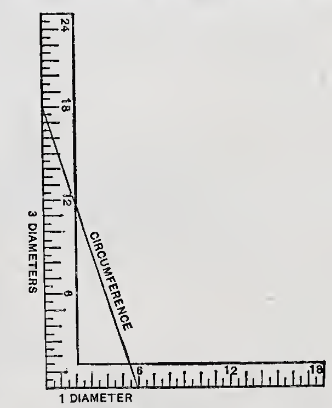
Note.—We have already assured our correspondent that his communications would be very acceptable. "Clang, Lang, Slang" has afforded a little innocent amusement without hurting anybody. Let us now get at more profitable work and have something that is of practical use all around.

Concerning the "Fast" Man on Hanging Doors.

From H. J., *Quincy, Ill.*—I desire to say to your correspondent J. S. B., that I don't use the man who hangs doors for hanging inside blinds ; consequently, I am unable to answer his questions. In order to satisfy G. H. and others, I will have my man prepare an explanation of his way of hanging doors by which such gratifying results are accomplished, and send it for publication soon. It would seem that certain inquirers doubt the truth of the assertion that a man can hang 20 doors in 10 hours. To convince them even before his statement is sent in, I will give one or two particulars at the present time. In the first place, he is a steady, hard-working man, and does not discuss politics during working hours. He puts down all his carpet sills, all of which have been prepared in advance, first. Then he fits all his doors, and, lastly, puts on the butts—the other trimmings, such as locks and bolts, it is customary in this vicinity, to put on after the painting is finished. Accordingly, that part of the labor is not neglected in my statement. He seems to gain more time in putting on the butts, compared with other men, than in any other portion of the work. He knows the required depth or angle necessary for the butts to be laid into the wood, while with most men it is necessary to try the butts several times during the process of fitting. With many it is necessary to put in layers or pieces of board underneath the butt to fill a space made by mistaken cutting. My man does not handle his doors as much as the majority of carpenters do ; he does not require an assistant to scribe the door by the opening. He uses a rod on which he lays off his butts. By this he lays off the butts on the door, and also on the frame, being careful to measure both the door and frame from the same end, either top or bottom.

Circumference from Diameter.

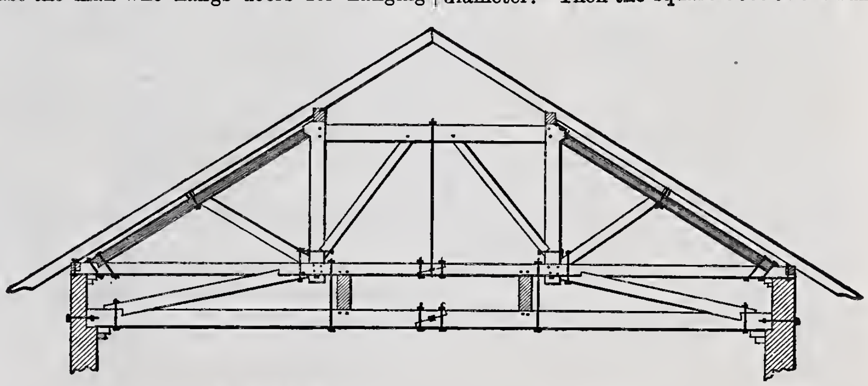
From Y. P., *New York City.*—I have read with great interest all that has been published upon the subject of the steel square, and I desire to call attention to a rule which I think will be of service to many of your readers. To obtain the circumference of any diameter, take one time the diameter on the tongue of the square, and three times the diameters on



Method of Obtaining (Approximately) the Circumference from the Diameter.

the blade. Then the hypotenuse of the triangle thus formed will equal the required circumference ; or the rule may be stated, in other words, as follows : To the square of the three diameters, add the square of one diameter. Then the square root of the sum will equal the circumference. The inclosed sketch will make the application of the rule plain. I recommend my fellow readers to use it.

Note.—Our correspondent has doubtless stumbled upon this rule by actual experiment. Any of our readers can see, by trial, that the result is a close approximation to the actual circumference. If, however, instead of taking one time the diameter on the tongue of the square, fifteen-sixteenths of the diameter is there taken, using three diameters along the blade, the result will be still closer to the actual circumference. Thus, upon a diameter of 16 inches, worked



Roof Truss.—Contributed by W. V. H.—Scale, 1-16 Inch to the Foot.

out as we have just described—that is, taking 48 inches along the blade and 15 inches along the tongue—we get 50.28 as the circumference, while 16 inches multiplied by 3.1416 is 50.26.

Proportions of Doors.

From G. W. C., *Yolo Yolo, California.*—With regard to the size of door for a 10-foot ceiling, I would say for front doors I use 28 x 68 inches, and for inside doors 26 x 66 inches. Of course the size of door depends in some measure upon the house. If the building be a two-story house, the front door can be larger than the dimensions I have given.

I desire to express my thanks to W. A. G., of Watsonville, Mich., for the information furnished with regard to the construction of picket fences.

From K., *Alfred Center, N. Y.*—My rule for the hight of doors is nine-twelfths of the hight of the room from floor to ceiling. This would make the doors concerning which A. K., of Smith Falls, writes, 7 feet 6 inches high.

ACKNOWLEDGMENTS.

P. J. P. Z., *Buffalo, N. Y.*, sends us a design for a picture frame intended for construction, by hand, from strips of walnut and cherry, which we are unable to publish at present for lack of space. Should the subject of picture frames receive more attention from our correspondents, we shall be pleased to refer to his sketch at another time in connection with others.

R. F. J., *Toronto, Canada*, has our thanks for the elevation and plan of a well-house. The structure is hexagon in plan, the walls being of latticework; a circular seat ex ends around inside. The opening of the well is at the center and is 18 inches in diameter.

D. Y. S., *Oswego, Kan.*, sends us a sketch and partial description of his tool chest, which, being very similar to others already published, we have not thought best to illustrate. In this connection we again remark that, even though we are unable to use our correspondents' favors, we are, nevertheless, always glad to receive them and examine them carefully.

J. P., *Mayville, N. Y.*, forwards the elevation and plans of a seaside cottage, which is somewhat peculiar in construction as well as in arrangement. The author calls attention to this peculiarity and the manner of building the house, some idea of which we can convey without engravings. The outside covering is made of 4 by 4 scantling, planed on all sides and ripped through cornerwise, making two pieces, each about 5½ inches wide. This is placed vertically and nailed against horizontal supports provided for it. In each angle formed by the triangular pieces, touching each other as they lie against the sills and plates of the building, is placed a small bead, thus giving to the whole exterior of the house a serrated or corrugated appearance. The windows and doors are constructed without casings, the studs being planed and so located as to take the place of jam casings. The edge of the outside covering projects over them and forms an outside stop. These are certainly quite novel features in the construction of a house.

From G. C. S., *New York*, we have a very complimentary letter concerning *Carpentry and Building*, especially commending the paper to apprentices and young graduates, which we regret our inability to publish in full. The writer, addressing himself to the young men in the trade, says: "Learn the 'how' first; master your trade, and you will acquire a conscious sense of power that will destroy the slip-shod way of doing things, so much now in vogue. The question with a young man is not how many acres can I shingle in a day, or how many dozen doors can I hang, but rather what can I do well, what can I do in a way to stand the criticism of a master and the wear of time."

N. Y. H., *Medfield, Mass.*, sends us a letter upon the use of the steel square for getting the lengths of rafters and braces, covering principles which have been explained in letters already published.

GENE, *Dunkirk, N. Y.*, forwards a neat sketch, together with a carefully prepared description of a method of obtaining the hip rafter for Mansard roofs, which is very nearly identical with one of those published two months since. We are sorry that he did not come in a little earlier, because there is just enough difference between his method and those we published to have justified our engraving his sketch along with the others. We think, however, the presentation of that subject in the May number sufficient for the present.

Several letters on the subject of shingling and what constitutes a day's work at hanging doors, &c., have been received, which contain no features of special interest, and which we feel that we cannot spare space to publish. Communications received on the subject of shingling in direct answer to certain queries propounded by a correspondent in a recent number, will be published in an early issue.

J. E. W., *Royalton, Wis.*, says: "My feats in shingling have been pretty thoroughly laughed at, but I have the satisfaction of knowing that I wrote nothing but the truth; but a truce to shingling stories. We have had enough of them." The same writer says: "I have an original design of a small house which I would send you if I thought I could make the drawings plain enough, so that you could get the idea. I am not much of a draftsman." We reply: Send along the drawings anyhow. No doubt we shall be able to understand you, and if the drawings are desirable for publication they will be engraved in good shape. We shall be glad to receive more drawings from our readers than we are at present obtaining. Plans for which we have no use will be returned when so requested.

The few letters that appeared in a recent number on scaffolding have not by any means exhausted the subject. We hope our readers will not drop it where it is. It is not less important than the tool chest question, which is still exciting interest. We have received several very desirable sketches and descriptions of tool chests which will be published in an early number.

G. H. H.'s fallacious rule for backing hip rafters, which was the theme of W. B.'s long letter, published in our last number, has received considerable attention from others of our correspondents. Among them J. E. W., *Royalton, Wis.*, who sends a letter with two diagrams, showing that the less pitch the roof has the more acute will be the angle of the backing by G. H. H.'s rule, which the writer says, as every carpenter knows, is the reverse of the truth; while C. M. A., *Manchester, N. H.*, illustrates by three diagrams a rule which the writer would substitute for that of G. H. H. In part this correspondent is correct in his rule and in part he is not correct. The exhaustive presentation of the subject by W. B. will, we think, be found of profit to him.

REFERRED TO OUR READERS.

Topics Suggested.

From J. M. J., *Maysville, Conn.*—I hope the fast shinglers will let up this hot weather and let us have something on verandas, front doors, iron columns, window caps, inside finish for doors, windows, &c. Would like to have a statement from your readers concerning how to crown joists. Would like a sketch of a method of hoisting joists. What is the best lintel to use over windows and doors? What is the best plan for anchoring into walls? There are a thousand other subjects that might be mentioned pertaining to building matters, a discussion of which at this time would give the boys something to study, during the coming winter, in directions that would be greatly to their profit.

Foundations.

From A. M. F., *Cuero, Texas.*—Will the readers of *Carpentry and Building* give me a statement of what is essential to make a good foundation for brick and rock walls? What should be the standard in determining the character of work performed?

Construction of Octagon Bay Window.

From F. P.—Will some reader of *Carpentry and Building* give, through its columns, a plan of octagon bay, showing the roof, the bevels of jack rafters and a general idea of the construction throughout? A bay window, thoroughly worked up in this manner, would, I think, be of general interest to your readers.

Roofing Material.

From F. B. L., *Milton, Pa.*—Will some reader of *Carpentry and Building* inform me if there is any material, not very expensive, which can be spread on a shingle roof that has too little pitch, for making it water-tight? I think I have seen something of the kind recommended. Possibly it was coal tar and sand. If some one can give me information based upon his own experience, he will confer a favor.

Construction of an Observatory.

From P. S., *Clarence, N. Y.*—I am about to commence a job of work which is somewhat new to me, and accordingly I desire advice of some of the readers of *Carpentry and Building*. The structure is an observatory, to be 50 feet in diameter at the base and 20 feet at the top, an octagon in shape, and its hight to be 100 feet. I desire a plan of framing and advice as to the size of timbers best to be used. If any one will furnish me with a diagram of the above, with directions for bracing, and also how to raise it, he will confer a great favor. I may mention incidentally that directly where it is to be erected there is a large pine tree. We have thought of leaving the tree and building around it, so that tackle may be attached to the tree for raising. Is this a desirable plan for the purpose?

Cupola for Barn.

From S. F. F., *Waverley, Vt.*—I have carefully read the criticisms made by a correspondent in a recent number of *Carpentry and Building* upon those who ask for plans. The object in writing to you at the present time is to ask forgiveness of both you and the readers of "our paper" for the wrong it seems I have done them. To ask for plans appears to be a very grave offense, and, as I have been guilty of it, of course I am willing to be forgiven; but I would like to get the plans just the same, anyhow. Now, what I want is a cupola suitable for a stable, the size of which is 42 by 100 feet, with 20-foot posts. It seems to me that such a thing, published in *Carpentry and Building*, will be of interest to others besides myself. Will not some of those old friends of ours, such as "Wood Butcher," H. M. C., H. H. F. and others, take my request into consideration? I am one of those 26-year old boys that want to learn, and as I have got a barn on hand to build which requires a cupola, I want some one to help me out. This is a plain statement of the case, and I hope the readers will accord me forgiveness and supply my wants.

From C. P. B., *Claremont, N. H.*—I am about to put up a barn, 40 by 70 feet in plan, with 16-foot posts in first story and 8 feet in basement, making a total hight of 25 feet 10 inches frame. The roof is to be square pitch, which will make a hight of 45 feet 10 inches at one end of the ridge and 37 feet 2 inches at the other end, the front end being for a driveway into the story above the basement. Will some of the readers of *Carpentry and Building* send me a design of a cupola or ventilator of the right proportions for the building I have described? It should be neat in point of finish, of as small cost as can be and look well.

Note.—A similar inquiry was published from another correspondent two or three months since, to which, as yet, we have had no reply desirable for publication. Not only the design should be shown, but also the construction. We hope our readers will give this subject attention.

CARPENTRY AND BUILDING

A MONTHLY JOURNAL.

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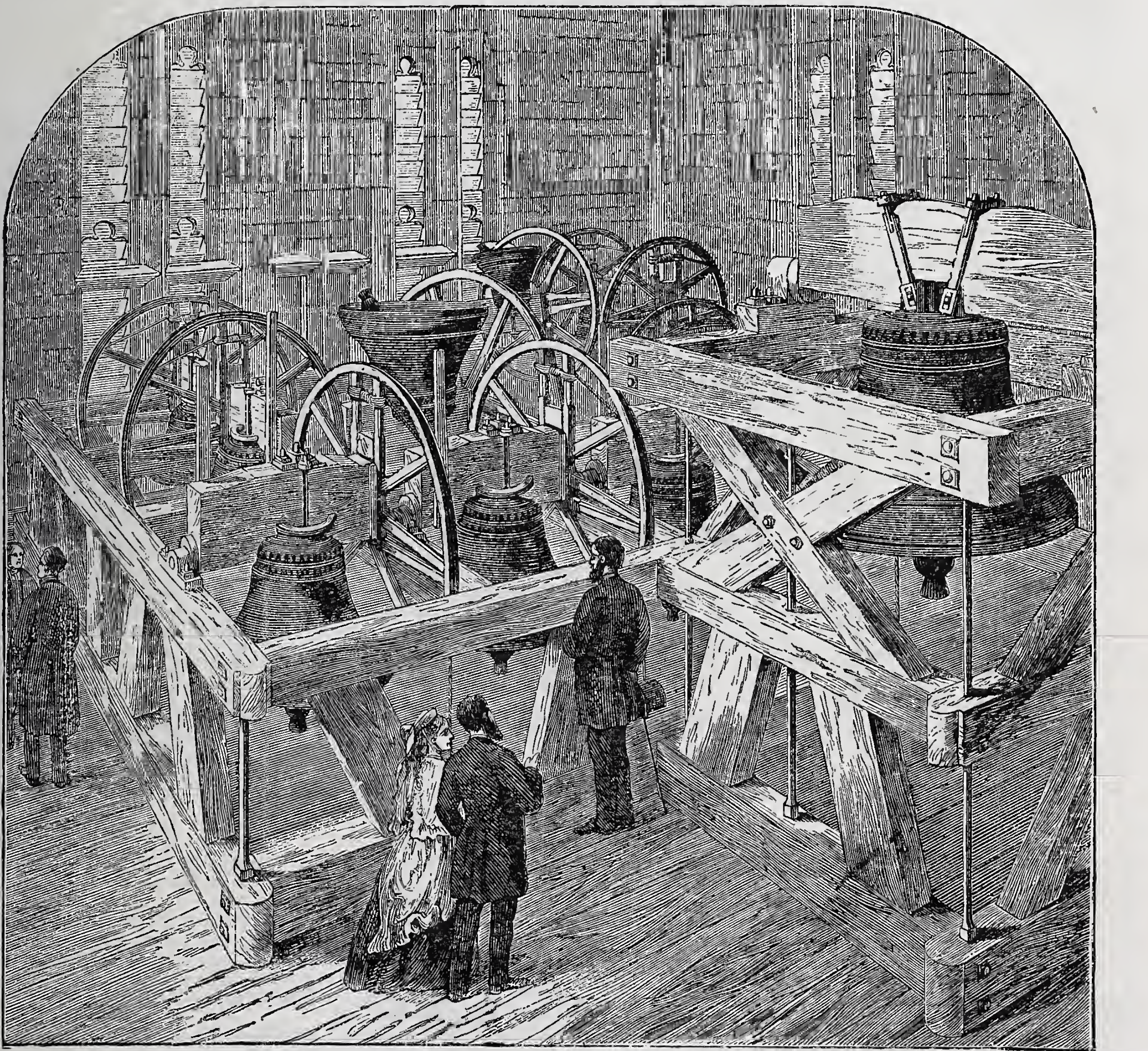
Chimes or Carillons.

The art of playing tunes upon bells of different sizes is a very ancient one, its origin probably dating back into the mythological times of the Chinese empire. In Europe the art of ringing bells of different notes in harmonious succession is exceedingly old. The first chimes or peals were originally played by having one man at each bell. These ringers, striking in their proper order, produced the music. This practice or method of the notes were played by the feet acting on peddles, while other parts were played by the hands, which for this purpose were protected by heavy gloves. Chimes rung in this way are still in existence.

The carillon which we illustrate is, however, of very different pattern. The falling of a weight furnishes power for striking the bells, and the machine or key-board is only required to trip the hammers. This machine was put up in 1874, in Worcester Cathedral, England, and is a fair type of the best ma- works upon the same principle as a music box, but instead of the pegs upon the barrel striking directly upon the bells or moving the levers that strike the bells, they simply liberate the hammers, which are thrown upon the bells by a weight. The machine is constructed so as to play no less than 28 tunes on 15 bells. This machine has 34 keys. It is wound up every morning, and plays eight times in the course of 24 hours. The same tune is repeated three times on each occasion, and continues in action 4½



Chimes or Carillons.—Fig. 1.—The Bells in Worcester Cathedral, England.

of playing is, we believe, kept up in some places even to the present day. As long ago, however, as the year 1480, machines were made for playing tunes upon chimes. In Holland chimes are used which could be played either by machinery or by a single individual working upon a key-board. Originally, the machine or key-board in these machines was so arranged that the stroke upon the key gave the force which sent the hammer upon the bell, consequently the work of playing a tune was very laborious. It was estimated that each stroke had to be equivalent to a two-pound weight. A part chines in use. We give a brief description: As will be seen by the plan (Fig. 2), there are 13 bells, varying in weight from 770 pounds for the smallest to 5600 pounds for the largest. The great bell of the tower, however, weighs more than 10,000 pounds. Making a total of some 15½ tons of metal. The cost, including the clock and taking down the old bells, was stated to be nearly $25,000. This chime is arranged so that it may be rung by hand, when the success of the tunes or chime depend entirely upon the skill of the performer. The Carillon machine, Fig. 3, is entirely automatic. It minutes. At the expiration of 24 hours the tunes are changed automatically. The motive power is obtained by means of a weight weighing 1600 lbs., which is regulated in speed by means of revolving vanes. The works of the machine are inclosed in a massive cast-iron frame, and bolted together with iron nuts and bolts 7 feet long. It weighs over a ton and a half. The line by which the weight is suspended is of steel, wound on an iron barrel, and is 280 feet long. Some of the hammers for striking the bells weigh as high as 225 lbs., their total weight amounting to rather more than a thousand pounds, while the weight of the whole machine, including hammers, cranks, lines, &c., is over 4 tons. It is said that this machine works with such ease, and throws so little strain upon the key-board, that it might be arranged to replace the barrels by a piano-forte key-board, allowing it to be played with the fingers.

The method of hanging these bells, as shown in Fig. 1, will strike most of our readers as somewhat primitive. All the yokes are of wood, and the greater portion of the framework is of wood, oak being used for the purpose. The unbalanced hanging doubtless makes the larger bells very difficult to ring, and though from their long swing the utmost power is obtained from them, yet it is at great expense of labor. The method in which the wooden and iron framing has been combined will doubtless strike many of our readers as a novelty. It is one which we hardly expect to see repeated in this country.

Paraffine.

The most distinguished mechanics of the present day are in the habit of accumulating, in some convenient place, a great variety of chemicals and substances which are used in the arts or in chemical investigation, or by mechanics. Note is made of the properties and uses of these substances, and all are arranged so that they can be made available at a moment's notice. A man thus prepared with a well-filled laboratory, is ready for any emergency which he may meet in the workshop. Although the mechanic cannot afford to stock laboratories, and would not find it profitable even though he might attempt to do so, he can have a few useful substances always within reach. Better yet, the mechanic may, with little expense, accumulate in a note or scrap book a great store of facts in regard to different substances, which may be of use to him in the absence of a well-stocked laboratory.

Among the substances which should have a page to itself in the note book is paraffine. This is so useful and valuable, and at the same time so cheap, that a small supply may well be kept in the shop.

Its name is derived from the fact that it has little or no affinity for other substances, the term paraffine being composed of the Latin words *parum* (little) and *affinis* (affinity). The material was discovered in 1830 by a German chemist named Riechenbach. It was first obtained from beechwood tar, but the petroleum oils are now the common source of supply. It has also been obtained from the distillation of shale. It is a hard, white, waxy substance, without taste or smell. It is composed of hydrogen and carbon, in about the proportions of 85 carbon to 15 hydrogen. It is not decomposed by chlorine, strong acids nor strong alkalies. The paraffine derived from wood tar melts at about 112° F.; that obtained from petroleum is harder or softer, according to circumstances. We have seen "soft paraffine wax" that would begin to show signs of melting at about 98 degrees, and other pieces that would stand, probably, 140° F.

Paraffine unites, by melting, with sulphur, phosphorus, wax and rosin, and dissolves freely in hot olive oil, in turpentine, in cold essential oils and in ether. Alcohol, even when pure, acts but slightly on it. Chemically speaking, however, it forms no known compound. For a long time the substance seemed to have little value, but it has since been found that for the mechanic it has a great value. The paraffine candle gives the best of all flames for fine blow-pipe work. If it is desired to put a drop of solder in a place where no soldering copper can reach, the solder pellet may be placed in position cold, and a fine point of flame made to melt it just where it is wanted.

Every one knows what havoc acids and alkalies make with corks wherever they come in contact with them. Here paraffine comes to the assistance of the workman. By boiling corks in paraffine they not only go in and out of the bottles tightly and easily at the same time, but they resist the action of the acids better even than the more expensive rubber stoppers, and are much more convenient than glass stoppers. Aqua-ammonia is found in almost every house, and in the summer time is difficult to keep, even when glass-stoppered bottles are used. It will give little trouble when the glass stopper has a coating of paraffine, or if the paraffined cork is used.

Paper soaked in paraffine can be used for a great many purposes for which tinfoil is commonly employed. If the paper is to be put around eatables of any kind, it has the great advantage over tinfoil that it is perfectly harmless, while most of the tinfoil in the market contains a large proportion of lead, which makes it injurious if it comes in contact with certain articles used for food. Many kinds of candy are now wrapped in paper coated with paraffine. Paper so treated is water-proof and impervious to the air. Plaster of Paris soaked in paraffine is a very different substance from the plaster as it comes from the mold. It is comparatively tough, can be chipped and carved or turned in the lathe, and a smooth clean surface can be obtained upon it. It then resists water very well and loses the chalky texture which characterizes it before it is so treated.

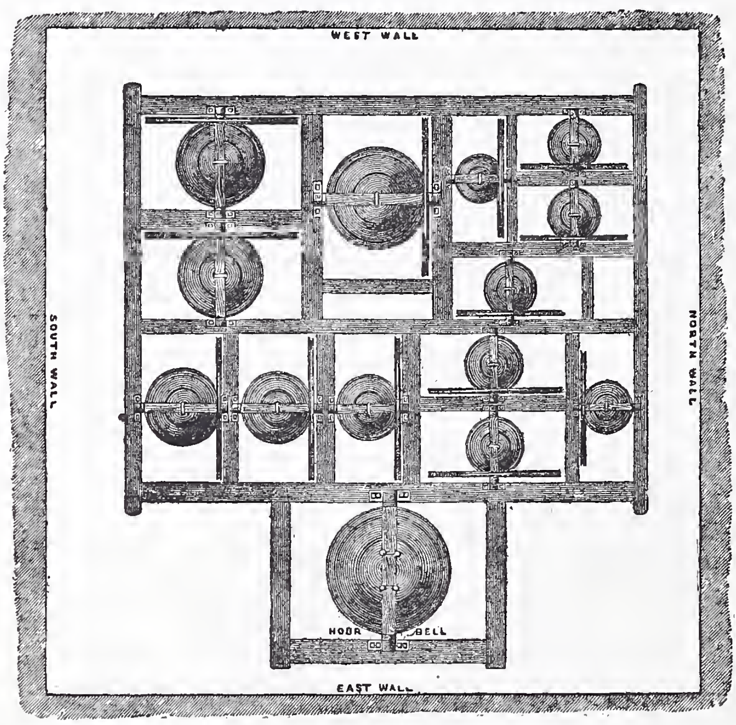
If doors, windows or the drawers of chests or boxes stick fast, there is nothing which will make them move so easily as rubbing the sticking parts with paraffine. If it can be melted on by passing a hot flat iron over the surface to which it has been applied, so much the better. It will then soak into the wood, and while rendering it smooth and diminishing the friction as though grease had been applied, there will not be the least danger of greasing clothes that may come in contact with it. A common paraffine candle is a convenient form, as it can be rubbed over the surfaces, and if the weather is not too cold, enough will stick to make the window or stubborn door go smoothly, if it will go at all. We have found paraffine the best of lubricators for all sorts of wood surfaces.

A plastic, semi-transparent compound for making casts of small fancy articles may be made by using a compound of two parts unbaked gypsum (probably whiting, or even plaster of Paris would answer as well), one part bleached beeswax and one part paraffine. This becomes plastic at about 120° F. By varying the proportions, it could be made harder or softer, as may be desired.

Wood thoroughly filled with paraffine, put on hot, will resist water, and tanks could, we think, be made in this way which would be entirely water-proof and very durable. This does not appear to have had sufficient attention from those who build tanks for holding water.

As paraffine combines readily with many of the oils and by their use can be softened, it is a very good substance from which to form etching grounds of various kinds for marking figures upon steel by the use of acid. A thin layer of the paraffine is put on, the figures or letters cleanly cut through the coating, and then the acid (nitric, in case of steel) is applied. Of course, a little ledge or dam of wax or paraffine is built up all around the place where the pattern is to be marked, in order to prevent the acid from flowing off. A thin coating of paraffine is an admirable protection for a tool, or any article of steel or iron which it is desired to prevent from rusting. Owing to its softness, it will only answer for articles which are not to be used. The coating peels off readily. It is put on by warming the article till it will melt the paraffine, which is then rubbed upon the surface until the article is covered with a thin coat Applied to a cloth of almost any kind, paraffine forms a water proofing substance in the body of the fabric. Even a paper box may be made to hold water by thoroughly filling the paper with paraffine. The paraffine must be well soaked in; otherwise the paper may swell. To apply it, take a pretty warm flat iron, not hot enough to scorch the paper, and rub a little of the paraffine on the bottom, and apply to the paper or pasteboard. Then, by keeping the iron well supplied, the paper is kept hot and the paraffine soaks in.

The iron rubs it in and spreads it over the surface at the same time. In this way the paper or board may be perfectly filled and made water-proof. Thick or porous paper or board needs a much greater quantity than that which is thin or more solid. Besides these uses, every one who uses it will find out a great many others for himself, applicable only in his own work, and which will be of great advantage.



Chimes or Carillons.—Fig. 2.—Plan of Bells in Worcester Cathedral.—Approximate Scale, 1/8 Inch to the Foot.

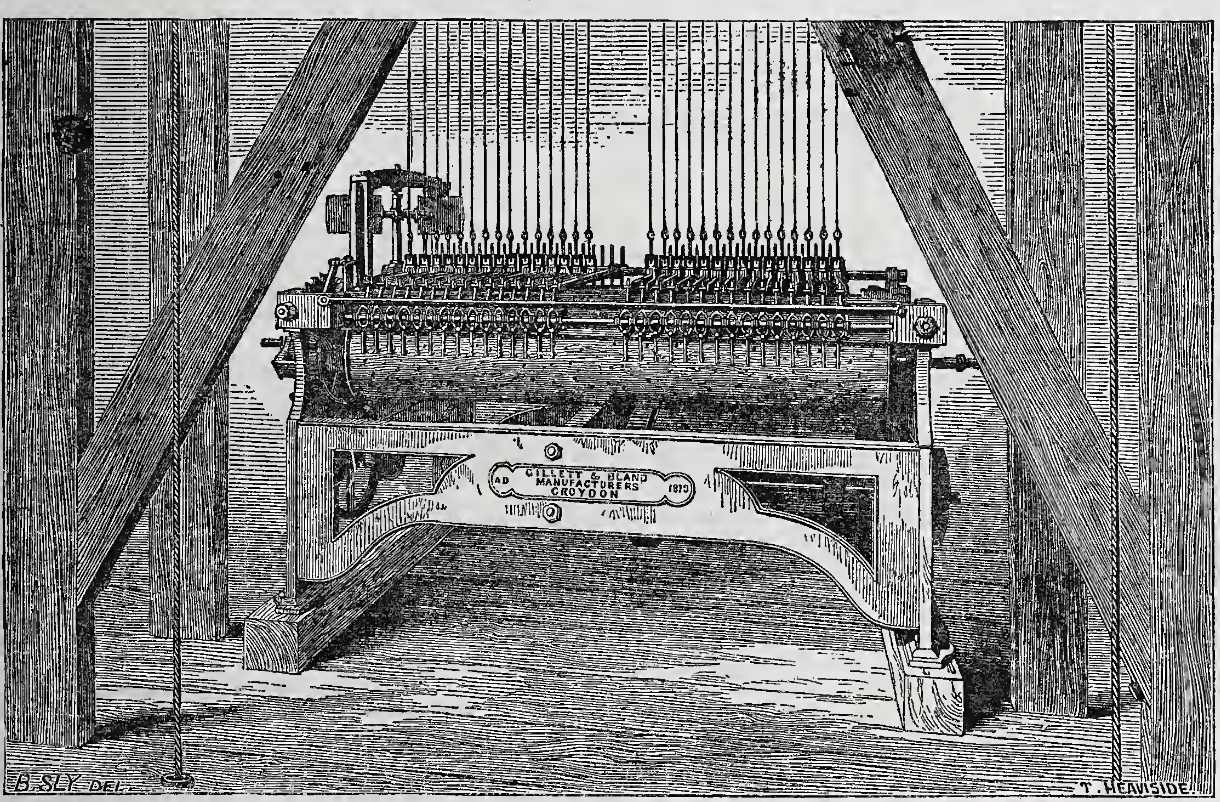
Gunter's Chain.—About the beginning of the seventeenth century Edmund Gunter devised the lineal measure called "Gunter's Chain," to facilitate the measurement of land and the computation of acreage. He made the chain consist of 100 straight links, each 7.92 inches long, in order that square links may be at once converted into acres by shifting the decimal point. For 7.92 inches = 0.22 of a yard, and the square of this = 0.0484 of a square yard = the 100,000th part of 4840 square yards, or of one acre; so that square links are converted into acres by dividing by 100,000, or by merely removing the decimal point five places to the left. (Example: A rectangular field measures 825 links by 430. How many acres does it contain? 825 square links × 430 = 354,750 square links, Now, one acre being 100,000 square links.

the area just found being divided by 100,000, or, what is the same thing, having a decimal point inserted before the fifth figure from the right, becomes 3.5475 acres, or 3 acres 2 roods 7.6 perches.) Gunter's chain is the land surveyor's general instrument for measuring the distance between two extreme points of a field. The hundred links into which it is divided are joined by rings, and at every tenth link, from each end to the middle, is attached a notched piece of brass, that at 10 links having one notch, that at 20 links having two, &c., and that at 50 links, the middle of the chain, having a plain circular piece of brass. For measuring short side distances perpendicular to the main line of measurement, a staff, usually 10 links in length, is used, called an "offset-shaft."

Blistering of Paint and Varnish.

Many are the opinions expressed regarding blistering, and although some very sensible theories are advanced, we are inclined to believe that the bottom of the subject has never been reached. We hold an opinion of the cause of this trouble, and it may be that this opinion has been forestalled by others ; but, as we have never seen the points laid down in print, we present them here. Blistering of a varnished surface, after the varnish has had proper time to harden, is due to the evaporation of moisture which lies confined under the shell of varnish. This evaporation is caused by heat, and it is seldom, if ever, a blister will rise upon a varnished surface without the temperature is raised to an extreme degree, near to that which the varnish received in its manufacture. The accumulation of moisture under the varnish may be brought about in several ways, the most particular one being in the closing in of moisture in the rough stuff. During the rubbing of the rough stuff the water used is partly absorbed, and unless due care is taken to give ample time for "drying out" before the application of subsequent coats, a great amount of moisture will be confined within the cells of the rough stuff. Boiled oil contains moisture, as of water, and in cases where steam is used to express the oil from the seed this percentage is increased. Turpentine, an extremely volatile liquid, also forms an evaporating substance which is rendered active by a slight heat, and in its haste to reach the air it disturbs the outer surface, either lifting an elastic coating into bubbles or blisters, or bursting open a hard and inelastic one into cracks. The primary cause, then, of blistering is moisture, either in the form of wet moisture or of evaporating liquids, such as turpentine. The wood may be unseasoned, or it may have been wetted in the course of preparation, such as steaming to bend, &c. The rough stuff water may have been applied before the evaporation of liquids had taken place, either of which would bring about disastrous results.

"Dry blistering" is simply the hasty absorption of the liquids from outer coats by putty or paint, which is especially porous, depriving the coating of the requisite amount of binding and adhesiveness. To prevent blistering, close up every lurking place for moisture, and be careful to have each coat dry before applying another.



Chimes or Carillons.—Fig. 3.—Carillon Machine Employed in Worcester Cathedral.

"Tools and the Man."

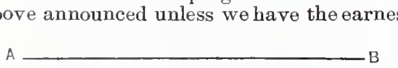
It is not tools that make the workman, but the trained skill and perseverance of the man himself. Indeed, it is proverbial that the bad workman never yet had a good tool. Some one asked Opie by what wonderful process he mixed his colors. "I mix them with my brain, sir," was his reply. It is the same with every workman who would excel. Ferguson made marvelous things—such as his wooden clock that accurately measured the hours—by means of a common penknife—a tool in everybody's hands; but then, everybody is not a Ferguson. A pan of water and two thermometers were the tools by which Dr. Black discovered latent heat, and a prism, a lens and a sheet of pasteboard enabled Newton to unfold the composition of light and origin of color. An eminent foreign *savant* once called upon Dr. Woolaston and requested to be shown over his laboratory, in which science had been enriched by so many important discoveries, when the doctor took him into a study, and pointing to an old tea-tray containing a few watch glasses, test papers, a small balance and a blow-pipe, said, "There is all the laboratory I have." Stothard learned the art of combining colors by closely studying butterflies' wings ; he would often say that no one knew what he owed to these tiny insects. A blunt stick and a barn door served Wilkie in lieu of pencil and canvas. Berwick first practiced drawing on the cottage walls of his native village, which he covered with his sketches in chalk, and Benjamin West made his first brushes out of the cat's tail. Ferguson laid himself down in the fields at night in a blanket, and made a map of the heavenly bodies, by means of a thread with small beads on it, stretched between his eyes and the stars. Franklin first robbed the thunder-cloud of its lightning by means of a kite made with two cross-sticks and a silk handkerchief. Watt made his first model of the condensing steam engine out of an old anatomist's syringe, used to inject the arteries previous to dissection. Gifford worked his first problem in mathematics, when a cobbler's apprentice, upon small scraps of leather, which he beat smooth for the purpose, while Rittenhouse, the astronomer, first calculated eclipses on his plow handle.

Ventilation of a Theatre.—The system of ventilation in use in the Madison Square Theatre, New York, is thus described by one of the daily papers : By means of two immense fan wheels, each 8 feet in diameter and having a face of 36 inches, the air in the theatre is completely changed in five or six minutes. The supply fan is below the theatre and draws the air from the roof, distributing it by a complicated process to all parts of the house at the rate of 1,000,000 cubic feet per hour. On its way from the roof the air is passed through an enormous net, known as the "dust-catcher," which is 40 feet in depth, cone-shaped and made of cheese cloth. By means of this the air is greatly purified before reaching the auditorium. It is next passed over an immense ice chest and cooled. From 2 to 3 tons of ice are consumed daily. A cupola 6 feet square on the roof of the building admits the air through four windows opening in the directions of the points of the compass, so that advantage can be taken of the direction of the wind at any time. Beneath the auditorium is an intricate system of air boxes and tin pipes. The pipes, 305 in number, are distributed to the seats on the floor above, and all are supplied from the large fan, which travels at the rate of a mile a minute. Each person in the parquet thus has a separate supply of fresh air throughout the performance. There is just about one mile of these tin tubes. As the air is always admitted from the front, there are no disagreeable drafts upon the backs of the audience. The heat from the footlights is driven below the stage and thence passes directly to the roof and escapes; and the heat from all the gas jets, which are inclosed in glass, is removed by a similar method. The impurities in the air caused by the 13,000 jets which compose the large chandelier are in like manner removed. The exhaust fan on the roof thus draws out of the building each hour 1,200,000 cubic feet of impure air.

Practical Stair Building.—I.

PREFATORY.

In commencing a series of papers upon the subject of stair building and hand railing, a topic of the greatest importance to carpenters and joiners, we desire to call the attention of our readers to our purpose, to the means we propose to employ, and to the ends we hope to accomplish. Our purpose is to discuss the subject from the practical side. To this end we shall draw from all the sources at our command, which include valuable original manuscripts, letters from practical stair builders, interviews with mechanics who are experts in this line, and the published works of recognized authorities. We shall take from each simply those portions which it seems to us are especially adapted to the requirements of our subscribers. We shall be guided throughout by the expressed wants of our readers, and shall give special prominence to those features concerning which our correspondents seem most anxious to be informed. Our correspondence department will ever be open for questions upon this subject, and all queries addressed to us will, in due course, receive the best replies we are able to give them. Any principle or problem which may be presented in one number of the paper will be open for discussion upon the part of correspondents in succeeding numbers, and criticisms and comments from practical men among our subscribers will always be welcomed. By this means we hope, in the course of time (the interval depending very much upon the interest which our readers take in the subject), to treat it quite exhaustively and in a manner calculated to make the art of stair building comprehensible to men of the most ordinary attainments in science. It is hardly necessary to add that we shall not be able to carry to a successful conclusion the programme we have above announced unless we have the earnest



Stair Building.—Fig. 1.—A Straight Line.

co-operation of all our readers. Hence we have taken special pains to express our hopes and wishes in the matter.

We propose to use plain language, to avoid technical expressions wherever possible, to define terms as we go along, so that there can be no doubt as to the sense in which they are used, and to explain the principles upon which the art is based in such a manner as to make the papers complete in themselves. This plan may render the articles of less interest to advanced students than some other course which might be recommended, but we are convinced that the large majority of our readers will be best served thereby.

At the outset, we shall be obliged to give some attention to the elements of geometry. We shall do so in the way of a familiar talk about principles rather than by abstract definitions.

Our endeavor throughout shall be to bring the subject down from the position in which it has been left by most writers to the level of the ordinary mechanic. We shall be very careful not to attempt anything above the comprehension of the rank and file of journeymen carpenters; and if, by any accident, anything does creep in which is not readily understood, our correspondence department will afford the opportunity of clearing it up.

ELEMENTS OF GEOMETRY.

1. Extension has three dimensions—length, breadth and thickness.

2. A point is place or position without magnitude, as the intersection of two lines or the center of a circle. It is therefore frequently represented to the eye by a small dot.

3. A line is measured by length merely, and may be either straight or curved.

4. A straight line, or, as it is sometimes called, a right line, is the shortest line that can be drawn between two given points. Straight lines are commonly designated in drawing by figures or letters at their extremities, as A B, Fig. 1.

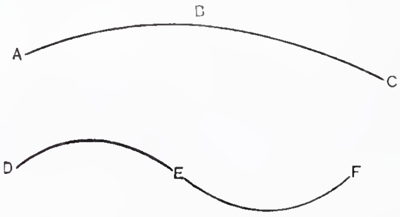
5. A curved line is one which changes its direction at every point, or one of which no portion, however small, is straight. It is therefore longer than a straight line from the same points. Curved lines are designated by letters or figures at their extremities and at intermediate points, as A B C and D E F, Fig. 2.

6. A given point or a given line expresses a point or line of fixed position or dimension.

7. Parallel lines are those which have no inclination to each other, being everywhere equidistant, as A B, A^1 B^1, in Fig. 3, which can never meet though produced to infinity. C D and C^1 D^1 of Fig. 3 are also parallel lines, being arcs of circles which have a common center.

8. Horizontal lines are such as are parallel to the horizon, or level. A horizontal line in a drawing is represented by a line drawn across the paper from right to left, as A B in Fig. 4.

9. Vertical lines are such as are parallel to the position of a plumb-line suspended freely in a still atmosphere. They are frequently called by mechanics plumb lines. A



Stair Building.—Fig. 2.—Curved Lines.

vertical line, or plumb line, is represented in a drawing by a line drawn up and down the paper, or at right angles to a horizontal line, as E C in Fig 4.

10. Inclined lines occupy an intermediate position between horizontal and vertical lines, as C D of Fig. 4. Two lines which converge toward each other, and which, if produced, would meet or intersect, are said to incline to each other, as D C and C B of Fig. 4.

11. Perpendicular lines are perpendicular to each other when the angles on either side of the point of junction are equal. Vertical and horizontal lines are always perpendicular to each other, but perpendicular lines are not always vertical and horizontal. They may be at any inclination to the horizon, provided that the angles at the point of intersection are equal. In Fig. 5, C F, D H and E G are said to be perpendicular to A B; also in Fig. 6, C D and E F are perpendicular to A B.

12. An angle is the opening between two straight lines which meet each other. An angle is commonly designated by three letters, and the letter designating the point in which the straight lines containing the angle meet is put between the other two letters.

13. A right angle. When one straight line meets another straight line so as to makethe adjacent angles equal to each other, each angle is called a right angle and the straight lines are said to be perpendicular to each other. Thus in Fig. 5 the straight line D H meets the straight line A B, and the angle D H A is equal to the angle D H B. Each of these angles, then, is a right angle, and D H is perpendicular to A B.

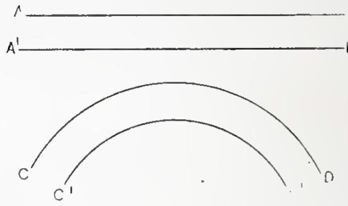
14. An acute angle is an angle less than a right angle, as D C B in Fig. 4.

15. An obtuse angle is an angle greater than a right angle, as A C D of Fig. 4.

16. A surface is that which has length and breadth without thickness.

17. A plane is a surface such that if any two of its points be joined by a straight line, the line will be wholly in the surface. Every surface which is not a plane surface, or composed of plane surfaces, is a curved surface.

18. The angle formed by the intersection of two planes is called a solid angle. (See Fig. 7.) The line of intersection is the vertex and the planes are the sides of the angle. In the figures shown, the line passing through E G is the vertex of the angle. Such an angle may be designated by the name of the vertex line, as the angle at E G, or by the names of any two lines drawn from a common point in the vertex and at



Stair Building.—Fig. 3.—Parallel Lines.

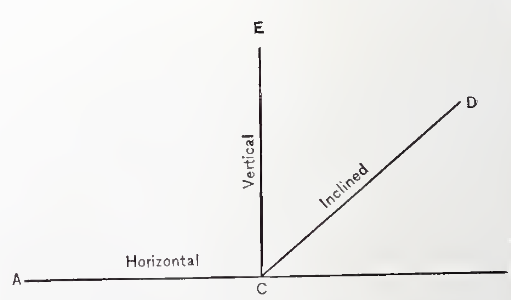
right angles with the vertex line, as the angle A B C, or the angle D E F.

19. A plane figure is a portion of a plane terminated on all sides by lines either straight or curved.

20. Rectilineal figures. When surfaces are bounded by straight lines they are said to be rectilineal.

21. Polygon is the general name applied to all rectilineal figures, but is commonly applied to those having more than four sides. (See Fig. 8.) A regular polygon is one in which the sides are equal.

22. A polygon with five sides is called a pentagon; with six sides a hexagon; with seven sides a heptagon; with eight sides an octagon; with nine sides a nonagon; with ten sides a decagon, and one of twelve sides is called a dodecagon.



Stair Building.—Fig. 4.—Names of Lines with Respect to Position.

Use of Spectacles by Workingmen.

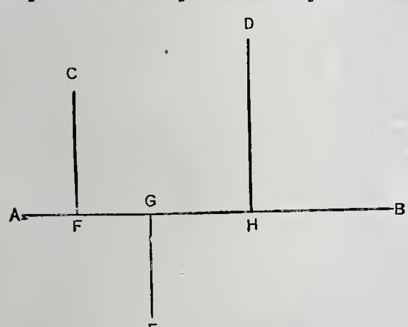
The following very interesting article upon the use of spectacles deserves the careful attention of workmen of all branches of industry, although it was originally addressed to machinists in particular:

It is often hastily assumed by employers that artizans wearing glasses are not so well fitted to do certain classes of delicate work as those who depend exclusively upon their natural eyesight. This notion, it would appear, is a mistaken one, and in a recent work on the subject, Mr. R. B. Carter mentions one very remarkable proof of the harmlessness of using glasses—and even of employing a single glass. Among watchmakers it is an unavoidable necessity of their calling to work by the aid of a single glass, and they appear to enjoy an enviable immunity from eye diseases. It is, he says, exceedingly uncommon to see a working watchmaker among the patients of the ophthalmic department of a hospital, and he entertains little doubt that the habitual exercise of the eye upon fine work tends to the development and preservation of its powers.

The persons who suffer most, according to Mr. Carter, from popular prejudice and ignorance on the subject of spectacles, are men of the superior artisan class, who are not engaged on work which requires good eyesight, and who, at the age of 50 or sooner, find their power of accomplishing such work diminishing. It is, he tells us, a rule in many workshops that spectacles are altogether prohibited, "the masters ignorantly supposing them to be evidences of bad sight, whereas the truth is they are not the evidences of bad sight at all, but only of the occurrence of a natural and inevitable change, the effects of which they entirely obviate, leaving the sight as good for all ordinary purposes as it ever was." Mr. Carter adds that "in many shops in which they are not prohibited they are still made an excuse for a diminution of wages; and the result of these practices is that hundreds of good workmen struggle on, perhaps for years, doing their work imperfectly, when a pair of spectacles would instantly enable them to do it as well as at any former period. In the present state of knowledge there is no excuse for rejecting a man's services, or for diminishing his payment, because he requires spectacles, unless it can be shown that, even when he is furnished with them, his sight is below the natural standard of acuteness." Persons who are condemned to the use of spectacles will thank Mr. Carter for thus coming forward as their champion.

Using Cements.

Quite as much depends upon the manner in which a cement is used as upon the cement itself. The best cement that was ever compounded would prove entirely worthless

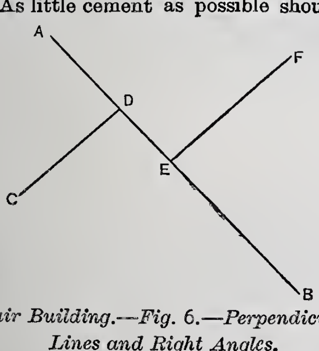


Stair Building.—Fig. 5.—Perpendicular Lines and Right Angles.

if improperly applied. Many complaints in regard to the quality, both of cements and glue, arise from neglecting proper precautions in their use. The following rules must be rigorously adhered to if success would be secured:

1. Bring the cement into closest contact with the surfaces to be united. This is best done by heating the pieces to be joined in those cases where the cement is melted by heat, as in using rosin, shellac, marine glue, &c. Where solutions are used, the cement must be well rubbed into the surfaces, either with a soft brush (as in the case of porcelain or glass), or by rubbing the two surfaces together (as in making a glue joint between two pieces of wood).

2. As little cement as possible should be



Stair Building.—Fig. 6.—Perpendicular Lines and Right Angles.

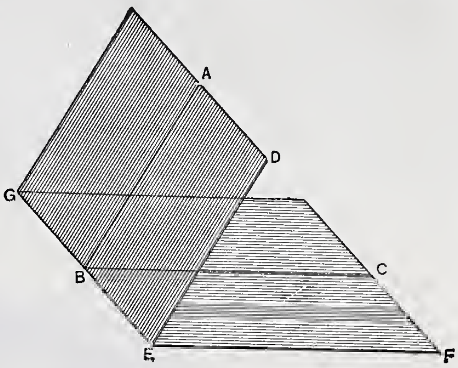
allowed to remain between the united surfaces. To secure this the cement should be as liquid as possible (thoroughly melted if used with heat), and the surfaces should be pressed closely into contact by screws, weights, wedges or cords until the cement has hardened.

3. Plenty of time should be allowed for the cement to dry or harden, and this is particularly the case in oil cements, such as copal varnish, boiled oil, white lead, &c. When two surfaces, each half an inch across, are joined by means of a layer of white lead between them, six months may elapse before the cement in the middle of the joint has become hard. In such cases a few days or weeks are of no account; at the end of a month the joint will be weak and easily separated, while at the end of two or three years it may be so firm that the material will part anywhere else than at the joint. Hence, when the article is to be used immediately, the only safe cements are those which are liquefied by heat and which become hard when cold. A joint made with marine glue is firm an hour after it has been made. Next to cements that are liquefied by heat are those which consist of substances dissolved in water or alcohol. A glue joint sets firmly in 24 hours; a joint made with shellac varnish becomes dry in two or three days. Oil cements, which do not dry by evaporation, but harden by oxidation (boiled oil, white lead, red lead, &c.), are the slowest of all.

Preventing Decay of Woodwork.—How to prevent the decay of woodwork exposed in open air to the changes of the weather, to alternations of wet and dry, heat and cold, is a problem that has taxed the ingenuity of man every where. Most timbers, worms and insect enemies apart, will last a long time if kept constantly dry or constantly wet in an equable atmosphere; but they will not long resist the effects of constant alternations from dry to wet and from wet to dry. More especially is this the case where the wood is placed in the ground, as in the case of the main sills of wooden houses, of posts for railings, &c. Charring, painting or tarring the surface of the wood is often adopted; but these remedies, even if always applicable, do not always produce successful results. They need to be continually renewed, and they certainly do not preserve the wood from the disease known as dry rot. The decay of wood embedded in the earth is also difficult to guard against; but a simple precaution, costing neither money nor labor, will increase the durability of posts put in the ground by 50 per cent. This is simply by taking care that the wood is inverted—*i. e.*, placed in the opposite direction to that in which it grew. Experiments have proved that oak posts put in the ground in the same position in which they grew, top upward, were rotten in twelve years, while their neighbors, cut from the same tree and placed top downward in the soil, showed no signs of decay for several years afterward. The theory is that the capillary tubes in the tree are so adjusted as to oppose the rising of moisture when the wood is inverted.

Inlaying.—Every one has noticed that in ordinary inlaying there is a very ugly glue joint, equal in its width to that of the saw used, which runs round the whole of the inlaid pattern. This, of course, looks bad, and further, it involves the use of a very fine saw to reduce the width as much as possible. This, again, involves the use of comparatively thin wood. To avoid this, tilt up the saw table a little on one side—say the right. With it in this position cut out the right side of a letter—say a capital I. Obviously the uppermost of the two pieces of wood on which we are operating would have its I slightly broader than the bottom one. Then finish the letter, being always careful to make the cut "sun about," as the phrase is; *i. e.*, in the same direction as the hands of a clock move. We now have an I cut out of the top piece slightly broader and longer than that cut out of the lower one. If we have proportioned the amount of "tilt" of the table with due regard to the thickness of the saw and of the wood used, the upper I will just fit neatly and tightly into the space left in the lower piece. Apply plenty of glue and gently tap the letter or monogram into its place, and we have a glue joint which will be barely visible. The amount of slope required in the table is very slight, and one soon finds out the happy medium.

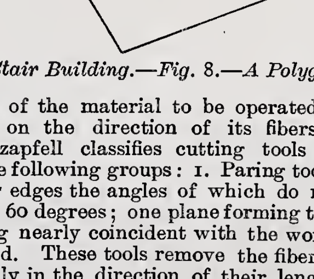
The Course of Lightning.—Prof. Calladon, of Geneva, has made some interesting observations on the course of lightning when it strikes trees and houses. He holds that the great discharges which injure the trees and houses seldom or never happen while the lightning has an unobstructed course—which it has along the thin upper branches of trees, where birds and their nests are often left quite uninjured by its descent. But it is where the electric current reaches



Stair Building.—Fig. 7.—A Solid Angle.

the thick stem that the tree becomes a worse and worse conductor, and it is here, therefore, the tree is what is called struck—*i. e.*, here it is that the electricity, failing to find an unobstructed channel to the earth, accumulates in masses, and gives out shocks which rend the tree. And the same is true of houses whose lightning conductors stop short of the ground. Prof. Calladon has also shown that the close neighborhood of a pool of water is a great attraction to the electric current, and that the electricity often passes down a house or tree till it is near enough to dart straight across to the water; and he thinks that, where possible, lightning conductors should end in a spring or pool of water. He believes that lightning descends rather in a shower. It divides itself among all upper branches of a tree, and it is received from hundreds of atmospheric points at once, instead of, as has been usually supposed, from one. Electricity is a rain, a number of tributaries from a wide surface, not a single torrent.

Edge Tools.—All edge tools may be regarded as wedges formed by the meeting of two straight or curved surfaces, or of a straight and curvilinear surface, at angles varying from 20 to 12 degrees. Occasionally the tool is ground with two basils, as in the case of the hatchet, the turner's chisel and some others. The angle of the basil in cutting tools depends on the hardness or soft-



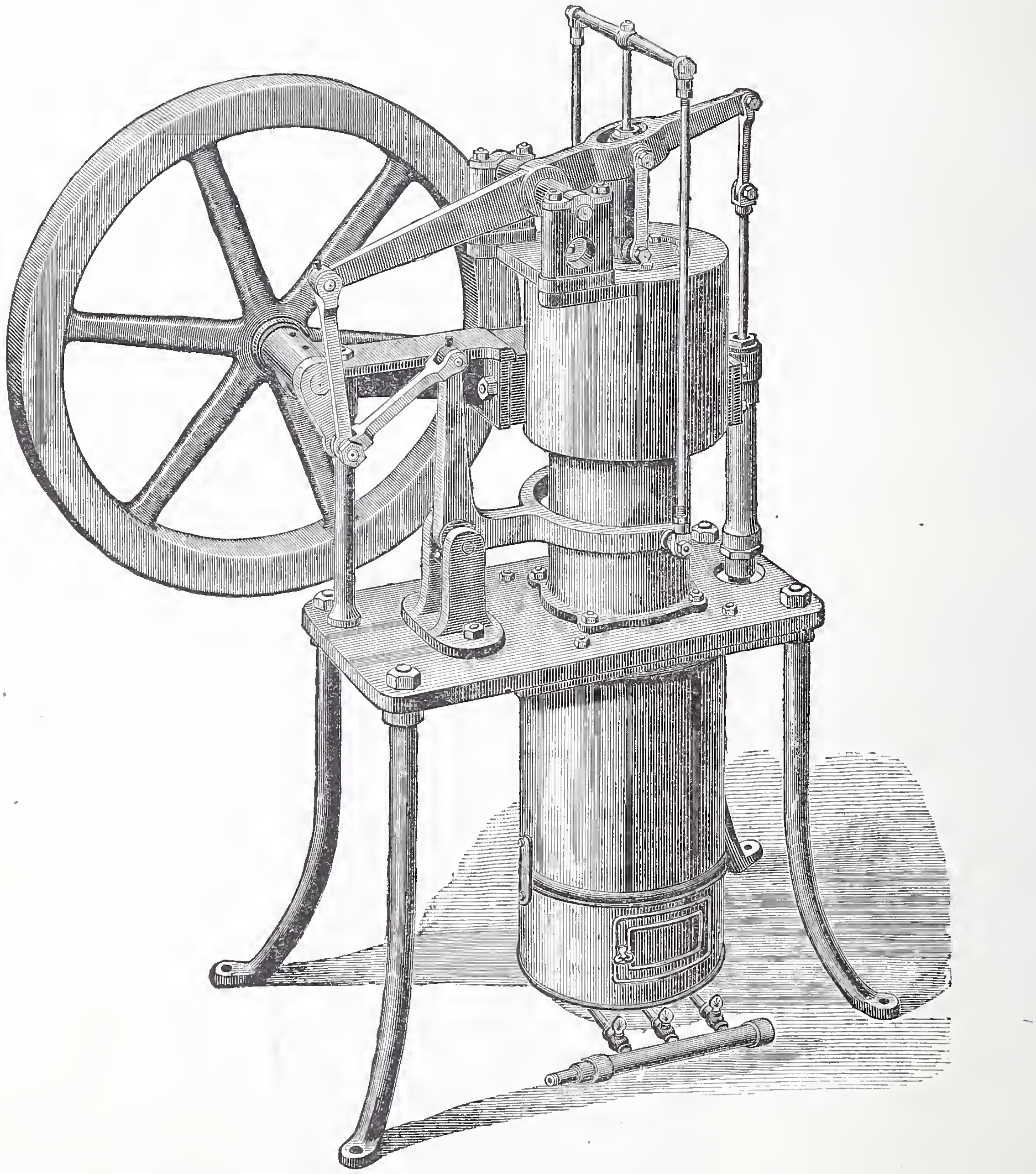
Stair Building.—Fig. 8.—A Polygon.

ness of the material to be operated upon, and on the direction of its fibers. Mr. Holtzapfell classifies cutting tools in the three following groups: 1. Paring tools with their edges the angles of which do not exceed 60 degrees; one plane forming the edge being nearly coincident with the work produced. These tools remove the fibers principally in the direction of their length. 2. Scraping tools with thick edges, varying from 60 to 120 degrees; the planes of the edges forming nearly equal angles with the surfaces produced. Such tools remove the fibers in all directions with nearly equal facility, producing fine dust-like shavings, by acting superficially. 3. Shearing or separating tools, with edges from 60 to 90 degrees, generally duplex, and then applied on opposite sides of the substance to be operated upon. One plane of each tool, or of the single tool, is coincident with the plane produced.

Ericsson's New Caloric Pumping Engine.

It is now about 25 years since Capt. John Ericsson astonished the country by the introduction of a small motor especially adapted for domestic work, in which the power was derived from heated air. There is probably no intelligent person in the United States who is not in a general way familiar with this fact, and yet very few people have even a vague idea of how, by means of heated air, an engine can be made to accomplish work. In describing a new pumping engine of this character, which Capt. Ericsson has lately given to the world, we shall endeavor to give some insight into its methods of working, as well as to call attention to some of the labors which he has beings merely for the purpose of pumping water or turning the cranks on machines. A host of caloric engines, copied from it to a greater or less degree, followed, and competed with it for the market. Steam-engine builders, attracted by the richness of the field, also entered into the competition, and have reaped an enormous harvest.

To those who are acquainted with Capt. Ericsson's manifold labors in the investigations of the most abstruse problems which he has carried on for years, the designing and construction of iron clads and other vessels of war, there would seem little likelihood that he would find time to return to the problem of the domestic motor. Such, however, is the case, and we find that the captain has produced a caloric engine and pump combined which, in many by absorbing heat. It does this almost instantaneously. In fact, for all practical purposes we may assume that the air does absorb heat in an instant, or without taking any time. As it becomes heated it tends to expand, and if allowed to push up a piston and accomplish work, it will become cold, just in proportion to the amount of work which it does. If after doing a given amount of work the air is carried back to the heated plate again, or the heated bottom of a cylinder, it will be instantly ready to do another portion of the work. In the long cylinder of the caloric engine we have the bottom highly heated by the application either of the furnace fire or a gas jet. In the upper end of the cylinder is a piston working up and down. The lower portion of the cylinder is occupied by a large, loosely



Ericsson's New Caloric Pumping Engine.

accomplished in this direction. In the field of domestic motors which are safe and easily managed, Capt. Ericsson has led the world by many years. In fact, he may be said to have created a demand for small engines of all sorts. Power is now used almost universally, even where the quantity needed is not more than can be obtained by the labor of an able-bodied man for half a day at a time. This is in marked contrast to what was the practice 25 or 30 years ago, when light machinery was frequently driven by men or boys. In country printing offices, one or two men were frequently employed to run the press. Capt. Ericsson's caloric engine, put in the market just before the war, was so cheap, so easily worked and so perfectly free from danger that people found it no longer profitable to use human respects, stands as far ahead of its competitors to-day as did the original engine 20 or 25 years ago. Our illustration shows the external appearance of the engine. It consists of a long cylinder, having a fire-pot at its lower end mounted in a frame, which occupies a floor space of about 24 x 30 inches. The pump is attached at one side to one end of an arm or lever, the other end of which is connected with the crank of the fly-wheel. How a machine so simple in external construction as this is can be made to give power simply by lighting a fire in its furnace, it is difficult even for the experienced mechanic to see. And the difficulty is by no means diminished when we say that the engine has no valves whatever.

Atmospheric air, when brought in contact with a highly heated surface, expands fitting hollow plunger. When this plunger is forced down to the bottom of the cylinder the air occupies that portion of the cylinder below the piston and above the plunger. The operation of the engine is as follows: By means of the arrangement of bell cranks, levers and connecting rods the plunger is first raised, by which movement the air within the cylinder is forced into the lower end, where it comes in contact with the hot surface of the bottom, and is heated and expanded instantaneously. At this time the piston is at the lower portion of its stroke. The heated air expanding with considerable pressure forces the piston up and turns the fly-wheel, thus performing one effective stroke. The energy stored up in the flywheel over and above what is used by the pump carries the plunger to the bottom of its stroke, while the superfluous heat in the air is absorbed by a water jacket which, as may be seen in the engraving, constitutes an enlargement of the upper end of the cylinder. The cool and contracted air, by a repetition of the motions we have described, is then again forced down upon the heated plate, expanding at the bottom of the cylinder, by which it is as before, and so returns continually through the same cycle. Thus it will be seen that the engine performs its work by taking in a fresh supply of air, and without the necessity of valves for the regulation of its motion. The cylinder being long, the packing for the piston is removed to a considerable distance from the heat of the furnace, and so is not liable to burn out. The plunger being simply a hollow shell and not fitting tightly in the cylinder, is not injured by the heat. In operating the engine, all that is necessary is to kindle the fire, and when the bottom plate of the cylinder has become thoroughly warmed, to give the fly-wheel a few turns. Thus started, it will continue in operation until stopped or until the fire is withdrawn, and the engine has become cool. It is a remarkable fact that so little is the amount of heat necessary for running one of these engines, that it will continue to run and perform work for a comparatively long time after the fire has been withdrawn. An engine of this kind with a 6-inch cylinder, it is said, will pump 200 gallons of water 50 feet high in 1 hour, or a proportionately smaller quantity of water to a greater hight. When gas is used for fuel, the consumption, according to some experiments, amounts to about 15 cubic feet per hour. The largest sized engine, which has an 8 inch cylinder, is advertised to raise 350 gallons in the same time to the same hight, with but a small increase in the consumption of fuel. If coal is burnt, an ordinary scuttleful is sufficient to last the engine for a day's work.

The caloric engine affords very many advantages over any of the domestic motors now in the market. There is no danger of explosion, and the engine requires no more attention than can be given by any one who has sufficient intelligence to build a fire or light a gas jet, and is capable of keeping a machine properly oiled. The insurance companies make no higher rates for the use of a caloric engine than they do for an ordinary stove. The pump used in connection with this engine is single acting, and is sent out complete with valves and connections all ready to attach unions to the pipes. In fact, all that is necessary to be done in setting up a pumping engine of this kind is to make the attachment between suction and dicharge pipes and screw the feet to the floor; the engine is then ready for operation.

Some idea of the labor that has been bestowed upon perfecting the caloric engine may be gained from the fact that one of Capt. Ericsson's early engines, built as far back as 1843, used the same air over and over. Capt. Ericsson built an engine operated by heated atmospheric air in London as long ago as 1833. In 1856 several engines were built having the water-jacket feature of this engine, so that we may really say that the engine as now put into the market is the result of more than 50 years continuous and successful experimentation. After his arrival in this country in 1839 he built several caloric engines in succession, all of which promised ultimate success, and in each one the dimensions were enlarged, until in 1851 he constructed an immense engine which had two working cylinders, each one being 72 inches in diameter. Few inventors, indeed, have had the courage to experiment so long on such a magnificent scale, and few have been so successful in their work as Capt. Ericsson.

We may say in conclusion that the parts of the engine are likely to be durable. Most of them, with the exception of the main links and pump connecting rod, have no appreciable amount of work to do; hence we may expect the machine to last. The manufacturers, Messrs. C. H. Delamater & Co., 10 Cortlandt street, N. Y., are building the engines upon the interchangeable plan, so that any worn or damaged portion may be easily and cheaply replaced should it be necessary.

In the article appearing in the July number of *Carpentry and Building*, entitled "Stable Furniture," cuts 2 and 4, by some accident, were transposed. We presume many of our readers detected this mistake at the time. We deem it only just, however, to call attention to it in this issue. The reversible corner manger is shown in position for use in Fig. 4, and is shown reversed for emptying in Fig 2.

Heating Buildings.

Mr. Edward S. Philbrick, of Boston, Mass., a well-known civil engineer, recently delivered a lecture before the students of the Massachusetts Institute of Technology upon the subject of the ventilation of buildings. His remarks upon the advantages of the open fire-place and its value as supplementing the more important and essential means for heating which must be used in this climate, are worthy of attention.

Mr. Philbrick says: The various methods of heating buildings which are in general use in this country have each their special uses and advantages. A proper selection or combination for any particular place requires some attention to be given to these different methods. Open fire-places are very wasteful of heat, and as a sole dependence are in this climate entirely inadequate for any purpose except single rooms of a limited extent. When used in connection with other methods of heating, they become a valuable auxiliary. The heat is imparted from them by radiation, which does not heat the air at all, except by first heating the walls and surfaces with which the air comes in contact; thus a degee of comfort is attained without over-heating the air. The sun heats the atmosphere in a similar way—by first heating the surface of the earth, which imparts heat to the air by contact. Moreover, the open fire is a valuable help in removing vitiated air from a room, and is, therefore, particularly useful in hospitals and other sick rooms. In a room that is occupied by women and children, and by men of sedentary occupations, and is heated by hot water, steam, furnaces, or stoves, a higher degree of temperature is required for comfort than if a small open fire is used in connection with the other means. Moreover, all rooms that are heated exclusively by currents of warm air that have passed through heating apparatus give a higher degree of temperature near the ceiling than near the floor, tending to make the head warmer than the feet, a a very unsatisfactory state of things, which is partly corrected by the open fire.

If, without an open fire, we demand in this climate that the air should be heated to 70 degrees or higher, while if supplemented by a radiating fire it is equally comfortable and much more conducive to health to keep the air about 10 degrees cooler—*i. e.*, if the fire shines on us—the desired heat of the body is maintained without heating the air above 60 degrees. When wood fuel was abundant, 50 years ago, scarcely any other means were employed for heating dwelling houses. The result was not satisfactory, for the influence of the fire was hardly felt beyond the room where it was kept. The fire might be too hot for comfort near by, while on the opposite side of the same room ice might be forming. When wood became more scarce and anthracite was first introduced into our houses, economy and ingenuity devised various kinds of close stoves, which, while very saving of fuel, overheated the air without providing for its renewal. The result was a detestable degree of closeness, with loss of vigor, pale faces and dyspepsia among the family. Later came the furnace in the cellar, which is only a large stove for heating rooms above by a circulation of hot air through pipes. The advantages of this method, as compared with detached stoves, are chiefly in the introduction of a constant flow of fresh air, if taken from a proper place, supplied to various apartments at will, heated to a comfortable degree, and a saving of labor by concentrating the fires in one place.

This was a considerable advance on the detached stove system, provided the air was allowed a way to get out of the room after being vitiated. In fact, for dwelling houses of small capacity this method, when properly regulated and proportioned, and supplemented by small open fires in the rooms that are constantly occupied, leaves little to be desired. The whole house can be thus kept at a temperature of about 55 or 60 degrees, while the rooms most occupied are heated to about 65 degrees, and thus made quite comfortable by small open fires of wood or soft coal. These heat the inmates without heating the air, as above explained. There is but little doubt about the lower temperature being most healthful, provided comfort is attained, for the breathing of cool air is far more conducive to physical vigor. Even invalids gain strength and can be made quite comfortable out of doors with the thermometer at 50 degrees, if well clothed and exposed to the sunshine while sheltered from the wind. In order to get good results from a heating furnace, regard must be had to the following: First, ample size for the fire-pot, and extended heating surface, so that the needed volume of air can be warmed without the iron becoming red hot and overheating the air. It should never be over 100° to 110° F. when introduced into the rooms. Second, ample-sized pipes, proportioned to the sizes of the rooms. No definite rules can be given for these sizes, which should be adjusted to the exposure of the room as well as to its size, particularly in a country house.

The management of the fire demands more judgment and foresight than is often bestowed upon it in the changeable weather of our climate. Anthracite fires are very convenient in this respect—that they do not need frequent attention to keep them alive; but if an equable temperature is to be maintained in the house, this fuel is so slow to ignite and so slow to burn away that some foresight must always be exercised in controlling the draft. A great variety of patterns for such furnaces are offered in our market. Their relative merits depend more upon the quality of workmanship and their strength than upon the particular kind of material. The strength and conductive power of iron render it almost the only material, though soapstone is used to a small extent. It is desirable to keep the joints tight, of course, to prevent the diffusion of the gases of combustion into the hot-air chamber that is to supply the house. For this end it is found that horizontal joints are better adapted than vertical ones in cast iron. Wrought iron has been considerably used of late, with tightly-riveted joints. When new, it is doubtless a tighter material than cast iron; but it is more perishable, and quite as likely to change its form and work its joints open by alternate heating and cooling, so that its superiority is not yet fully established by experience. The permeability of cast iron to the passage of gases is due more to the quality of the metal than to its fusibility.

There is no more difficulty in making cast iron impermeable to gases of combustion than for steam, and it is used universally for steam pipes, and to some extent for boilers also, under a thousand times the pressure that can ever exist in a stove with an open smoke-pipe. In order to avoid the chance of furnaces leaking gas, the exit for smoke and gas to the chimney should be ample in size and unobstructed by dampers. Such dampers should be forbidden by the Board of Health. If the draught is to be checked to reduce the heat of the fire, the smoke-pipe should never be reduced in capacity. The proper way is to close the orifices below the fire and exclude the air from the grate. In order to accomplish this more effectually, the fittings for doors below the fire should be made heavier and firmer than they now are, and carefully fitted by planing the joints, so as to control the flow of air into the fire.

It is found to be difficult to get satisfactory results in distributing heated air by horizontal pipes to a greater length than 10 or 12 feet from their origin, particularly when the room to be heated lies to the windward of the furnace, in extreme weather. When houses are expanded in size beyond the limits that can be thus served, two furnaces answer the purpose better than one.

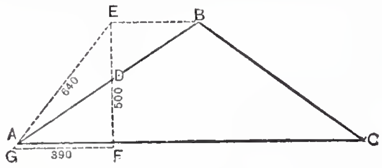
Machinery makes almost perfect copies of many things, and makes them cheaply; but art, ground out by steam engines, is not, after all, of a very elevating character.

Wooden Roof and Bridge Trusses.—Application of Principles.

BY GASTON M. ALVES.

Having treated in the preceding articles of mechanical principles and strengths of materials, it is now proposed to enter into the consideration of their application to some of the common forms of roof trusses.

The methods here pursued will be those of geometrical analysis, in which the amount of the strains are determined by scale measurements. The name geometrical analysis may impress those who are little acquainted with mathematics as something difficult and abstruse, but if carpenters will remember that they have simply to measure off pounds on a line to a scale, just as they are accustomed to lay off feet on a line to a scale, there will be no more difficulty in the geo-



Roof and Bridge Trusses.—Fig. 5.—Simple Form of Roof Truss, composed of a Pair of Rafters and a Tie-Beam.

metrical analysis here given than they find in their every-day drafting for framing, provided they have taken the pains to comprehend the mechanical principles heretofore given. Those familiar with analytical trigonometry will readily see the means of calculating the strains without resorting to the scale.

It may be stated here, however, that scale measurements are easier and less liable to errors, and, where the diagrams are carefully made, are sufficiently accurate for all practical purposes.

We may take in general the loads which roof trusses will be subjected to as follows, in pounds per square foot:

Wind and snow	20
Principal rafters and all material above them	10
Total	30
Tie-beam, joists, lath and plastering	15

The latter to be proportionally increased when a lower floor is suspended.

We will first investigate the simplest form of roof truss, Fig. 5, composed simply of a pair of rafters and a tie-beam. The dotted lines are merely used to indicate and measure the strains.

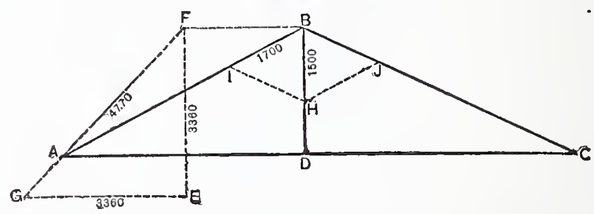
Let us assume the span A C to be 14 feet and the rise 4⅔ feet. Assume the trusses to be 2 feet apart and the material of fair pine. With any convenient scale, not less than ¼ inch to the foot, draft the truss. By scale measurement the rafters will be found to be about 8⅓ feet in length, and each rafter will bear 8⅓ times 2; equals 16⅔ square feet of roof surface, which, multiplied by 30 pounds, will give 500 pounds for the load on each rafter. Taking the horizontal length of the rafter, which is 7 feet, we will first ascertain the required dimensions to bear the transverse load of 500 pounds. Let us assume a depth of 4 inches in the rafters. Referring to the table of safe transverse strengths (April number, page 69), we find the safe strength of a beam 1 inch broad, 4 inches deep and 7 feet long is 286 pounds. Dividing 500 by 286 and we have 1¾ inches, nearly, as the breadth of the rafter that will safely bear the transverse load of 500 pounds. We have now to provide for the crushing strain, explained in March number, page 44. We find by scale measurement that this crushing strain, E G, is 640 pounds. We will take an additional amount of cross-section, at the safe crushing strain of 1000 pounds per square inch to meet this strain. Two-thirds of a square inch will give us 666 pounds, some 26 pounds more than the strain. We will then add this ⅔ of a square inch to the side of the rafter already found, which will make the rafter 1 5-6 x 4 inches, to meet both the transverse and crushing strains; we will say 2 x 4 inches

It may be remarked here that when a member of a truss is subjected to a cross strain and a strain of compression, the above method of calculating its dimensions for each strain separately, and then adding the dimensions obtained for the size of the member, is not in accordance with strict theory, but, at the same time, it is safe and sufficiently accurate for all practical purposes. Indeed, all rules on this particular subject must be more or less empirical, for the reason that no one can tell precisely how the fibers of material will behave under the combined strains, and hence pure theory cannot be applied. It will also be well to remark here that both rafters subjected to a cross strain and purlins are proportioned by the rules of safe transverse strength, and that ceiling-joists and tie-beams are proportioned by the rules of stiffness; hence, for the former we use table in April number, page 69, and for the latter, table in May number, page 90.

We will now take the tie-beam or ceiling-joist A C. Its length being 14 feet, we multiply by 2 feet, the distance apart, and we have 28 square feet of ceiling surface, and this by 15 pounds gives 420 pounds as the load. Let us assume a depth of 7 inches to the tie-beam or joist. In the table in the May number, page 90, we find opposite 7 inches and under 14 feet, 215 pounds for a beam 7 inches deep, 14 feet long and 1 inch broad—hence, a beam 2 inches broad, otherwise of the same dimensions, will be sufficiently stiff under a load of 430 pounds—10 pounds more than the estimated load put upon it; hence, we will make our beam 2 x 7 inches. The beam will also have a tensile strain, G F, of 390 pounds, due to the horizontal thrust of the rafters, which, even if it was much greater, might be disregarded as within limits; a tensile strain will increase the stiffness and transverse strength of the beam. It is, however, very useful to know the amount of this thrust, in order to securely stay the foot of the rafters, which will hereafter be explained under the head of Joints. Such a truss as Fig. 5 is seldom built, but the principles involved in the ceiling-joists and rafters of small cottages are the same.

We will now consider Fig. 7, which, although it is not a good form of truss, yet will serve as a link in gradually developing the subject of roof trusses.

We will take the span A C as 20 feet, the rise B D as 5 feet, and the trusses 10 feet from center. Having laid this off to a scale, we find by scale measurement that the length of the rafters is about 11.2 feet; 11.2 × 10 equals 112 square feet, which, by 30 pounds, gives 3360 pounds as the load on each rafter. The horizontal length of the rafters being 10 feet, and assuming a depth of 8 inches, we find by the use of table page 69 that the breadth will be 4.2 inches. We find by the principle page 44 that there is a compression of 4770 pounds, due to the load on the rafter. This will give the rafter an additional cross-section of 4.77 square inches. The rafters have also an additional compression from the weight of the ceiling, carried to B by the tie-rod or king-bolt B D. Let us now estimate the amount. It is plain that the king-bolt B D sustains one-half of the weight of the ceiling, the other half being borne by the walls at A and C. Hence

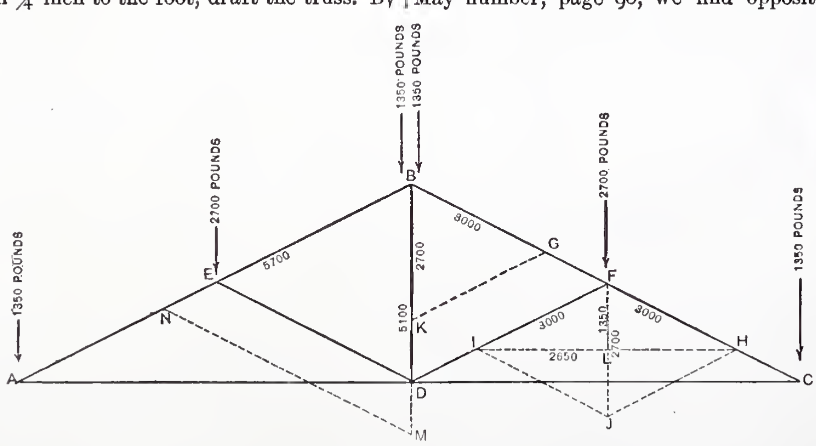


Roof and Bridge Trusses.—Fig. 7.—A Form of Truss not Recommended for Use, but Introduced to Illustrate Principles.

10 feet, half the length of the tie-beam A C, multiplied by 10 feet (distance of the trusses apart) gives 100 square feet, which by 15 pounds gives 1500 pounds as the weight sustained by the tie-rod or king-bolt B D. Laying off 1500 pounds on the line B D equals B H, we have by scale measurement, according to the parallelogram of forces, I B or J B equals 1700 pounds, the compression on the rafters due to half the weight of the ceiling. Taking the length of the rafter 11.2 feet, and its depth 8 inches, and regarding it as a pillar, we find its safe strength to be 464 pounds per square inch; hence, dividing 464 into 1700, we have 3.66 square inches of cross-section to resist the strain. The least side of the rafter is not taken, because the roof covering prevents it from bending laterally. Now, 4.77 square inches and 3.66 square inches = 8.43 square inches, which, divided by 8, the depth of rafter previously assumed, gives about 1.05 inches as additional width to the rafter. Hence, we have for each rafter 4.2 + 1.05 equals 5¼ inches in width and 8 inches in depth —a large rafter for so small a span, but none too large for such a truss, the defects of which will be seen as we enter into the discussion of other and better designs.

To proportion the king-rod, we find on page 68 that a ½-inch rod will sustain 1963 pounds, and, as this is 463 pounds more than the load, we will take this as the size, the next size smaller, ⅜ inch, not being sufficiently strong.

Now for the tie-beam. It being supported in the middle, we will consider it composed of two beams of 10 feet each. We have a load on each 10 feet of 1500 pounds. Assuming its depth to be 8 inches, we find by table page 90, that such a beam 1 inch broad will properly sustain 630 pounds. Hence a breadth of about 2½ inches would be sufficiently stiff, but, in order to correspond with our rafters, we will make it 5¼ inches in breadth.



Roof and Bridge Trusses.—Fig. 6.—A very Common and Excellent Form of Truss for Spans not Exceeding 32 Feet.

We come now, Fig. 6, to a very common form, and, at the same time, a very excellent form of a roof truss, when the span does not exceed about 32 feet. (At a greater span than this a different design or a modification of Fig. 7 will generally be better.) Let us assume the space A C to be 32 feet, the rise B D to be 8 feet, and the distances between the trusses 10 feet. The purlins to be placed just over or very near the ends of the braces at E and F, so that the rafters will not have to bear a cross or transverse strain. Having drafted the truss, we find by scale measurement that the length of the rafters will be about 18 feet, $18 \times 10 = 180$ square feet; 180×30 pounds $= 5400$ pounds, the load upon the rafter. The purlins being placed at A E B F and C, we have no cross or transverse strain upon the rafters, and consequently no oblique crushing strain, as in the two previous figures. Of the rafter B C, it is plain that one-quarter of the weight of the roof, viz., 1350 pounds, is sustained at C; one-half, viz., 2700 pounds, at F, and one-quarter, 1350 pounds, at B. The other rafter, of course, is affected in the same manner by its equal load. The weight of the roof borne by the rafter directly at C produces on the rafter a crushing strain obliquely across the fibers, but the strain is so slight that it need not be considered. We will now consider the strain produced by the weights at B and F. On the vertical line from B lay off B K = 2700 pounds; construct the parallelogram of forces, and measure the line B G = say 3000 pounds, which is a compression on the rafter B C. In the same manner lay off F J = 2700 pounds, which will give an additional 3000 pounds compression, F H, on the rafter. To this point we have 6000 pounds compression. The weight F J also produces a strain of compression, I F, of 3000 pounds on the strut F D. I F may be resolved into I L = 2650, and F L = 1350. The former is neutralized by the contrary force of the strut E D. The latter, added to the equal force from the strut E D, making 2700 pounds downward pressure at D, and which is sustained by the king-post or king-rod B D. B D also sustains half of the load of the tie-beam A C, which equals $16 \times 10 = 160$ square feet; 160×15 pounds $= 2400$ pounds; $2400 + 2700 = 5100$ pounds borne by the rod B D. Lay off B M equal to 5100 pounds, and B N = 5700 (strain on the rafters due to the pressure of struts and half weight of load of tie-beam) $5700 + 6000 = 11{,}700$ pounds, total compression on rafters. We are now to regard the rafters as columns bearing this load. The rafters being stayed at E and F by the struts and purlins, we are to take only their half lengths, viz., 9 feet. We find from the rules given in the April number for the safe strength of columns, that a column 5½ x 5½ inches, or a column 5 x 7 inches, each 9 feet long, will safely bear the load of 11,700 pounds. We will take the latter, and make our rafters 5 inches wide by 7 inches deep. We will make the tie-beam 5 x 10 inches, which will be sufficiently stiff, according to the table, under a load of 2405 pounds, 5 pounds more than the load. The braces have to bear a compression of 3000 pounds; making them 3 x 5 inches, we find they will only safely bear a compression of 2300 pounds—700 pounds less than the load—hence we will make them 4 x 5, which will safely bear 5200 pounds—2200 pounds more than the load. We occasionally meet practical (?) men who condemn calculations, and boast of a common-sense judgment. Would unaided judgment ever arrive at the fact that a brace 4 x 5 inches could be over twice as strong as one 3 x 5 inches?

Referring to our table of rods, we will make our king-bolt ⅞ of an inch in diameter. The reader is again reminded that in the above truss there is no cross strain upon the rafters, and there is supposed to be no weight on the tie-beam other than its own weight and that of the joists and plastering; otherwise the dimensions given above would be too small, but it is hoped that the attentive reader will find no trouble in proportioning the truss, by the aid of the foregoing principles, to meet any additional weights or requirements. As Fig. 7 is a very common form of roof truss, it might be expected that a table should be added here of the sizes of its different members for different spans, but such a table could be compiled to be based upon the same conditions of pitch or inclination of rafters and loads on tie-beams; and as these conditions are various in practice, such tables are calculated to work mischief, and should never be indiscriminately used by designers. To those who are acquainted with algebraic formula, the following will furnish absolute rules, meeting all conditions that can occur in such a truss.

Let W = the weight on each rafter.

Let W' = the weight on the entire tie-beam.

Let W'' = the weight suspended to the center of the tie-beam.

Let A = the angle included between the rafter and a vertical.

Let R = the compression on a rafter.

Let S = the compression on a strut.

Let T = the tension on the king-rod or post.

Let H = the tension on the tie-beam.

Then will

$$R = \text{sec. } A \left(\frac{3W}{4} + \frac{W'}{4} + \frac{W''}{2}\right)$$

$$S = \text{sec. } A \left(\frac{W}{4}\right)$$

$$T = \frac{W}{2} + \frac{W'}{2} + W''$$

$$H = \text{tan. } A \left(\frac{3W}{4} + \frac{W'}{4} + \frac{W''}{2}\right)$$

In the next paper other roof trusses will be considered.

Hand Magnifiers.

There is scarcely any one engaged in the mechanical arts who does not find occasion at times to use a magnifying glass. Though cheap microscopes and hand magnifiers have been brought within a few years so low in price as to be within the reach of all, almost every one possessing a magnifier of some kind, yet there are very few people who have any adequate idea of their value. There are fewer still who can use them to any advantage or gain any considerable amount of information from them. Yet a pocket magnifying glass need not cost over $1 or $1.25. Though having a comparatively small magnifying power, it will enable one to decide a great many questions that would otherwise be utterly unsolvable.

Taking up the question of the simple microscope for carpenters and builders, we are met first by the question of what sort of a magnifying glass should be employed. The varieties of glasses which can be used in the hands are quite numerous. Linen provers and bank note detectors, the eye glasses of jewelers and the 10-cent. magnifiers of the toy shops all go under one general series of instructions, and in their use depend for their successful operation upon the same principles. In regard to them Dr. Phin, in his little work on "How to Use a Microscope," says: "These are perhaps the most important of all optical instruments, and yet we rarely find a person who can use them successfully." There are but three points that require attention, viz.: The proper position of the magnifier itself, the perfection of illumination and the steadiness at which the instrument is held at the exact focal distance from the object. Many microscopes are so constructed that it is impossible to place them in a wrong position. The side which goes next to the eye, and the side which goes next to the object are so well marked that no mistake can be made. The greatest liability to error exists where there are two or three lenses of different powers fixed in the same frame and used together. This forms one of the most common and useful of our magnifiers, and the rule is always "to place the lens of the greatest power nearest the object. Plano-convex lenses should be placed with the plane or flat side next to the object." This little quotation contains a great deal of very valuable information, which should receive careful attention from any one using the magnifying glass. The exact focal distance is the distance at which the lens would throw a clear, sharp image of the sun or of a distant object upon a screen or sheet of white paper. When looking at an object through a lens, the focal distance is the distance at which the object is seen with the greatest clearness.

The same author continues: "Yet magnifiers are, in the majority of cases, used for examining opaque objects, and one of the most important conditions for perfect division is that the object be well illuminated. First of all, then, see that the light falls full and direct upon the object; then place the magnifier as nearly in focus as can be done without actually looking through the lens, and after this approach the eye to the magnifier. The errors most commonly committed are turning the object away from the light, cutting off the light by the projecting medium of a hat or cap, shading the object by the hands or the lens itself, and attempting to examine an object in a room that is not sufficiently lighted." Some one writing on this subject remarks, in a very funny way, that there are few things so disappointing and disgusting to a man who undertakes to work with a short-focus sample magnifier as finding his nose is so long that he cannot get near enough to the object to see it. With the higher powers of magnifying glasses a good deal of care is necessary in getting the light upon the object, for eyebrows, nose, and even the cheek, are likely to throw shadows when the object must be brought within an inch and a half of the eye.

Having secured a proper position for the magnifier and a good illumination, the next step is to devise some means for holding the lens steadily in focus during the examination. This is most readily effected by resting the hand that holds the lens upon the hand that holds the object, and then move together and the focus remains unchanged. Where the object is a transparent one it may be laid upon a piece of glass and looked at toward a piece of white paper. Thus the light is greatly increased, and there is little difficulty in the adjustment. Most of the common objects requiring examination are of such a character that even though the magnifying power is great, we can recognize the minute points from their having been described by others, or from actual knowledge in regard to them. While it would be impossible for a man with a hand magnifier to determine the structure of a piece of wood, if it was an utterly unknown substance to him, yet by taking thin shavings and using a magnifying glass, he can recognize the structure which he already knows has been determined by the use of more powerful glasses. A hand magnifying glass, properly used upon the edge of a tool, will determine many things in regard to how it has been ground and the condition of its edge which could not be found out by the eye alone, nor would the magnifying glass enable the points to be decided if we did not already know what the effects of grinding at different angles were, and how the edge of a tool ought to be.

The little linen prover so common among the dealers in dry goods houses is of great value, enabling one to estimate very accurately the relative size of the grains of various materials which may be presented to him. With such a glass the quality of a stone, the sharpness of sand or the quality of a piece of wood may be ascertained with much greater certainty than though dependence was placed upon the unaided eyesight. So much knowledge can be obtained in this way, after a little experience and some practice in the use of a hand magnifier, that we are surprised that intelligent men at least do not make greater use of it.

Screws in Soft Wood.—The hinges of boxes, especially very small ones, frequently break loose on account of the small size of the screw, which easily pulls out of the wood. Consequently it is often very difficult to repair an article of this kind. Even experienced cabinet makers and others who work upon fancy articles find difficulty in making the screws hold. If the screw hole is not too badly broken out, the hinge may be taken off entirely, some thick glue made, and the hole filled with it. The screws are then immersed in the glue, the hinge put in place, and the screws driven home as quickly as possible. When the glue hardens, the screw will be held fast even in soft wood. If the screw hole is deep and glue is not at hand, an easier way is to heat the screw until it is hot enough to melt rosin. A little rosin is then put on so as to fill up the threads, and the screw is then quickly put into the hole and driven home. The rosin melting upon the screw, and being forced into the wood, makes a very strong and durable cement, which holds the screw firmly in its place. In this way fancy articles can easily be repaired, and often will be stronger than when they left the manufacturer's hands. These directions are especially applicable to screws which are driven into pine and softer woods.

To Prepare Veneers Before Laying.

One of our English exchanges publishes the following directions:

Mahogany veneer is the easiest to manage, as it requires neither drying nor flattening, but is put on just as it is received. If badly sawn, it must be toothed until the saw marks are nearly out before laying.

Satin wood, king wood, manila wood, zebra wood, ebony and snake wood should all be treated in same manner as mahogany.

Bird's eye maple veneer, if sawn veneers, should be well shrunk between hot cauls previous to laying.

Tulip wood, purple wood, coromandel wood and yacca wood should be treated the same as bird's-eye maple.

Rosewood veneer, if new wood, should be held over a shaving fire, and kept moving quickly until the gum begins to boil out of the pores of the wood; then place between two cauls and hand-screw down till dry; then tooth and veneer. Knife-cut veneers do not require this treatment.

Wainscot oak veneer, same as mahogany.

Thuya wood, the same as maple.

Pollard oak veneers. Well shrink between hot cauls, and tooth all to a thickness as nearly as possible, and joint up with a buhl saw. Place two pieces of veneer together, and follow the figure of the wood with the saw. When the veneer is made to the size required, place all the pieces as fitted, and fasten them down on a board with a few veneer pins; glue some strips of paper over the joints, and let them remain until dry. If a large top is to be made, it is best done in two or three parts, and jointed together at the last. Where much work of this kind is done, a marquetry cutter's "donkey" should be made; this is like a harness maker's clamp, fixed on the edge of a sawing stool with a string through the top, and secured to a piece of wood at the bottom of the stool, so that the pressure of the foot is sufficient to grip the veneer for sawing, and is instantly released by raising the foot. After jointing up as described, take out the veneer pins, and fill up any little imperfections in the under side with glue and yellow ocher; then lay with a caul.

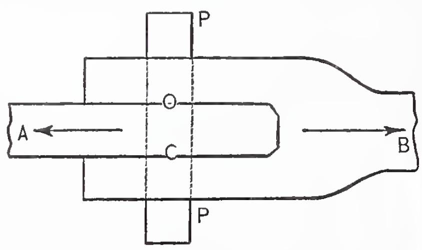
Plain walnut veneers should be treated like mahogany.

Burr walnut veneers. First damp all over with a wet sponge, then cut out the required size for the work; it will cut very easily when damp, and not split. A shoemaker's common cutting knife is very useful for a veneer knife, and can be bought for about four pence. After cutting out, place between hot cauls, and when cold it will be well flattened and shrunk. Then fill up all holes and joint together. If the holes should be made round or square the joint will show; they should be cut an irregular shape, like the figure of the wood. After the pieces are fitted in, glue paper on the back; and when dry, if the joint should not quite close in any part, just damp the place with the finger before veneering. It is best to lay this sort of wood with a caul where possible, in which case a sheet of paper should be placed all over the veneer before the caul is put on, as the glue will come through every part. Some size the veneers before laying, but this is a waste of time, as, when the caul is removed, the glue will be found to have penetrated the veneer like a sponge. In cleaning off flat work, time is saved by the use of an iron smoothing or panel plane. For shaped work, just damp with a wet rag well rubbed with soap, and it will be found to crape up as easy as possible.

Amboyna veneers. Treat similar to mahogany, but joint up like pollard oak veneers.

Laying and Nailing Floors.

The fact that the floors of buildings are scarcely secondary in importance as a feature of strength, their being properly nailed becomes a material matter for consideration. No one who understands the science of construction will undertake to question the value of floors in buildings as a means of bracing and stiffening, either in brick or frame constructions. And this fact being admitted, the question of the best method of laying and nailing them becomes important. Yet there is no portion of the work, as a rule, more carelessly executed, except where care becomes an obligatory and imperative necessity in special cases. To lay floors properly, they should fill out snugly to the walls at all parts. The more solidly this is done the more complete will be their bracing effect. Every piece of timber used in a building has a proportionate strengthening value, and that value is increased or diminished by the manner in which each piece is applied and secured. Every single nail driven is one part of the general strength obtained, although one nail is very insignificant considered in connection with



The Shearing Strength of American Woods. —The Method of Experimentation Pursued by Mr. Trautwine. B, Iron Holder. P P, Pin Passing through the Parts in a Cylindrical Hole. Arrows denote Direction of Strain.

the thousands used in a building. One or two or a hundred may be omitted and apparently no harm result; but still their support and strength, whatever that might be, is taken from the whole. This is particularly applicable to the nailing of the floor. Each and every floor should not only fit snugly at the walls, and the joints be driven up solidly, but they should be nailed with two nails at each and every nailing, driven from the face, or "through nailed," and the nails set in with nail-sets. This is the best method of nailing floors with a view to their solidity; and when so laid and nailed the full strength of the flooring is obtained, and their entire value secured, as a principle of strength, as well as their utility. This "through nailing" proposition will, however, be met with the argument that "it makes many holes in the surface, and detracts from neat appearance in the face of the floors." But the argument is valueless, except in ball-room, kitchen and other similar floors not intended to be covered by carpets, oil-cloths, &c. No argument is possible to prove that through nailing does not give greater strength and solidity. These are fixed facts; and if so, then the method of through nailing is the better in all cases where floors are covered, as nail holes do no injury and are unseen when covered up.

The "tongue," blind or "secret nailing" process was unknown in the boyhood days of those who have lived a half century, and when first adopted the nails were driven into every timber, with due regard to the angle at which they were driven, and the heads of the nails were not bruised into the wood, but when sufficiently driven by the hatchet or hammer to touch the wood, a nail-set was used to complete the driving, and many a journeyman received his discharge and boys were kicked for driving the nail too far, and bruising the edge of the flooring. But of later days the nails are banged into the wood, without any regard to the bruising of edges, and not much in reference to the angle at which driven, although the proper slant of the nail is of the highest importance. The nearer possible perpendicular they are driven the greater the draw and the more solid will be the floors. But often they are forced in at so flat an angle that many of them bolster up the boards, and the result is a disagreeable, creaking sound in walking over the floors, with very little strength from the nailing. There would be less objection to concealed nailing if proper care were practiced. But it is a more acceptable method to "floor-layers," as a greater number of squares can be laid within working hours; and if there is no one watching, and the work is being done "piecework," it is an easy matter for the workman to omit one-fourth or one-third of the nails, and no one be the wiser after the following board is driven up. The labor of secret nailing is not more than one-fourth that of driving two nails from the face and setting them in with nail-sets. In wide flooring, concealed nailing is by no means good, even if carefully performed; and so far as strength to the building from the floors and their solidity are concerned, by two through or face nails in each and every board at each nailing place, it is much more than doubly increased. As before remarked, in uncovered floors the secret nailing provides a more perfect face, and this is the only recommendation for this system of nailing.

The Shearing Strengths of American Woods.

Much interest has been taken in the various communications which have appeared in *Carpentry and Building* concerning the strength of timber and the methods of calculating strength. A number of inquiries have been addressed us as to the methods employed in determining the figures which are used in the calculations. As partially answering these questions, and also being of general interest in connection with this subject, we give below the account of some experiments made by Mr. John C. Trautwine, a well-known authority in matters of this kind, and which was originally communicated to the *Journal of the Franklin Institute*. The experiments were of a very practical character, and were made to ascertain the shearing strength of a number of kinds of native woods, in order to determine the reliability of this material for pins or tree nails, for which it is commonly employed. For the purpose of the experiments Mr. Trautwine employed an iron holder, shown in the accompanying engraving, through a cylinder hole in which a wooden pin, P P, was placed. In being tested, two specimens of each kind of wood named in the annexed table were tried, all the pieces being of fairly seasoned wood and free from defects. The pieces tested were in the shape of cylindrical pins, .64 of an inch (or full ⅝ of an inch) in diameter. The central pieces sheared off were ⅝ of an inch long, and that of the two areas simultaneously sheared .644 of a square inch.

The test specimens fitted closely into the cylindrical hole of the holder, and as the two parts A and B of the holder were pulled in opposite directions, the test pieces could only yield by direct shearing at O and C. The trials were made upon one of Riehlé Brothers' testing machines. To obtain the results in pounds per square inch of total sheared area, Mr. Trautwine has multiplied his experimental values by 1.55 (that is .644 x 1.55 = 1 square inch.)

SHEARING STRENGTH OF AMERICAN WOODS.

	Lbs. per sq. in.
Ash	6280
Beech	5223
Birch	5595
Cedar, white	1372 to 1519
Cedar, Central American	3410
Cherry	2945
Chestnut	1535
Dogwood	6510
Ebony	7750
Gum	5890
Hemlock	2750
Hickory	6045 to 7285
Locust	7176
Maple	6355
Oak, white	4425
Oak, live	8480
Pine, white	2480
Pine, yellow, Northern	4340
Pine, yellow, Southern	5735
Pine, yellow, very resinous	5053
Poplar	4418
Spruce	3255
Walnut, black	4728
Walnut, common	2830

CORRESPONDENCE.

The pressure upon our columns in this department, which, as we explained to our readers some months since, was for a while quite severe, has become considerably lessened from the fact that for this and the preceding number we have received fewer letters than we have published. Our supply has necessarily been drawn from letters on hand left over from other issues. As we remarked in the last number of *Carpentry and Building*, this state of affairs cannot be continued indefinitely. Either more letters must come from our readers or this department must be reduced from its present size. We trust it will not be long before our readers will find it convenient, both with respect to the weather and their daily business, to again favor us with an abundance of letters. When we are regularly receiving large mails from our subscribers it makes us feel that they really appreciate the work we are doing, and that they are interested in it accordingly. We are always disposed to welcome letters even at times when we are receiving more than we can conveniently dispose of.

Tool chests come in for attention again this month, and form quite a feature of the correspondence presented to our readers. No doubt some excellent ideas will be obtained by many in the trade from the cuts and descriptions which will be found in the following pages. We present in this number a design for a cupola for a barn, which has been contributed in answer to the correspondents who have been asking for something of this kind. A second design, also very desirable in its general features, was received too late for engraving in time for use in this number, but will appear later. The diversified character of the correspondence presented at this time will, we think, make this number of unusual interest to our readers.

Design of Cupola.

From H. N. T., *Spencer, Mass.*—I send you herewith a sketch of cupola which I am now engaged in erecting at this place. It is put upon a barn the size of which is 45 x 72 feet, having 25-foot posts, and a roof of one-third pitch. I think the drawing is so complete that explanation is not necessary. Painted in parti-colors, I think the cupola will show very well.

The Putty Side of Glass Doors.

From E. H. T., *Dover, N. H.*—I have had 15 years' experience in the construction of houses, &c. I always put the putty side in on doors, for reasons I will explain. The flush molding has got to be on the same side as that upon which the putty is, and the raised molding on the opposite side. The raised molding is rabbeted to prevent the weather from destroying the door; further, it adds to the looks of the door to have raised moldings outside.

From J. W. C.—Your correspondent C. D. S. asks which side of a glass door should be outside. In general, the putty side should be out, the same as a window. This construction keeps water from getting between the glass and sash. In some cases where it is desirable to make a very neat finish, the molded side of the sash and door is put outside for the sake of appearances. We have done work of this kind in this vicinity, but in all ordinary cases we put the weather side out.

From H. W. C., *Newark, N. J.*—It is right to put the molded side out first, because it looks better. Second, because if the putty is out any one can remove the glass with a jackknife, and thus be able to unlock the door.

From W. W., *Pittsburgh, Pa.*—To your correspondent C. D. S., who asks a foolish question about the putty side of glass doors, I would say: Put the putty away entirely and use moldings on both sides of the glass. To the Editor I would say, don't give up your valuable space to any more foolish questions of this kind.

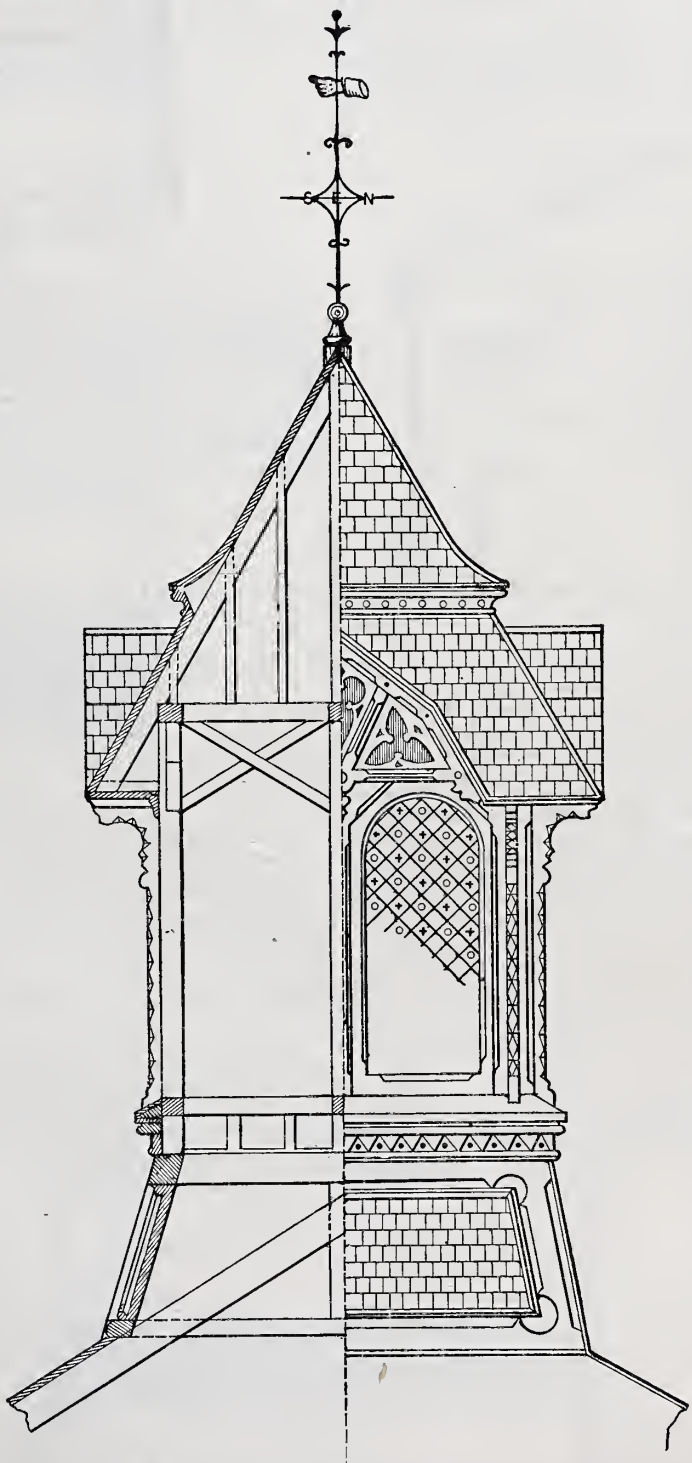
Note.—It occurs to us that our correspondent did not ask a foolish question, since the experience of practical men differs materially. By the above letters it will be seen that he is advised to follow each of several different ways. It will be necessary for him to consider all the replies, and do just as his own judgment dictates.

Leaning Chimneys.

From S. A., *New York City.*—Can you tell me why all the chimneys on the east side of the city lean toward the north?

Note.—When we received this query the implied statement that the east-side chimneys lean to the north was so new to us, that we set about finding out the facts in the case before attempting to account for them. As the Second Avenue Elevated Railroad in many places is considerably above the tops of the houses, and as this would give ample opportunity for investigation, we took that road, going up and down town for the purpose of making a careful investigation of the matter. The results are these: A very large proportion of the chimneys do lean toward the north—but not quite all. New chimneys are straight almost without any exception, and so are those standing edgeways toward the south. But without exception, however, so far as we have been able to observe, all the chimneys that are more than two or three years old and stand flatways to the south, do lean toward the north or are bulged on the southern side. Many of the older square chimneys also lean in the same direction. By flat chimneys will be understood those that are two, three or more times wider than they are thick. In the greater number of cases all the northern sides are hollow on a horizontal line, showing that the ends have been pushed north faster than the centers. The southern sides are bowed outward in the center, making a bulge which shows very plainly in the older work. Another very interesting point is that many of the party walls which rise above the roofs also lean in a northerly direction. When two walls come together, or when there are two separate chimneys with only an inch of space between them, the one on the south shows signs of bending, but the other will usually stand straight up without any signs of curvature. In general, the chimneys which are protected from the sun do not show any tendency to curve.

These are the facts in regard to the leaning of chimneys so far as we have been able



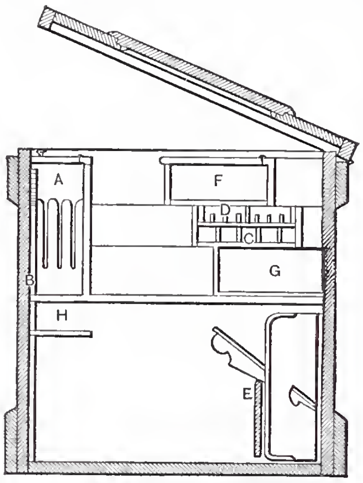
Design for Cupola, by H. N. T.—Scale, ¼ Inch to the Foot.

to gather them. As to the causes we can say but little. They all bend away from the sun, and those having the greatest exposure to its rays bend the most. We do not like to give an opinion in the matter until we can learn something more of the behavior of brick-work in other parts of the city and of the country also. Can any of our readers suggest an explanation?

Does brickwork follow the same rule all over the country, or is the leaning confined to this city? It will be a favor if our readers will make note of the condition of the chimneys in their neighborhoods and report.

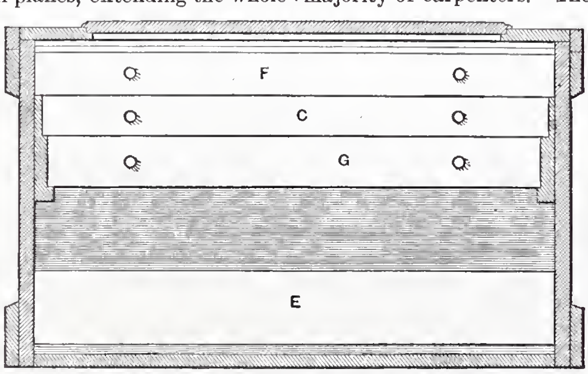
Tool Chests.

From T. G. O., *Marblehead.*—Not noticing any tool chests like mine illustrated in *Carpentry and Building*, I have concluded to send you some sketches, which you can use or not, as you may think best. By examination of the drawings it will be seen that

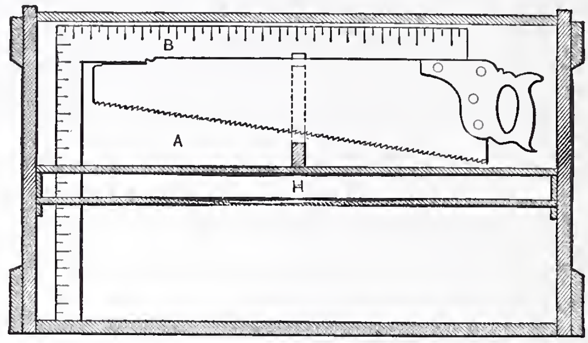


T. G. O's Tool Chest.—Fig. 1.—Transverse Section.—Scale, 1 Inch to the Foot.

I place the box for saws in the front of the chest (1). Its capacity is such that it will hold six saws, provided handles are reversed and two blades put into one slot of the rack, which is made of hard wood, seven-eighths of an inch thick. My steel square, B, is hung on the front of the chest, the blade directly under the lid of the saw-box, and the tongue passing through the bottom of the box and through the shelf provided for the plumb rule. In the second drawer, C, is a case for a set of bits, the apartments being calculated for bits commencing at 4-16ths and varying by 1-16th at each advance up to 1 inch. The upper half of this compartment, indicated by D, is made to lift out by taking hold of the center partition, which is made as wide as can be. The large bits are laid in the bottom of the drawer, and partitions, ⅛ inch thick, are put between. In the bottom and at the back side of the chest, E, is a rack for small planes, extending the whole length. These planes are intended to be kept ½ inch from the bottom, in order to allow of brushing out the dust and dirt. Fig. 2 of the accompanying illustrations shows a vertical section in front of the doors, F C G of Fig. 1. E in Fig. 2 represents the partition for supporting planes, which is indicated by the same letter in Fig. 1. Fig. 3 represents a vertical section taken through the saw rack, and showing the position of square, shelf for plumb rule, H, &c. Fig. 4 represents a plan of the chest at the top, A being the lid of the saw-box, and K being a lid to the top drawer, F, or Fig. 1. The scale of the accompanying engravings is 1 inch to the foot.

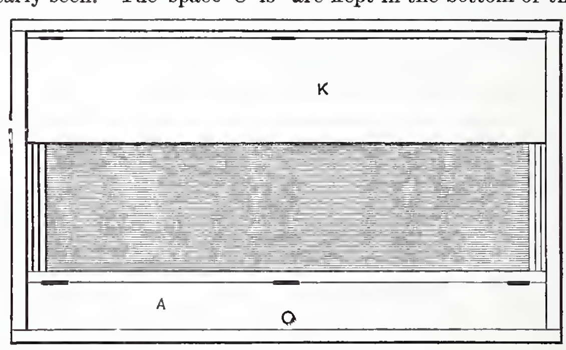


T. G. O.'s Tool Chest.—Fig. 2.—Longitudinal Section in Front of Drawers.—Scale, 1 Inch to the Foot.



T. G. O.'s Tool Chest.—Fig. 3.—Longitudinal Section through Saw Rack.—Scale, 1 Inch to the Foot.

From E. A. W., *Cassville, N. Y.*—I inclose you drawings of my tool chest. I have used a chest built after this general plan for nearly 12 years. The following is a description of the sketches: Fig. 1 shows a front elevation of the chest, the drop leaf shutting off the drawers being open; the middle drawer at the bottom is for plow and philister. The long drawer at the top is for the level, &c. Fig. 2 shows an end section, in which the action of the drop covering the front may be clearly seen. The space C is for molding tools and bench planes; S is for saws, while A represents a place left open to the bottom of the chest, into which to drop squares. The top piece of the drop shutting the front is allowed to project at the ends, shown in Fig. 1, so as to prevent the same from being pulled entirely out.



T. G. O.'s Tool Chest.—Fig. 4.—Plan of Chest.—Scale, 1 Inch to the Foot.

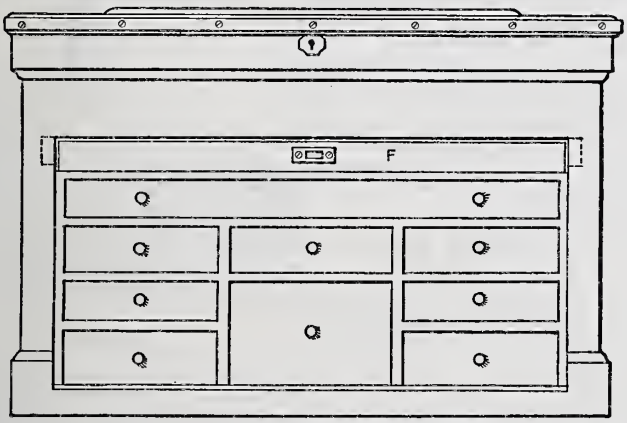
From E. D. S., *Springfield, Vermont.*—I inclose sketches of the interior of my chest, not that I think it is a perfect one, but that it is better than those in use by the majority of carpenters. The chest is 3 feet long, 2 feet wide and 2 feet high, somewhat larger than those in general use. I find it none too large for my purpose. There are five tills on the back side, supported by a rack for holding molding tools, screw box and chisels. There is a rack in front, with two narrow tills underneath. Referring now to the inclosed sketches, No. 1 represents the top till, which is 2½ inches deep, inside measurement. A is for bit brace, B for gauges and C for miscellaneous articles. No. 2 is 2 inches in depth; D is for drawknives and spoke-shave, E for chalk spools, F for plow. No. 3 is 1¾ inches in depth; G is for auger bits, H for bradawls, I for dividers and monkey-wrench, J for try squares. No. 4 is 1½ inches deep; K is for gimlet bits, M for bevels and L for hammers. The small spaces shown are for screws, brads, etc. No. 5 is 1¼ inches deep; N is for level, O for large bits and broad gouge. No. 6 is the saw box and chisel rack; Q is for oil stone, R for saws, P for chisels and gouges. No. 7 is 1½ inches deep; S is for files, T for saw set, U for long screw-driver and V for rasps. No. 8 is 1¼ inches deep; W is for small tools, X for automatic borer, Y, extension bit, and Z, oil stone. My planes are kept in the bottom of the chest. If any one will suggest an improvement upon this arrangement he will confer a favor.

Brevity and Conciseness.

From J. M. J., *Maysville, Ky.*—I find in every number of *Carpentry and Building* what is worth to me more than five times the price. I would suggest, however, that if contributors could learn to describe their methods by means of fewer lines, a very desirable change would be effected. There would be less work and worry of mind in comprehending the writers' meaning. In the number before me W. B. employs six diagrams in order to find the backing of a hip rafter, which, to me, are unnecessary, however correct they may be. If W. B. would cut his rafter and then transfer the angle of his walls to the foot already cut and marked where lines intersect the sides of rafter, he will have obtained the depth to gauge from top of rafter. It is evident by this plan that there is no drawing to make; in fact, no headwork to perform.

Note.—We think this correspondent hardly treats W. B. fairly in the above criticism. However simple an operation may be, it frequently requires many words and lines to demonstrate the reasons for it, and to convey it intelligently to the minds of others. What W. B. undertook to do in the last number of the paper was to show, first, the principles underlying the backing of hip rafters, and, in the second place, to demonstrate the fallacy of a rule sent in some time since by another correspondent. Although his communication was lengthy, and to illustrate it we found it necessary to make a number of engravings, we believed the subject well worth the space it occupied, and we do not think now that the same object could be as well accomplished with many less words or fewer illustrations. If our correspondent will read through W. B.'s communication he will find it very different from what he seems to suppose it is. He will find that instead of its being a rule for backing hip rafters it is a discussion of principles, and a demonstration of the truth or fallacy, as the case may be, of different rules named.

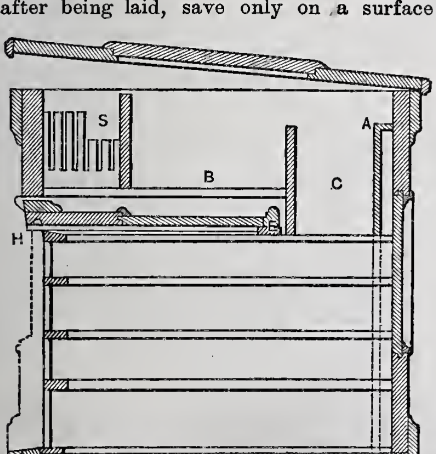
One feature which characterizes *Carpentry and Building*, and which distinguishes it from all other building journals, consists of this very willingness to publish the reasons for everything, and to devote all necessary space to the discussion of any question in which a considerable portion of our readers are interested. We do not think a majority of our subscribers would be satisfied with the bare statement of any rule. We take them all to be intelligent men, anxious to learn the reason for things, in order to be able to make their own applications as circumstances vary and different requirements arise.



E. A. W.'s Chest.—Fig. 1.—Elevation of Chest, with Face of Drawers Exposed.—Scale, 1 Inch to the Foot.

Shingling.

From E. H. C., *East Rochester, N. H.*—I propose to address myself particularly to your correspondent C. E. I agree with him that the pitch of a roof does have much to do with the durability of shingles, and for that matter so does the manner in which they are nailed. I think it best to ventilate shingles from the under side, provided they be laid without painting, and also provided that the ventilation does not hinder their being nailed in the proper way. I do not think it good economy, however, to put on good shingles without first dipping them in a good roof paint, and letting them dry before laying. A poor shingle is not fit to be used under any circumstances. I think shingles never ought to be painted after being laid, save only on a surface vertical or nearly so. Your correspondent says that durability of shingles would probably be increased 10 to 12 years by dipping them in linseed oil or even paint. I desire to ask him why a wooden shingle would not last as long as any part of the building if dipped in paint. I think a shingle should last quite as long as any other part, provided it be of good quality and be well attended to. If this be so, is it not the best economy to use good shingles in the beginning, and to dip them in good roof paint before laying, and put them on in the best manner, repainting them whenever they need it? Would not such a plan as this be much cheaper than tearing off old shingles, and laying new roofs every 12 or 15 years, as is the practice at present?



E. A. W.'s Chest.—Fig. 2.—Transverse Section through Chest.—Scale, 1 Inch to the Foot.

Saw Filing.

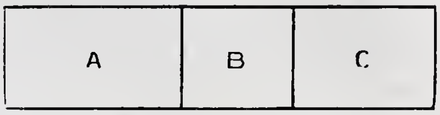
From J. P. S., *Hillsborough, Wis.*—My method of saw filing is as follows: Make a clamp full length of saw blade. Joint it straight on top and bevel outside edges. Place saw in clamp, with points of the tooth barely projecting above the top. Run an old flat file 8 or 10 inches long on top of the clamp once or twice, in order to straighten the edge of the saw. The edges of the clamp will prevent the file from cutting off too much. The saw is then ready for setting. Adjust the set to what is considered enough for the kind of saw. Set three or four teeth on one side and then as many more on the other side, and if the set is sufficient, finish setting the saw in the same manner. If not, give the set more space, regulating it until there is enough set in the saw. Don't bend more than about one-third of the tooth in setting. The most satisfactory sets, I think, so far used are the Stillman (lever) and Aikens (hammer). I should prefer, however, the set described in the May number of *Carpentry and Building* to any I have yet used. After setting the saw, place it in the clamp again, with the teeth projecting a suitable distance above the top and in a strong light. File each tooth to a point and no more. In filing cut-off saws for soft wood, give the point a good deal of bevel by holding the file at an angle with the blade of the saw. In saws designed for cutting hard wood the bevels should not be so great. I file toward the point of the saw, and without filing I joint the side with a whetstone. For rip saws I hold the file as near level and square across as possible. The cutting edge of the tooth of a rip saw should be a little hooking, or less than square with the edge of the saw.

Shingles and Short-hand.

From E. H. C., *Rochester, N. Y.*—I desire to ask what kind of a shingle it was upon which "Wood Butcher" wrote that remarkable communication published in the June number? I think he must either be a short-hand writer or the shingle must have been of mammoth size, cut from one of the large trees of California.

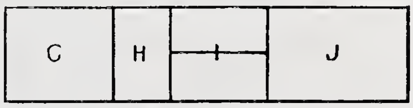
By the way, if "our paper" has a short-hand writer upon its staff, and therefore is prepared to take phonographic notes, I will send whatever I may have hereafter in phonography, as I am "one of them."

Answer.—We do not think it necessary to construe "Wood Butcher's" letter literally with reference to the shingle matter. When we received his communication, written upon several shingles instead of one, it did not occur to us that there was necessarily a discrepancy between his statements and the facts, and therefore we published his letter just as it had been written. We are under the impression that "Wood Butcher" is not a short-hand writer, but there are several short-hand writers upon the regular staff of the paper, and accordingly, if it is any convenience to E. H. C. to send his communications in phonography, we shall be pleased to receive them in that shape. The specimen of his short-hand writing before us is very neat and quite as legible to us as his ordinary style.

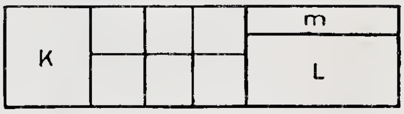


No. 1.—Top Till.—A, Bit Brace. B, Gauges. C, Miscellaneous Articles.

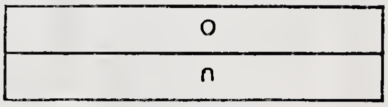
No 2.—D, Draw Knife and Spoke Shave. E, Check Spools. F, Plow.



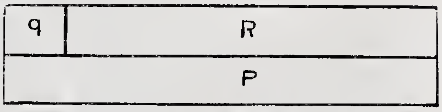
No. 3.—G, Auger Bits. H. Bradawls. I, Divisions and Monkey Wrench. J, Try Squares.



No. 4.—K, Gimlet Bits. M, Bevels. L, Hammers. Small Apartments for Screws, Brads, &c.



No. 5.—N, Level. O, Large Bits and Broad Gauge.



No. 6.—Q, Oil Stone. R, Saws. P, Chisels and Gauges.

No. 7.—S, Files. T, Saw Set. U, Long Screw Driver. V, Roops.

No. 8.—W, Small Tools. X, Automatic Borer. Y, Extension Bit. Z, Oil Stones.

Tills in E. D. S.'s Chest.—Scale, ¾ Inch to the Foot.

The Advantage of Plain Language.

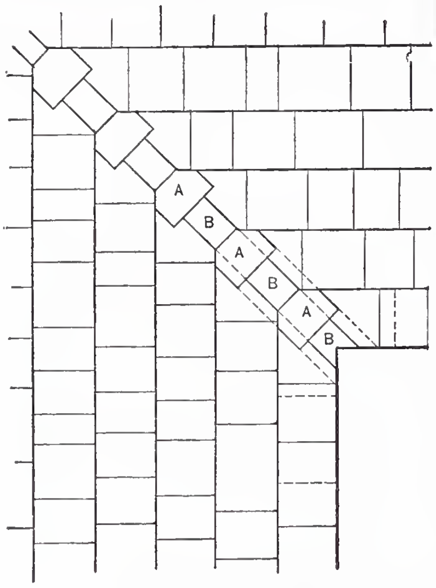
From J. A. W., *Bloomington, Ill.*—I admire the strong, vigorous language of some of your correspondents—W. B., for instance. Men who labor for a living have very little time to qualify themselves to understand such technical terms as scholars use in expressing their ideas. Hence, readers of *Carpentry and Building* appreciate writers who rise above or get below—whichever way one chooses to consider it—the disposition to demonstrate in scientific terms, and who give us plain, simple illustrations and explanations that young apprentices and "jours" can fully comprehend. Therefore I say—sail in, old chips; if we cannot stand the knocks, we can stand from under.

Octagon Miter.

From D. H. J., *Danielsonville, Conn.*—Your correspondent J. W. C. asks a method for laying out an octagon miter. I lay the square on the stick and take 12 inches on the blade and 5 inches on the tongue, then marking along the side of the tongue gives the miter joint. A bevel can be set by this line if many joints are to be made.

Shingling Valleys.

From J. R. W., *New York.*—The inclosed sketch illustrates a way to shingle a valley that I have tried with quite satisfactory results. I now send it to *Carpentry and Building* in order to learn the opinion of the craft at large concerning it. The manner of doing the work is as follows: First take a strip 4 inches wide and chamfer it on the edges on the outside, so that it will lay down smooth to the sheeting, and nail it into the valley. Take a shingle about 4 inches

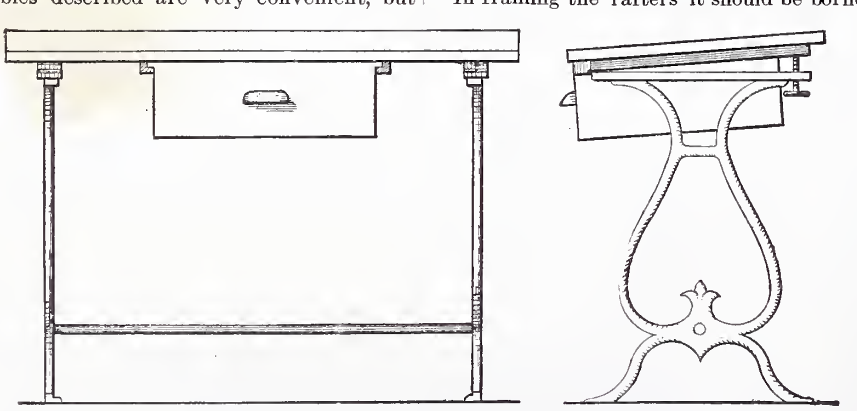


J. R. W.'s Method of Shingling Valleys.

wide to start with and lay lengthwise of the valley, fitting the shingle on each side. The first course, which is always double, would then start with the narrow shingle marked B, and carried up the valley as shown in the sketch. Half way between each course lay a shingle, A, about 4 or 5 inches wide, as the case requires, chamfering underneath on each side, so that the next course will lay smooth over it.

A Drawing Table.

From G. N. C., *Hancock, N. H.*—The June number has just reached me, and, as usual, is full of good things. The drawing tables described are very convenient, but how many of us can afford so much expense? I inclose you sketches of a table I have made for my own use. I took a pair of sewing-machine legs, to which I fastened a top of pine, as shown in the drawing. I attached a drawer 6 inches deep, 14 inches wide and 18 inches long. The table is elevated, according to requirements, by a screw, the action of which is clearly shown in the sketch. The material cost me 50 cents, and I spent upon it three hours' time. It saves me many a dollar in the course of a year's business.



Front Elevation. *End Elevation.*

G. N. C.'s Drawing Table.

Portable Bench.

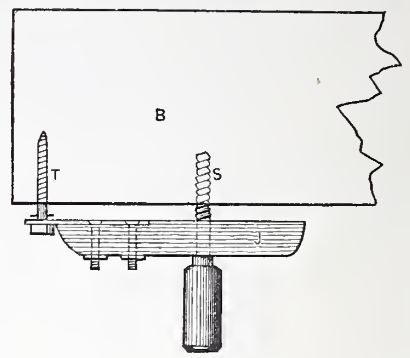
From L. E., *Bangor, Pa.*—I have designed, but not yet executed, a very cheap bench such as carpenters frequently need upon which to do a little planing or fitting up on small jobs where it is scarcely worth while to take a bench of the ordinary kind. B in the accompanying sketch represents a joist 10 or 12 inches wide, 2 inches thick, of whatever length may be desired. The jaw J is 2 inches square and 15 inches long. To one end of this, and parellel with it, is attached a piece of band iron of the same width, being bolted on with two countersunk tire bolts and projecting beyond the end about 2 inches. Through the center of this projection a hole is drilled for a ⅝-inch lag bolt, by which the jaw is secured to the plank as shown at T. Just under the band iron a small hole is drilled through the bolt, in which an iron pin is driven tight. This is for adjusting the jaw according to the thickness of the work to be held. The screw S is the same as proposed for a clamp in answer to C. W., of Newport, Conn., in a recent number of the paper. If the thread in the plank wears out it may be repaired by boring a hole from above, crossing that of the screw and inserting therein a piece of good wood. I have not proposed anything for legs, as this device is intended rather to be nailed up against studding, or in any other position where it may be needed for temporary use.

Answer to a Question in Framing.

From A. H. F., *West Meriden, Ct.*—On page 79 of the April issue of *Carpentry and Building* is a question addressed to me, which I take to be a request for information how the lower end of the valley rafter should be placed to bring the cornice of wing and main building the same width, while their roofs are of different pitch. My attempt to answer this question is on the supposition that he wishes his valley to be straight and the planceer to cornice level.

The point where the foot of the valley rafter should rest for this purpose is where its seat crosses the plate, said seat being a level line drawn from outer edge of the crown molds at the point where they are mitered together, and meeting a plumb line dropped from the point at which the ridge of the wing meets the roof of the main building. This is the seat over which the valley on the upper surface of the roof boards stands. Owing to the different inclination of the roofs the joint at the intersection of the roof boards on the two roofs is not in a plumb line, the under side of the roof boards resting on the valley rafter nearer to the side next the steeper roof; but in practice this need not be regarded except where the pitch of one roof is much more than the other.

In framing the rafters it should be borne in mind that our object is to have the plane of the upper surface of the roof boards meet the upper and outer corner of the crown mold, and as the roofs differ in pitch we must make allowance for it where the rafters rest on the plate. To illustrate let us refer to the illustration on page 35 of the February issue of *Carpentry and Building*, where we will suppose the dimensions there given to apply to the span measured from the outer edges of the crown mold, the cornice projecting 2 feet from face of the plates, leaving the wing 8 feet and main building 20 feet in width. Here, as the rise for one roof is 8 inches more to a foot of run than the other, there is a difference of 16 inches in the hight plumb over the face of the plates, and as this is too much to allow for in framing the rafters, we must do it by raising the plate. As all our plumb measurements are taken to the top of roof boards, and their thickness taken on the plumb line passing through them and deducted, more will be



L. E.'s Portable Bench.

deducted for an inch board on the steeper roof, thus making the difference in the hight a trifle less than 16 inches. This must be borne in mind, that the roof boards may range with the corner of the crown mold.

If this fails as an answer to the question according to its original intent, it may meet the wants of some one else.

Slaking Lime.

From L. B., *London, Ont.*—I was slaking some common lime the other day, when a gentleman standing near asked me to explain what caused the steam to escape from it, and he also asked what the nature of the steam was. I answered that I thought the steam came from the water that I had just put on, but what caused the heat I did not know. Will you please explain the process of slaking lime?

Answer.—Lime is the oxide of the metal called "calcium." Ordinary limestone is composed of the oxide of calcium combined with carbonic acid. When, by means of heat, we have driven off the carbonic acid, so-called caustic lime, or "quicklime," remains, or the oxide of calcium. This has the property of combining with water and forming a solid compound, known to chemists as "calcium hydroxide," or slaked lime. It is not necessary here to go into chemistry or the philosophy of the matter in order to explain how it is that when a liquid enters into a solid form heat is produced, but it is sufficient to say that in cases where a liquid changes to a solid form, a greater or less amount of heat is always produced; and in this case the combination of the water with the lime to form a solid is the cause of the heat noticed, and it is this heat which produces the steam. Sometimes the amount of heat is so great as to set wood on fire, and in the great lime kilns of the Eastern States it sometimes happens, when a shed is flooded, that the woodwork is ignited by the slaking lime. Fire in vessels carrying lime is of frequent occurrence, as it is almost certain that a vessel will be set on fire if she springs a leak and the water reaches the lime.

Measurement of Brickwork.

From J. C. D., *Vienna, Ill.*—Will you or some of the readers of *Carpentry and Building* give me a rule for measuring brick in walls—or, rather, a rule for measuring chimneys, flues, arches, &c.?

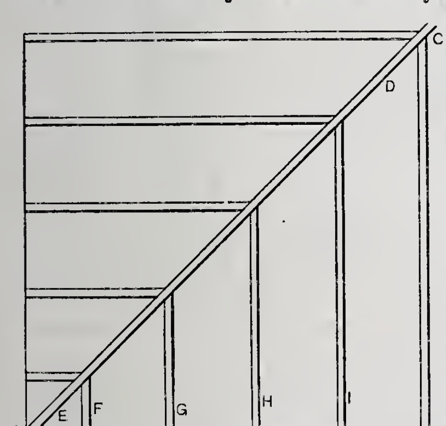
From F. G., *Albia, N. Y.*—What are the customary rules for masons' measurement of brick walls?

Answer.—Rules for measurement in brickwork depend very much upon local custom, and what is good practice in one section of the country might be considered altogether wrong in another. In many places walls are measured solid, with no allowance for openings, counting seven bricks to the square foot for each brick of thickness in the wall. This would make seven bricks per foot in walls 4 inches thick, 14 bricks per foot in walls 8 inches thick, and 21 bricks per foot in walls 12 inches thick. In all cases the measurement is taken on the face to the longest angle. In other localities it is customary to deduct half the openings and to figure double for chimneys. Arches are commonly figured double. In heavy walls it is very frequently the custom to figure out the openings; in light walls they are figured in. As we have remarked above, however, very much depends on local custom. If our readers will favor us with statements and rules for different sections of the country, we shall be pleased to publish them for the benefit of the writers of the above letters and others who may be interested in the same subject.

Bevels of Common Rafters and Lengths of Jack Rafters.

From W. C. M., *Birmingham.*—The manner of getting lengths of bevels of common rafters has been so often told that I shall say nothing about it. The seats of hip and valley rafters are found by taking half the width of building on both blade and tongue; then take the run on blade and rise on tongue for the length of hip. The backing of the hip can be got by measuring half the thickness of rafter on horizontal cut at foot of rafter, or take length of hip on blade and rise of roof on tongue; then the tongue gives bevel. To get the side bevel of hip rafter where it abuts against the ridge, take length of hip on blade and run on tongue; the blade gives the cut.

The length of jack rafters I get by means of a diagram like the inclosed, in which A B represents the plate or ridge, as the case may be. B C represents the length of common rafter and A C the length of hip or valley rafter. F G H and I represent the jacks. The parallel lines A C represent half the thickness or hip measure. After it is backed I put this draft on a board and mark the scale length on each piece, so as not to have too much on my mind. The down and level bevels of jacks are same as common rafters. The side bevels of the jacks are obtained by



Determining the Lengths of Jack Rafters.

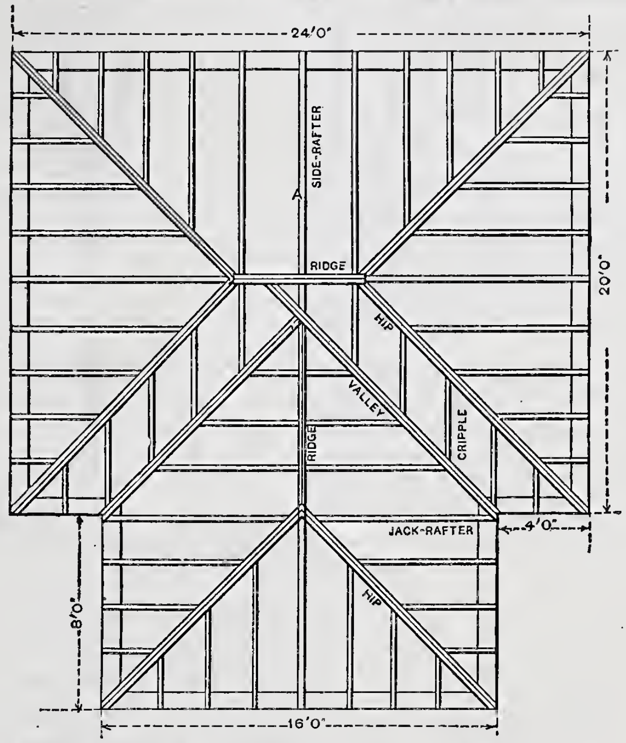
taking the length of common rafter on the blade and its run on the tongue. The blade gives the cut and also the bevel of a shingle to lay in the valley or hip. It also gives the lower end of planceer for side gables, while the tongue gives the cut for ends of sheeting and planceer for eaves. There is a point not noticed in any of the rules I have seen. When the side gable has a different pitch from the main gable, it is necessary to take the length of rafter for the pitch on side on which you are working, and the run of rafter for the side against which it abuts, to get the side bevels of jacks. This may look very simple to some, but I obtained it only at the cost of considerable study and some experimenting.

Remedy for Defective Roof.

From J. K. S., *Waterbury, Conn.*—If your correspondent W. C. T., of Worcester, Mass., will take off his slate and put on good, sound spruce boards, square edge, using seasoned lumber if possible, and overlay them with tarred felt, and upon this foundation relay his slate, he will have no further trouble with the roof. A slate roof should never be put on without felt underneath. A slate roof properly laid is the best roof in the world.

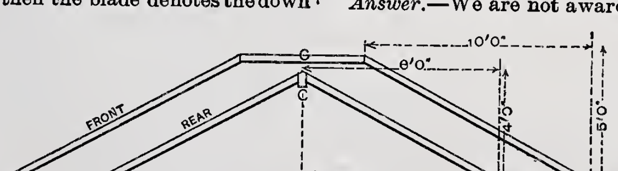
Finding the Cuts in a Hipped Roof.

From G. H. H., *Philadelphia.*—In the accompanying sketches I present a view of a hipped roof having a front of 24 x 20 feet, with a rear wing of 16 x 8 feet, with a pitch



Finding the Cuts in a Hipped Roof.—Fig. 1.—Plan of Framing.

6 inches to 1 foot. My purpose is to present some rules for finding the various cuts required. My sketches show the position of rafters in a roof of this kind. It will be observed that one of the valley rafters is run up to and fastened to the front ridge pole. This is, of course, above the rearage, and is the nearest point of support in a self-sustaining roof. The rafter in this case is supposed to lay or fit to the side of the ridge pole. The side rafter A on the sketch is first to cut. The up and down bevels are found thus: By the statement of the pitch of the roof above it will be seen that it is 6 inches to the foot. Then take one foot on the blade of the square and 6 inches on the tongue. Place these marks to the back of the rafter to be cut. Scribe along the blade for the down bevel, which will fit the blade at B. Scribe along the tongue for the up bevel, which will fit at C or the ridge. By trial it will be found that the diagonal line of a right angle that measures 12 inches each way from the corner is 17 inches, or such a close approximation to it as to make that figure accurate enough for rough work. Then, to get the up and down bevel on the hip and also the valley rafter, we take 17 inches on the blade and 6 inches on the tongue of the square; then the blade denotes the down



Finding the Cuts in a Hipped Roof.—Fig. 2.—Section through Roof.

bevel, and the tongue the up bevel. The side bevel of the valley rafter where it fits to the ridge is found by taking the length of the valley rafter on the blade and the run on the tongue. Scribe along the blade for the side bevel. The hipped cuts are found in like manner. The jack rafters and cripples are laid off by the some process, taking the bevels on the plain rafters for the up and down bevels, and taking the length of the jack on the blade and the run of the tongue, scribing the blade for the side bevel.

To find the difference in length of jack rafters when they are set 2 feet from centers, or, in other words, to find what is called the gain of the rafter, take 6 inches on the tongue of a rafter and 12 inches on the blade; then measure diagonally from 12 inches to 6 inches, and it will give, as a result, 13 7-16 inches. By this we find that the rafter has gained 1 7-16ths of an inch in running over 1 foot—or, in other words, that it will gain 2⅞ths of an inch in running over 2 feet. Then, as the rafters are 2 feet from centers, one jack is 2⅞ inches longer or shorter than its neighbor. Always deduct one-half the thickness of the hip rafters from the lengths of jacks, and twice the thickness from the length of cripples; measure half the thickness from where jacks strike the side of hip to center of hip in line with jacks.

I have given my explanation for the use of the square, which I find much handier than making scale drawings by which to measure. The saving of time also is an important item. It is a good idea to use a square having twelfths of an inch on one side, and to have a pocket rule with a corresponding device. By this means a mechanic always has with him a plan when at work. Great care is required in setting up roofs that are cut by rule, as any little variation will throw all the cuts out of place. Timber that is not of uniform thickness should be boxed to some determined dimension.

Eastlake and Queen Anne.

From S. B. A., *Jamestown, N. Y.*—Can you inform me where a work can be procured showing the finish for inside of dwellings in Eastlake and Queen Anne style?

Answer.—We are not aware of any book having been published which describes and illustrates the Eastlake and Queen Anne styles of finish. Although these two forms are designated by the word "style," it seems to us that they are entitled to little more than the form "fashion," for their distinctive features are not such as to entitle them to a better rank than that of a fashion. Although they are quite popular at the present time, they have not been before the public long enough to have made an appearance in standard literature. It is almost needless to add that what is called Queen Anne of the present day, in many of its features, would astonish the people of the age from which it takes its name, if it were possible for them to see it. And, on the other hand, Mr. Eastlake is compelled, for his own reputation, to repudiate many of the forms and shapes to which manufacturers have attached his name.

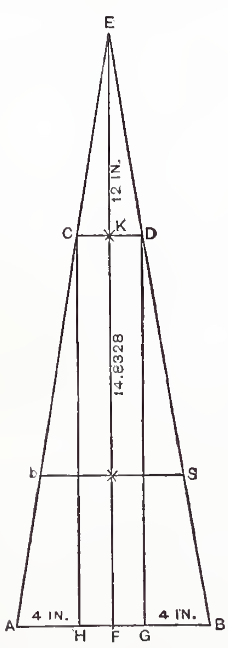
Problem of Equal Areas.

In the July number we presented two answers to the question propounded by T. V. D. in the May number, both of which, we remarked at the time, were in error. We now publish a third reply, which arrived too late for engraving to appear in the last number, and which treats of the problem in a manner somewhat different from our correspondent's original request. While P. D. is undoubtedly correct in his calculations, he has applied geometrical methods to the solution of the problem, whereas our correspondent's original request was for its solution by lines alone. Accordingly, it would seem that there is room for still further answers to this question.

From P. D., *Wallingford.*—In the May number of *Carpentry and Building* I see that T. V. D., Royal Grove, N. Y., proposes a problem, and respectfully solicits a demonstration from some correspondent by lines. Probably the following solution may come up to his requirements, and may be considered by the Editor worthy of insertion :

The demonstration, as may be seen, is based on true geometrical principles, but the dimensions given in this case involve surds, or irrational quantities or numbers. When the square root is extracted, decimals come into play. Nevertheless, the demonstration will be found to act on general terms, and is not confined to any particular condition. I think T. V. D. is a scientific person, but if not, perhaps some other correspondent will forward another solution more agreeable to his taste.

Let A B C D be the board as given by T. V. D. Produce the two converging sides till

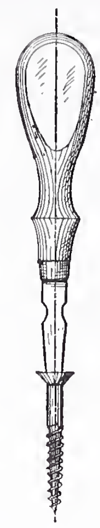


Problem of Equal Areas.—Letter from P. D.

they meet in the apex E ; then draw the two perpendiculars D G and C H. As the two triangles D B G and D K E are equiangular, they are similar, and therefore the sides about the equal angles are proportional, and we have B G : G D : : D K : E K. Substitute the numerical values, and we have 4 : 24 : : 2 : E K or 12. This, added to the perpendicular distance in the given trapezoid, gives 36 inches, the altitude of the triangle A E B. Next, bisect the base A B in F.

The required bisecting line of the board becomes the base of a triangle similar to the larger triangle A B E, and its locus or position is determined by the following proportion. By a well-known proposition in Euclid similar figures or polygons are to one another as the squares of their homologous sides; therefore triangle A E B : triangle formed by half area of board + triangle E C D : : E F ^{2} : to the square of the altitude of similar triangle E *b* S. The altitude of the triangle E *b* S being found by measuring its length on the perpendicular E F from E, we find the point on the line E F through which, if a line be drawn parallel to the base A B, it will bisect the given trapezoid. Verification of the same may be made by substituting the numerals.

The area of the trapezoidal board is $\frac{12' + 4'}{2} \times 24' = 192'$ square inches, and half this is 96 square inches. To this add area of triangle E C D = 24 square inches, and we get 120 ; therefore 192 + 24 = 216 : 120 : : $36^2 = 720$. Extract square root and 26.8328 is found to be the distance from the vertex of the triangle along the perpendicular through which the bisecting line is drawn parallel to the base, or 26.8328—12 =14.8328, distance from the point K to the bisecting line. The length of this bisecting line may be found by the proposition already quoted, that is, 216 : 120 : : 12^2 = 80, and $\sqrt{80} = 8.9442\frac{2}{3}$ inches as the length of *b* S.



Advantages of Long and Short Screw Drivers. —Fig. 1.—Short Screw Driver in a Screw Head.

The Relative Advantages of Long and Short Screw Drivers.

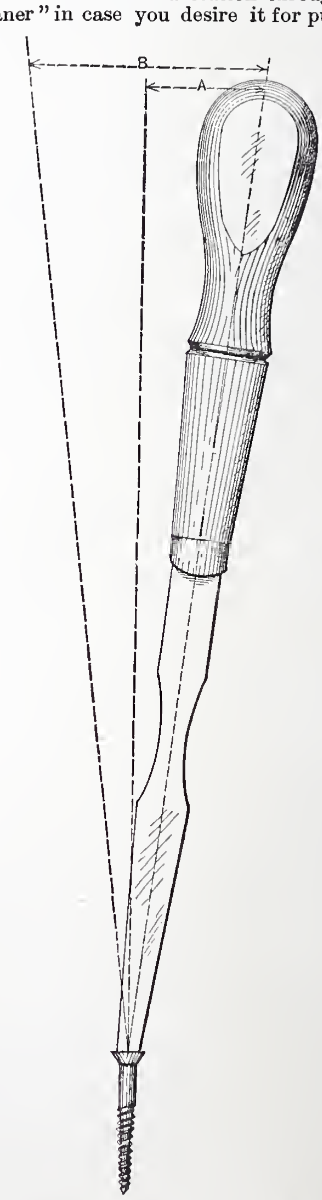
From L. R. H., *North Argyle, N. Y.*—Will you please inform me what philosophical principle is involved in the fact that a long screw-driver will turn a screw with less power than a short one ? Can you explain the phenomenon to an unphilosophical subscriber ?

Answer.—Our correspondent, in asking his question, virtually asserts that, with a long screw-driver, more power can be applied to the head of a screw than with a short one. This fact has often been denied, yet we believe it to be well established. The difference in the lengths of the screw drivers admits of a difference in the manner of using them, and this difference in the way of using accounts for the difference in the power exerted. In Fig. 1 of the accompanying illustrations we represent a short screw-driver at work. It will be noticed that the center line of the screw coincides with the center line of the screw-driver. If a long screw-driver were placed in exactly the same position, and were to be held, while being used, as straight as it is necessary to hold the short screw-driver, the results obtained would be substantially the same in the two. The usual manner of using a long screw-driver, however, is like that shown in Fig. 2. Instead of the screw-driver being held exactly in line with the center of the screw, it is inclined to one side, which, in effect, makes the handle very much larger than it really is. The space A in Fig. 4 shows the inclination of the handle from a vertical line. The space B, which is double that of A, represents the diameter which the handle of the screw-driver in effect has by virtue of being worked in the manner indicated. Fig. 3 shows an enlarged section of the screw head, showing the point of a long screw-driver in the slot, and illustrates the leverage obtained by the long screw-driver when inclined. A short screw-driver inclined so as to move in a circle having a diameter equal to B of Fig. 2, would be thrown out of the slot in the screw head.

Figs. 4 and 5 represent an experiment made to demonstrate the truth of the principles we have just described. The point of a small screw-driver is ground, beveling so as to give its handle, when revolving, motion in a circle of diameter equal to that of the long screw-driver. In other words, the space C in Fig. 4 is made to correspond with the space A in Fig. 2. With the short screw-driver thus managed, no more power is required to operate it than is required to operate the long screw-driver. Hence it would seem that the reason for a long-handled screw-driver requiring less power than a short one lies in the facts we have described—partly in its having a larger handle, whereby power is more readily communicated, and partly because a larger handle, in effect, is given to the screw-driver by its handle being moved in a circle.

Another Draft on W. B.

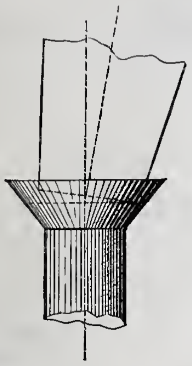
From C. H. R., *Independence, Iowa.*—Please run this communication through the "planer" in case you desire it for publication. W. B., with the aid of his granddaughter, shingled that hip before he backed it. Nevertheless, I shall have to render my verdict in favor of the defense ; but, as the old man says he "likes to be tapped upon all points, that wisdom may flow," I will venture



Advantages of Long and Short Screw Drivers. —Fig. 2.—Position of Long Screw Driver Handle when Driving Home a Screw.

to ask—doubting not but that I will be pretty generally seconded in the request—that he forego another noon-time nap, take that venerable jack plane of his, smooth up another shingle, and give us a diagram of the manner in which he gets the lengths, bevels, cuts, &c., of that selfsame hip and its accompanying jack rafters, described in Fig. 5 of his backing diagrams.

While I have my pen in hand, I would say that as regards location of door knobs, I always place them in the center of the lock-



Advantages of Long and Short Screw Drivers. —Fig. 3.—An Enlarged Section of a Screw Head, showing how the Long Screw Driver gains its Advantage.

rail, without any regard to the kind of lock used. In case of an ordinary mortise lock, this plan dispenses with the necessity of removing either of the tenons, which always weakens the door.

Construction of Cisterns.

From D. H. J., *Danielsonville, Conn.*—Answering H. W. J. in reference to the construction of cisterns, I would say that I believe it to be the better way to wall the inside in hard brick, laid in one part cement and two parts of sand. Plaster the inside with one part or less of sand, and finish by washing it over with a brush. When it is dry enough, build a filter of soft brick and arch it over, first putting in pipes to draw from. All the water is then drawn through the bricks, and is clean no matter how much dirt is in the cistern. I have a cistern of this kind in use, and from experience regard it as very complete. Some plaster directly on the dirt, but I believe seldom obtain satisfactory results. I have known cisterns constructed in this manner to crack by the settling of the covering or by frost, and to need almost constant repairs. When a cistern is constructed of brick, the dirt should be tamped as the wall is laid up.

Carpentry among the Mountains in the Far West.

From W. A. J., *Canyon City, Oregon.*—I desire to call the attention of the readers of *Carpentry and Building* to circumstances in which all the knowledge of his trade a man possesses is likely to be put into use. I am at present doing business in a small mining town in the mountains. There is no planing mill and no molding machinery here; accordingly, I am compelled to take all my stuff in the rough, get out all my moldings by hand, do all my planing by hand, and make doors, sash, &c., without the aid of any machinery whatever. I am thinking some of the carpenters who are accustomed to all the accessories of modern tools and labor-saving machinery would be at a loss sometimes how to carry on their trade under such circumstances.

Records of Material and Labor.

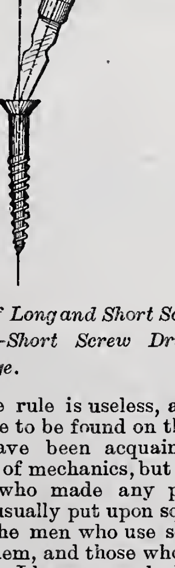
From W. F. W., *Lincoln, Nebraska.*—It seems to me that the suggestion made by G. H. H. in the May number of *Carpentry and Building*, that workmen keep a record of time on various kinds of work and send the same to *Carpentry and Building* for publication, would hardly be practicable. If none but careful and reliable records were sent—such, for example, as the one furnished by G. H. H. seems to be—it would undoubtedly be an excellent thing for all who are anxious to learn to estimate. But I fear that many would take advantage of such a chance to blow about what they had done. Others would be careless in keeping account of time, and accordingly their records would be valueless. The result would be that a large part of the letters received would hardly be worth the paper upon which they were written. *Carpentry and Building* is too good and too useful a paper to be filled with such trash.

Let us compare the different estimates of a day's work at hanging doors, as an example of what might be sent in. By the letters already published in *Carpentry and Building*, it will be seen that all the way from 5 to 20 doors per day is considered fair work. In the matter of shingling, estimates vary from 1200 to 5000 per day. Now, after reading all the different letters upon the subject, who could tell from them what constitutes a fair day's work? A person might very naturally think that an average between the lowest and the highest figures would be about right. Figuring upon this basis, 12½ doors per day and 3100 shingles per day would be the rule. Anyone that is practically familiar with work can plainly see how far wrong such an estimate is. A contractor who undertook to build a house upon such figures would "get left" badly. On many kinds of work there would probably be but one record sent in, which, perhaps, would be as wide of the mark as hanging and trimming twenty doors per day. Such figures are of no use to any one in making estimates.

By what I am saying I do not mean to disparage in the least the reliable letters published on estimates, of which there have already appeared quite a number. I only wish there were more of them. I am decidedly of the opinion, however, that the plan of G. H. H. cannot be a success. A competent builder, having a knowledge of all the facts, might cull out the trash from such letters as were sent in, leaving for publication only those which are reasonable, but such a course, in all probability, would not be satisfactory to those whose letters were rejected.

Scales on Steel Squares.

From F. M. S., *Hickory, Miss.*—After looking over the description of the carpenter's square published in the January number, I desire to make a few remarks. I have been using the square for 40 years, and from practical experience I am convinced that the octagonal scale is useless,

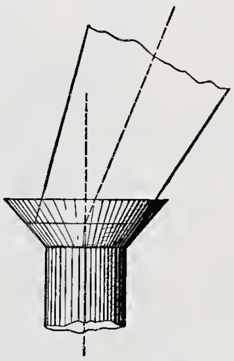


Advantages of Long and Short Screw Drivers. —Fig. 4.—Short Screw Driver with a Beveled Edge.

that the brace rule is useless, and that the board measure to be found on the square is useless. I have been acquainted with a large number of mechanics, but I have never known one who made any practical use of the scales usually put upon squares. The majority of the men who use squares don't understand them, and those who do have no use for them. I have never had any use for the octagonal square and brace rule or board measure, and I consider them objectionable on the square. They partly spoil the use of one side of the tool. Some 20 years ago I was working in New Orleans. I tried at the different hardware stores of that city to buy a square of good quality unencumbered with these difficulties. I did not find what I wanted. The merchants all assured me that all squares of good quality were stamped with these various scales, and accordingly I had to submit. I have often been perplexed, when applying the square, by being compelled to turn it over, and the question passed through my mind—why do manufacturers spoil one side of a square by these useless scales?

Every practical mechanic should make himself familiar with the rule for extracting square root, since it is so often needed in practice. If a workman is possessed of this knowledge, he can readily calculate the length of any brace he wants, and by knowing the rise and run, can lay the square upon the timber, with the plate and tongue properly placed so as to get the bevels for top and bottom. As to the board measure of the square, it is too boyish for any mechanic to use at all. Any expert in measuring lumber can tell the amount of lumber without making a figure, and in more pieces than can be taken off the square, and yet one side of the blade is spoiled by stamping this rule upon it.

I have a suggestion to make: As ten has been adopted as the basis of our numerical

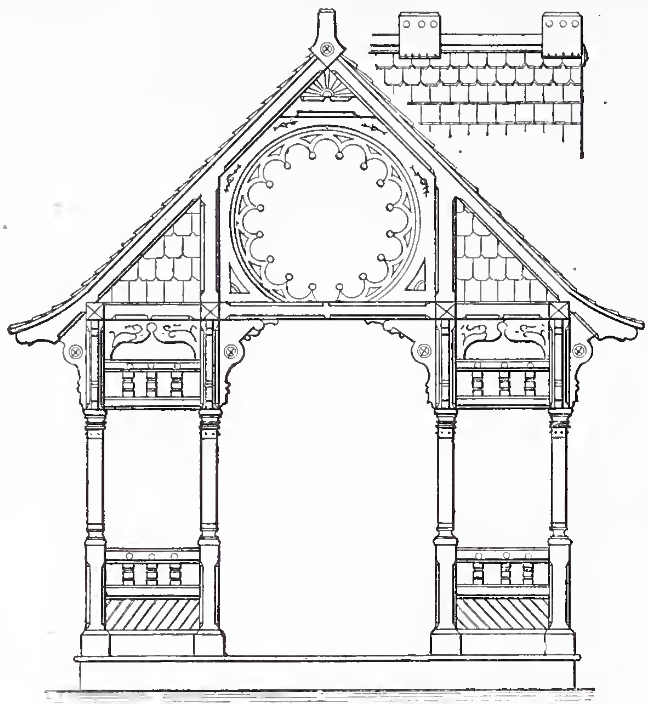


Advantages of Long and Short Screw Drivers. —Fig. 5.—Enlarged Screw Head, showing how the Beveled Point of the Short Screw Driver Acts.

scale, a foot on the square ought to be divided into ten equal parts, and each of these parts in turn divided into ten equal parts. By this means the foot would be divided into 100 equal parts instead of 96. The diagonal scale should be divided into 10ths and 100ths. The angle of the scale should be divided into 100 parts instead of 90. The divisions—one-quarter, one-eighth, one-sixteenth—should be dispensed with altogether. With these changes we should have a decimal system. If, on the other hand, the base of our numerical scale was twelve instead of ten, then the foot divided into 12ths and the inch into 12ths would be all right. In that case the diagonal scale should be divided into 12ths and 144ths. The angle of the scale should be divided into 144 parts instead of 90; then we should have a consistent duodecimal system, which might possibly be better than the decimal system. As it is at present, we have a mixture of two sets. It is not probable that the basis of our scale will ever be changed, but still the square might be changed to the decimal system.

Repairing a Slate Roof.

From F. L. E., *Bangor, Pa.*—Your correspondent W. C. T., in the May number, asks how to repair his slate roof. From his statement it appears that the workmanship in laying the slate, in the first place, was not of the best quality, although I have known similar difficulties to occur in roofs of the best character where the melting snow has been backed up by a gutter above the eaves, or by a snow-catcher. His slate was described as being laid on common roofing lath. This is just right. He should get masons or plasterers provided with good point mortar, and have them fill up the angle between the upper edge of the lath and the slate, and also the joint between the slate from one lath to the next. This method has been in use in this neighborhood for the past 25 years, and may be depended upon as reliable where the inside is not exposed and plastering is done by spreading a coat of thin mortar along the lath on which the previous course terminated, and down the joint which it is intended to cover. With the slate in hand the nail holes will come right in this mortar. Press into position



Design for Well House.—Fig. 1.—Elevation.—Scale, ¼ Inch to the Foot.

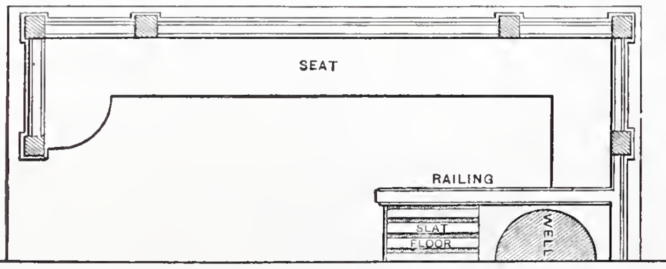
and nail fast. Whether this would be as cheap and effectual in W. C. T.'s roof as the roof of tin, I can't say. I merely give it for what it may be worth to him and others.

Design for Well House.

From C. W. M., *Fair Haven, Conn.*—In answer to the request of your correspondent F. J. L., of Stockbridge, I send herewith a design of a summer house to cover a well, which I have prepared in illustration of my ideas of a house for the purpose. I have endeavored to make the drawing so plain as to be self-explanatory.

Furring Brick Walls, Fitting and Hanging Doors, &c.

From T. H., *New York.*—I have been a subscriber to *Carpentry and Building* from



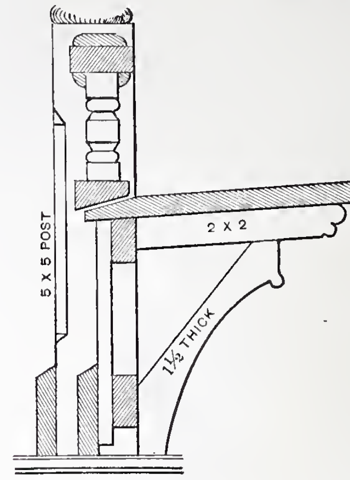
Design for Well House.—Fig. 2.—Half Plan.—Scale, ¼ Inch to the Foot.

the start, and have been much edified by a perusal of the correspondents' department. So far the discussion has been principally in the matter of shingling, framing, &c., subjects with which we in New York have very little to do. Accordingly, I have so far refrained from rushing into print, but when it comes to furring walls, trimming doors, trimming and running slide doors, or doing any other work appertaining to a brick house, I feel justified in making a few remarks.

With regard to furring brick walls, I would advise M. W. C. to discard all wall strips, large and small, and nail his furring into brick joints. A strip of wood built into a brick wall is a delusion and a snare. In a very short time it will shrink and become loose. The smaller the strip the less the shrinkage; but still shrinkage takes place, and after a time rot sets in. Tenpenny nails properly driven will be found sufficient to fasten 1 by 2 inch furring to a good wall; but in the same walls 20d., and even 30d., nails may be found necessary. In walls laid with cement mortar, 8d. nails will be found sufficient. The nails should be toed alternately upward and downward into the horizontal joints. A nail driven straight into a brick joint will not hold. The method above devised is the one now in general use in this city, and is the result of long experience. All kinds of wall strips have been tried and found to be failures.

In regard to hanging doors, what constitutes a fair day's work depends entirely upon the kind of doors used—whether hard wood or pine—and also upon the size of the doors. I am of the opinion that the man who in a workmanlike manner hangs twelve pine doors of an average size—say, 2 feet 8 inches by 6 feet 10 inches, and 1½ inches in thickness—does a good day's work. I have seen men do more, and I have also seen men work very hard and do considerably less. The above estimate does not include the locks, as it is not customary in this vicinity to lock doors as they are hung. Putting on hardware is generally the last job in the building.

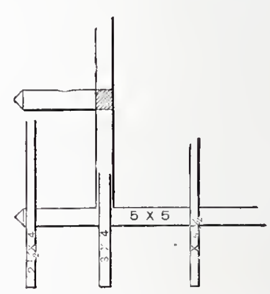
The best and quickest way for fitting doors is to put down all the saddles first; next, having brought the door to the proper width, and having marked the hight of the opening on the bottom rail of the door, set the door in the opening and scribe the bottom with the compass to the mark on the rail; then lay the door on two saw-benches, and, having taken the exact hight of the opening at each side, and marked it on the top end of the stiles, measuring from the scribe at the bottom, draw a straight line across the top of the door through these marks, but as much short of that line as you wish, to allow for the joint at top and bottom; cut the door off to this line at the top



Design for Well House.—Fig. 3.—Section through Seat.—Scale, 1 Inch to the Foot.

and to the scribe at the bottom. This method is, I think, much to be preferred over the old way of fitting without the saddle. Who has not again and again been annoyed, when fitting saddles to doors which other men had hung, to find doors too long to admit the saddle?

With regard to sliding doors, your correspondent A. M. has treated this subject so exhaustively as to leave little more to be said. I think, however, that a style of head in use in this city is preferable to the one he shows, as the pins, of which there are two in each door, one directly over each sheave, offer less resistance to the running of the door than the top rail rubbing its entire length, as it must do by O. M.'s method. Another thing, I think it better to board the box horizontally instead of vertically, as he shows, from the fact that when they are



Design for Well House.—Fig. 4.—Plan of Roof Framing at Corner.—Scale, ¼ Inch to the Foot.

boarded horizontally, it is possible to get out of the "way" by removing the base board and one or two boards of the lining. This is always necessary in this neighborhood. As we do not use a carpet strip, we do not consider the exact depth of the pocket material, so long as it is deep enough. We use a pin to stop the door, then we bore a hole, say 1 inch or 1¼ inches in diameter, in the edge of the back stile half way between floor and head, and drive into it a pin just long enough to stop the door at the required point.

I hope that brother chips in this city will take a hand in the discussio in *Carpentry and Building*, thereby making the paper more interesting to city readers and extending its influence.

A Self-educated Carpenter.

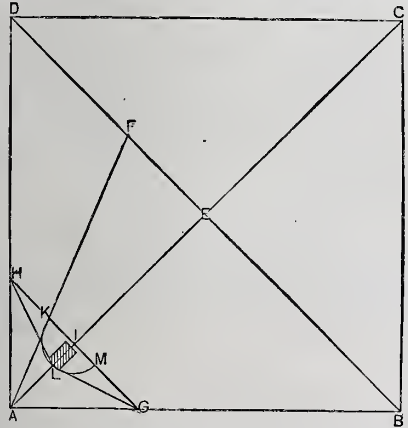
From H. J. B., *Glyndon, Minn.*—I cannot refrain from adding a word of approval for *Carpentry and Building.* It has been especially valuable to me. Some four years ago, other means of making a living failing me, and believing myself possessed of some little tact in the direction of carpentry, I procured a few tools and contracted to build a house. One or two old chips smiled. I asked one of them to show me how to lay out my rafters. He replied : "Oh, you are ingenious, you can study it out." I went to work and studied it out in building a story and a half 16 x 24 house. I worked alone for two years, and in that time performed a great amount of hard work. Then I began to work with others, and I found to my surprise that a large part of the mechanics were behind me in knowledge. During the four years referred to I have had a taste of carpentry, cabinet work and wagon work, have built saw mills, and have set up in good shape a large quantity of wood-working machinery. I am now classed No. 1 in joinery and store and office fixtures. At present I have all the work I can do. With the assistance of a practical journal I should have had an easier path. As it is, I take great satisfaction in seeing some of the problems upon which I have worked solved in a scientific manner in the columns of "our" paper. Looking back at the way I have obtained the little I know of the business, I advise all beginners to get books if they can, and to study while they practice, for it requires practice to carry out rules to a success. In common with others I would like to see *Carpentry and Building* enlarged, but by all means keep the paper down to the masses, so as to help the learners.

Backing Hip Rafters.

From S. F. D., *Newark Valley, N. Y.*—I think *Carpentry and Building* is supplying a need long felt among builders. An interchange of ideas among mechanics cannot fail to be of great service; accordingly, I think the paper deserves ample support. In the June number appeared some plans or rules for backing hip rafters which are decidedly incorrect. I send you herewith a rough drawing which, I think, "Wood Butcher" will find to be a correct rule for performing the operation. Let A B C D be a plan of the building. Draw the diagonal lines A C and B D; set up E F for rise of roof; then A F will be the length of hip rafter. Make A H and A G equal. Draw G H; then with one foot of dividers at I, make an arc cutting the hip at K; then draw L G and L H. Set the bevel by the line A E, and L H or L G, and you have the required angle for backing.

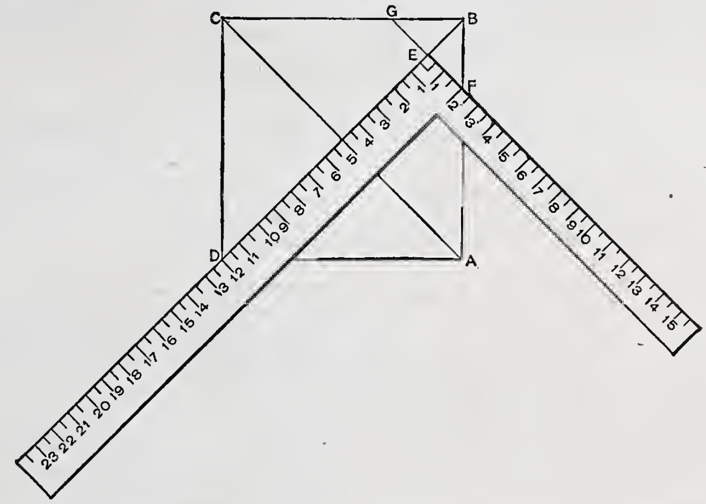
I hardly ever back hip rafters. I use timber 2 inches thick and frame the hip rafter a little lower than the others, and therefore they require no backing. I get the required strength of the timber in the depth, using 2 x 6, 2 x 8, 2 x 10 or 2 x 12, as may be required.

Note.—We take pleasure in publishing the above communication, and have also an engraved the sketch sent in by our correspondent. The plan which he describes is that



Backing Hip Rafters.—Diagram Accompanying Letter from S. F. D.

given in one of the oldest and most standard works on the science of carpentry, and the sketch which our correspondent furnishes is the same as that in the work referred to. It is needless for us to say that the rule is correct, but admitting its correctness does not necessarily prove that our correspondent "Wood Butcher" was wrong in the rules and principles laid down in his interesting communication which appeared in the June number. We are impressed with the fact that many in the trade look upon a rule as a fixed formula, and something to be followed by rote. The idea of reasoning the thing out on principles does not seem to occur to them. Accordingly, when the principles upon which a certain plan with which they are familiar are applied in a little different manner, and, it may be, accomplish the same result, they are disposed to think the rule wrong, because it does not correspond with the letter of the plan they have heretofore employed. We think this is the trouble with our correspondent who says above that "Wood Butcher's" rules are decidedly incorrect. The principles upon which "Wood Butcher's" rules are based and those set forth by S. T. B. are identical. The intelligent reader is likely to study principles rather than rules, and, having become familiar with principles, will be able to understand the reason for rules, and to recognize the consistency and accuracy of rules, even when they differ in their forms of expression and their manner of working from those which they have seen before.



Laying off an Octagon by means of a Framing Square.—Diagram Accompanying Letter from F. M. S.

Laying off an Octagon.

From F. M. S., *Hickory, Miss.*—To lay off an octagon it is only necessary to have a framing square and a pencil. Draw C B A D, say, 10 inches square; then draw the diagonals A C and D B. Next, lay the blade of the tool on the square, ranging with B D, the tongue 5 inches from the crossing of the diagonals. Draw the line E F; then turn the square over, ranging with the same line, and extend the line E F to G, and do the same with the other corners. The result will be an accurate octagon, from which may be calculated the length on the sides of any size octagon required.

Making a Square Stick Octagonal.

From H. G., *Medina, Ohio.*—I notice the methods of different correspondents, as described in the May number of *Carpentry and Building*, for making a square stick octagonal. I will give my method of making a square or round stick octagonal. I strike a circle on the ends of the stick according to the desired size; then with my dividers I step around the circle, dividing it into eight equal spaces. I then draw a line from one point to the next, and so on until I have the octagon. A pentagon or hexagon, or any other equal-sided polygon, may be laid out in the same way.

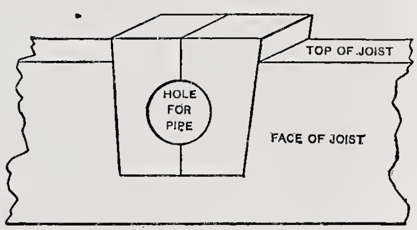
Gas Fitters Notching Joists.

On page 133 of the July number of *Carpentry and Building* we published a letter from Alexander Black, architect, Keokuk, Iowa, which first appeared in *The Metal Worker*, concerning the notching of joists by gas fitters. The appearance of that letter called out a reply from Mr. Robert Bunce, architect, of Quincy, Ill., which was addressed to Mr. Black, and which has been forwarded to us by the latter gentleman for publication. Mr. Bunce writes as follows: "I was very glad to see your article on notching joists. In the past I was so much annoyed that I inserted a clause with reference to the matter in my specifications. The remedy that I adopted was to have some little castings made to fit around the pipe and wedged into the notch, and by this compressing the wood to its maximum. The sketch I inclose will show what I mean. I would merely add that in the sketch the bevil of the wedge is very much exaggerated. In driving or fitting, great care is necessary to be taken in order that compression shall not be too great."

Accompanying this letter Mr. Black writes us as follows: "I may add that I usually designate the position of the gas-lights, as well as the position of the pipes, on the floor plans, so that there ought to be no excuse for the difficulties narrated in my former letter. It frequently happens, however, that the carpenter requires the plans and specifications constantly; accordingly the gas fitter merely learns the position of the lines, and then runs the pipes to suit himself without further inquiry. I have found it an excellent plan to make a diagram of the gas piping for the special use of the gas fitter, and I will add, in justice to gas fitters, that I have always found them obliging and ready to adopt the best methods. Their failure at times is merely from the want of technical knowledge."

Sash and Door Clamp.

From L. E., *Bangor, Pa.*—Your correspondent C. W., of Newport, asks for a plan for clamps for bringing up sash and doors. If he has a work bench with a screw



Gas Fitters Notching Joists.—Sketch Accompanying Letter from Mr. Robert Bunce.

and will make a trestle the same hight to keep the work on a level, he will find himself possessed of a method quite as convenient as anything which can be gotten up. I have used a lag screw or wood bolt ⅝ of an inch or ¾ of an inch in diameter, and as long as I could get it, with a 5 16 inch hole drilled through its head. Through this I have a piece of ¼-inch round iron welded in the form of a chain link 6 inches long. This link may be turned to either side, and may be used as a lever to turn the screw, and can always be turned out of the way. Another good form is this. After the iron is put through the screw head and bent double to form the lever, weld the ends together parallel, and turn this part at a right angle, to stand as the handle of a crank when the lever is at right angles with the screw. This screw is to be put through a piece of hard wood about 1½ inches square, which is inserted in a mortise in the end of a trestle just tight enough to be driven up or down and stand with the screw at any desired hight. This also makes a good screw for some of the other forms of clamps in common use.

Error in Formula Corrected.

From C. H. M., *Fair Haven, Conn.*—I would like to say a word about the formula given by Mr. Gaston M. Alves, in the article on the strength of materials published on page 90 of the May number of *Carpentry and Building*. I cannot make the two prove each other. We will take the first, where

$$1\text{-}6\left(\frac{B \times D^3}{.013 \times L^2}\right) = W.$$

Suppose we take a timber 2 x 4 inches and 6 feet long. Then

$$1\text{-}6\left(\frac{2 \times 4^3}{.013 \times 6^2}\right) = 437.6 + \text{lbs.}$$

Now, the reverse formula he gives as follows:

$$1\text{-}6\left(\frac{W \times L^2 \times .013}{B}\right) = D^3. \text{ Accordingly,}$$

$$1\text{-}6\left(\frac{437.6 \times 6^2 \times .013}{2}\right) = 218.8,$$

the cube root of which is a fraction over 6 inches. Now, since we started with a 2 x 4 and wind up with a 2 x 6, it is evident that a very large screw is loose somewhere.

Let us try the formula

$$\left(\frac{W \times .013 \times L^2}{1.6 \times B}\right) = D^3$$

$$\text{Then } \left(\frac{437.6 \times .013 \times 36}{1.6 \times 2}\right) = 64,$$

the cube root of which is 4 inches. Now, I should like to know the right and the wrong.

Answer.—Upon receipt of this letter we forwarded it to Mr. Alves, who replies as follows:

I am just in receipt of your favor, inclosing the correspondence of C. H. M. concerning formula given by me in May number, page 90, as follows:

$$1.6\left(\frac{B \times D^3}{.013 \times L^2}\right) = W$$

$$\text{and } 1\text{-}6\left(\frac{W \times L^2 \times .013}{B}\right) = D^3$$

The latter formula was a slip of the pen that escaped my notice. It, of course, should be

$$\left(\frac{W \times L^2 \times .013}{1.6\,B}\right) = D^3$$

as C. H. M. suggests. Am much obliged to him for pointing out the error.

About Tracings.

From T. W. C., *Stamford, Conn.*—I notice that many readers of *Carpentry and Building* are in trouble about tracings. I desire to give them the benefit of a "wrinkle" that has saved me a great deal of annoyance. I always employed in my work imperial tracing cloth, glazed on both sides. Dull, black dressing cloth is objectionable because the ink is liable to pass through. I get from a druggist some white pipe-clay, finely powdered, and rub it all over the dressing with a piece of chamois leather. The pipe-clay absorbs the grease from the cloth and causes the ink to flow freely from the pens. I have employed this method for some years, and should not think of attempting to make a dressing without it.

With regard to a point for stretching paper in the article in the April number, it was advised to fasten down the adjacent edges. Now, I could never make that plan work. I first catch about 3 inches in the center of one side, then a like space in the opposite side, and the other two sides in the same manner. Then returning to the first side I rub from the center both ways a few inches, and again opposite, and so on. The result is that the corners are fastened last and the sheet is perfectly tight, having no wrinkles in the corners.

Using Grindstones.

From P. S., ——— ———.—I desire to contribute to *Carpentry and Building* an idea concerning the use of grindstones which I learned from a German mechanic. It is the best thing I ever saw. Fasten a beveled piece of wood across the frame of a grindstone at the left hand end as you stand facing the stone, with the right hand on the handle of the crank. The piece of wood is placed close up against the stone, the bevel being such as is desired for the tools to be ground. The iron to be ground is held in the left hand, and is placed bottom up on the beveled piece, and against the stone. By this means it is possible for the left hand to hold the iron steadily and in the required position, while the right hand is left free for turning the stone. By the description above given, it will be seen that the stone is to be turned to the right.

Filling Cracks in Plastered Walls.

From K., *Alfred Center, N. Y.*—G. N. C. can cover the cracks in his plaster by using plaster-of-Paris prepared as follows: Mix it with water until it is very thin, stirring it constantly until it is set the first time. When in this condition it may be used for several hours before it will get hard. Apply with a small pointing trowel, or an ordinary case-knife will do. After filling all the cracks, kalsomine the ceiling in order to hide the filling.

Jointing Oil Stones.

From W. A. J., *Canyon City, Oregon.*—A very easy way to joint oil stones after they have become hollow in the center is to rub the face of the oil stone upon a sheet of coarse sandpaper, applying just water enough to moisten the face of the stone, without dampening the paper too much or starting the glue which holds the sand.

REFERRED TO OUR READERS.

Concrete Buildings.

From A. B., *Fredonia, Pa.*—I am thinking of putting up a concrete building 20 x 60 feet, in plan having two stories of 10 feet each. I desire to inquire from some of the practical readers of the paper how the cost of such a building will compare with that of a brick or frame building? Further, can the outside of the building be blocked off into squares to imitate cut stone, and can it be colored brown and blue to represent different qualities of stone? I also desire to inquire how much cement of the kind and how many bushels of sand will be necessary to provide for a building of the character above described? Any information which your readers can furnish me will be thankfully received.

Design for Public Library Building.

From G. N. C., *Hancock, N. H.*—I will be under obligations if some reader of *Carpentry and Building* will furnish for publication a design for a public library building, to be one story high, with mansard roof, slated, to have a door in one end, and to stand end to the street. Size to be about 22 x 30 if built of brick, with granite and stone trimmings, and lighted from windows in the roof. I should also be pleased to have suggestions as to inside finish. In return for such a favor I will furnish for publication an estimate in advance, and also an itemized account of the expense of building it.

Putting in Wire Screens.

From H. H., *Red Bluff, Cal.*—I desire the opinion of some reader of *Carpentry and Building* as to the best way of putting in wire screens in windows having outside blinds. Some of the carpenters in this neighborhood put the screens on the outside under the top sash. Is there any better plan? Will readers of *Carpentry and Building* furnish sketches illustrating approved methods of arranging mosquito frames?

Design for Outside Stairway.

From W. A. J., *Canyon City, Oregon.*—I come with a request for the correspondents' department. I wish to build a flight of steps from my front porch, on the second floor, to the sidewalk, and I wish a design for the same. The distance from the porch to the walk is 12 feet, with a rise of 10 feet. I don't wish the steps to have any supports in the center, but would have the space beneath finished in an ornamental manner—for example, arched. I would very much like to hear from the readers of *Carpentry and Building* upon this subject.

Laying Out Blinds.

From SUBSCRIBER, *Pittsburgh, Pa.*—Will some practical reader of *Carpentry and Building* please show the proper way of laying out blinds, rolling and stationary slats, and greatly oblige myself, and, I presume, many other readers?

Durability of Sugar Maple.

From J. P. S., *Hillsborough, Wis.*—Will readers of *Carpentry and Building* furnish me some information with regard to the suitability and durability of sugar maple for heavy framing, such as barns, &c. What precaution, if any, can be taken to prevent decay? I shall be pleased to note the kinds of experience with this timber.

Clamp for Drawing Doors Together.

From J. Y., *Uhlersville, Pa.*—I desire to ask a question of the readers of *Carpentry and Building*. I am in need of a clamp to draw doors together, something not too clumsy and yet strong enough for the purpose. It should be made out of ⅝ or ¾ inch iron, and of a size adapting it for a 3-foot door. Will some reader of the paper give me directions for constructing such a clamp?

More Rules Wanted.

From L. S. C., *East Machias, Me.*—I desire to refer one or two questions to the readers of *Carpentry and Building*. One is how to cut ribs for connecting walls and ceiling when the ground plan is furnished on one radius and the ceiling and walls on another. For example, say one is four feet and the other six feet. Another is this, how to cut corner board to fit side of circular hip at any given radius.

Pitch and Form of Gutter Cornice.

From W. F. P., *Berea, Ohio.*—Will some of the readers of *Carpentry and Building* please give me the best method for obtaining the pitch and form of a gutter cornice. I would also like a few designs for gable ornaments. Which method is the best for sheeting a house, applying the boarding inside or outside? Is the tarred paper objectionable on account of smell? Answers to any of these questions will greatly oblige.

Further Particulars Given.

From S. F. T., *Bellevue*, ———.—I notice a correspondent complains that I do not give full particulars in a question I asked some time since. I would add that the roof I desire rises 8 in 12 inches and is gabled. I shall feel under great obligations for any information your correspondent may kindly furnish.

Construction of Screen Doors.

From J. U., *Eulerville, Pa.*—Will some reader of *Carpentry and Building* present me with a design for a fly-door, something neat in appearance, with bracketed corners?

Scribner's Rule.

From J. W., *Wheeling, W. Va.*—I would be obliged if some practical reader of *Carpentry and Building* would explain the rule for measuring logs known as "Scribner's rule." Please illustrate it by practical examples.

Proportions of Curb Roof.

From C. B., *Kings, Ill.*—I would like to hear from the readers of *Carpentry and Building* their opinion as to the proper proportions of a curb roof for a barn. I frequently have occasion to build roofs of this description, but have nothing besides my own ideas to work from. I trust those who have had experience in the matter will contribute for my benefit.

CARPENTRY AND BUILDING

A MONTHLY JOURNAL.

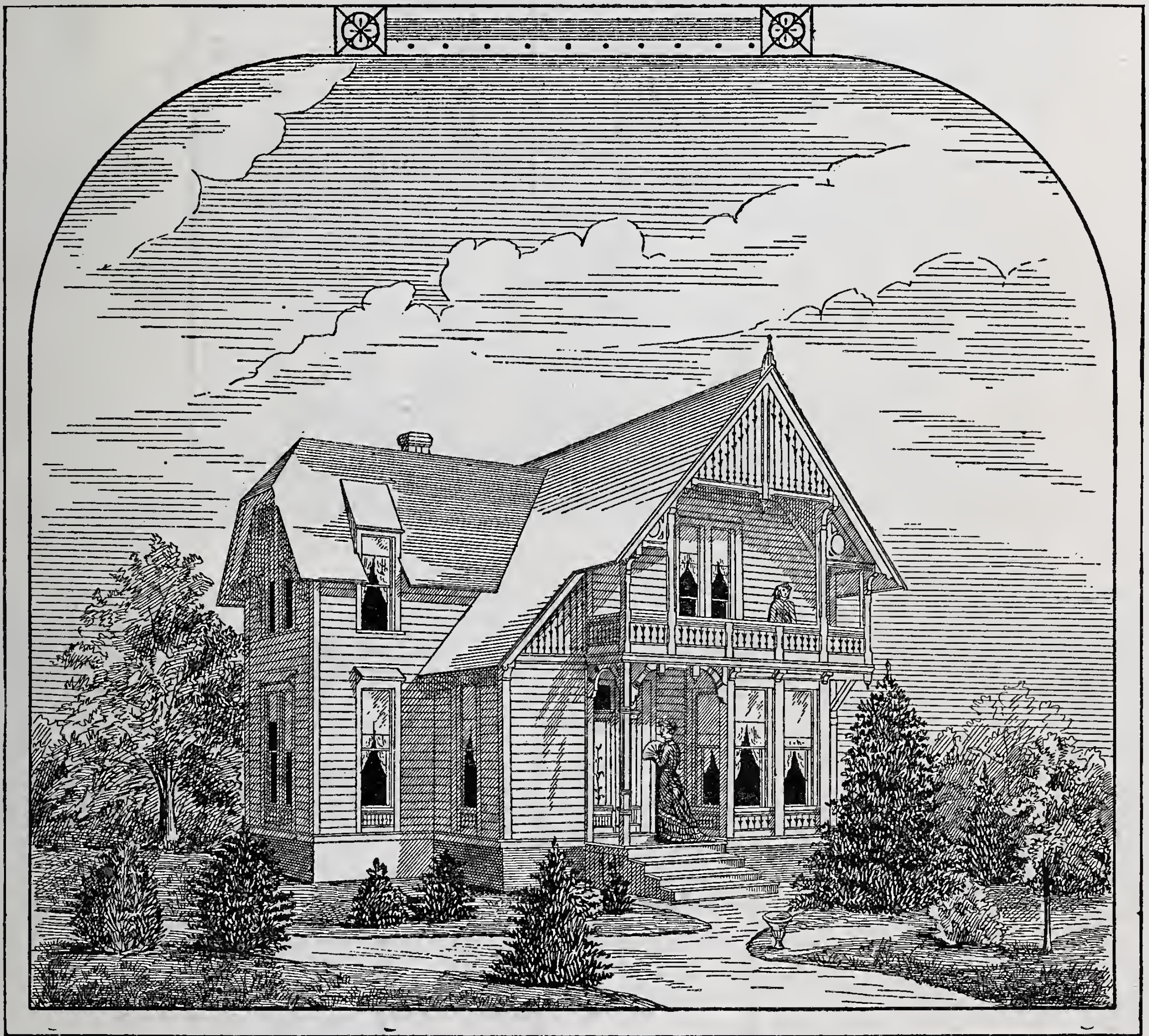
VOLUME II. NEW YORK = SEPTEMBER, 1880. NUMBER 9.

A Frame Dwelling.

The accompanying perspective view, elevations, floor plans and details represent a very comfortable and inexpensive frame dwelling, designed by Mr. George Miller, of Bloomington, Ill. At the time at which the drawings were made, which was several months since, Mr. Miller estimated the cost of building a house to this design in the neighborhood of Bloomington at about $1250. Since that time the cost of building material and labor has risen, and there are various sections of the country in which it cannot be built so cheaply as in the neighborhood in which Mr. Miller resides. Our only object in presenting these figures is to supply the want, almost always expressed upon the presentation of a new design, to know what it will cost. Many of our practical readers will no doubt estimate the drawings according to their own ideas and the locality in which they reside, obtaining results which will be entirely satisfactory for use.

The first story is designed to be 10 feet high; the second story, 9 feet high; the cellar to extend under the kitchen only, and to be 6 feet in the clear; the cellar to have a 12-inch wall, and an 8 inch wall to extend under the remainder of the house. We shall not attempt to enter into a detailed specification of the materials to be used in a house of this design. They should be the best of their respective kinds, but should be selected with reference to the relative convenience of obtaining them in the vicinity in which the building is to be erected. The design is such that it can be adapted to any class of materials. The foundation and cellar walls may be made of stone or of hard burnt brick, as may be determined by circumstances.

The arrangement of the house has many features which recommend it for use. The front hall and its stairway occupy very little space, and what is consumed is utilized to the best advantage. The stairs are divided into short runs, the landing being at the front end of a passage or hall, which communicates with each of the three chambers and bath room. The three principal rooms on the first floor, it will be noticed, communicate direct from the hall, which occupies the center of the house. The kitchen is so far removed from the parlor and dining room as to leave no chance of offensive odors reaching the latter apartments from it. Communication between the dining room and kitchen may be had by either of two means, through a passage way from which a door leads on to the back verandah, or through the pantry and china closet. The cellar stairs lead direct from the kitchen, and are arranged in such a manner as to be quite economical of room. If we were to criticise at all, it might be with reference to the chimneys. A single chimney to accomodate both parlor and dining room would seem to be objectionable, except on the score of extreme economy. An additional flue, we think, would not only add convenience to the house, but would improve its outward appearance.



A Frame Dwelling.—Fig. 1.—Perspective View.—Geo. Miller, Architect, Bloomington, Ill.

Three good-sized chambers are provided on the second floor, each of which is furnished with a closet of ample size. Space is also found for a 6 x 7 bath room, which is to be fitted with bath tub and wash bowl. Close proximity to the chimney, situated in the corner of the parlor on the first floor, affords the chance of locating the water pipes in such a way as to protect them from danger of frost. The front balcony surmounting the porch of the front door, and the bay window of the sitting room, are features which renders the front of the house quite attractive.

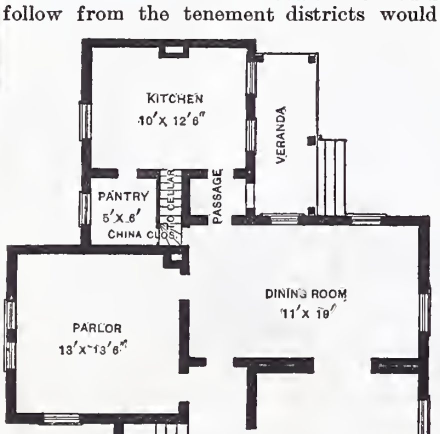
A Frame Dwelling.—Fig. 2.—Front Elevation.—Scale, ⅛ Inch to the Foot.

Dwellings in New York.

A daily paper, commenting upon the present activity in the building business in New York, says:

A large proportion of the dwellings now in course of construction in this city are apartment houses. The suites of rooms in such houses are termed French flats, and are designed to accommodate one family each. Those most in demand are what are known as small flats, consisting of a parlor, dining room, kitchen, two bedrooms and a bathroom, with closets for dishes and for an ice box, and a small storeroom. The area of such a flat is usually mainly devoted to the parlor. The bedrooms are small; the kitchen is smaller; the bath is large enough for a person to kneel in. But, notwithstanding the perverse ingenuity of the designer, such a suite of rooms rents for a high figure, provided the location is genteel. Such a flat in the fifth story rents at the lowest for $35 a month, or $420 a year—$220 more than a neat two-story cottage on a fair-sized lot in almost any American city of not more than 50,000 population. A fourth-story flat like the one described rents for $40 a month, and the increase is about $60 in the yearly rental for each successive suite below. The rental of the ground flat is $660 a year, or $160 more than is asked for a comfortable and well-suited brick dwelling with ample yard in a city like Utica, Rome or Syracuse. Higher rents are asked for large suites; but they are not proportionately higher, because the demand for large flats is less than for small.

At the present rate of building, the families who prefer to live in French flats will soon have been supplied. Investors then may turn their attention in another direction. The number of families who can afford to pay from $10 to $15 a month for rooms is vastly greater than the number who can pay from $35 to $55, and thousands of such families are now living on the outskirts of the tenement districts in small and poorly-ventilated rooms, because of the scarcity of such quarters as they desire. They would gladly pay $12 a month for three rooms, comprising a large sitting and dining room, a good-sized kitchen, and a fair-sized bedroom, well ventilated, and the kitchen provided with stationary cooking range and other conveniences. These families would not insist that the location should be genteel, provided that it was healthy and decent. There is a great demand for living places of this kind, and it would not be supplied in many years, even if the investors now building French flats should begin to put money into such houses. The removals that would follow from the tenement districts would



A Frame Dwelling.—Fig. 3.—First Floor Plan.—Scale, 1-16th Inch to the Foot.

considerably decrease the pressure there, and in time the building of a better class of tenement houses would become a necessity in order to get tenants.

If better and healthier quarters are to be provided in this city for the families of the large class of industrious men who are ready to pay $10 or $15 a month, the relief must come, not from any philanthropic movement, but from the business investment of money.

A Competition in Stove Designs.

We have no doubt that many of the readers of *Carpentry and Building* will be interested in learning something about competition in stove designs, which was announced in a recent number of *The Metal Worker*. We believe this competition is the first attempt ever made to call out the talent of professional designers in the way of contributions to the art progress of the stove-founding industry of the United States. Hence, unusual importance attaches to it. Since there are no artists who have made a specialty of stove designs, this proposed competition appeals to designers in other lines who may chance to feel interested in this direction. Up to the present time, manufacturers of stoves have been content to depend chiefly upon their own ideas and the skill of their pattern makers, who, hampered by the traditions of the business and restricted by the prejudices of their employers, have had little or no encouragement to the study of art. There is a business reason back of this advertised competition. It is authorized by one of the leading stove manufacturing firms of the country. Its real purpose is to obtain desirable designs for stoves to be manufactured for next season's trade. It marks a step forward in the progress of an important industry, and will be watched with interest by all friends of industrial art.

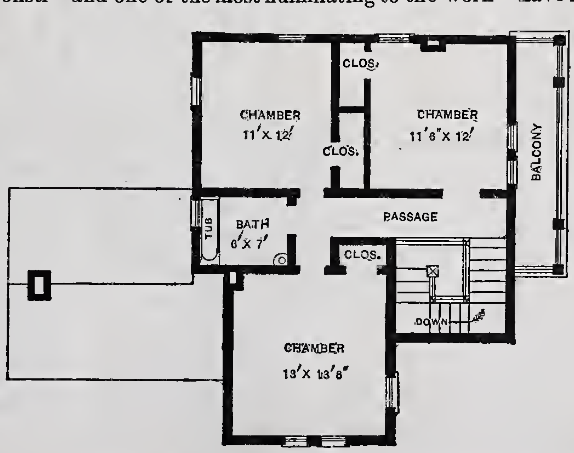
By the terms of the competition, designs are requested for the outside casing of a base-burning stove, for the outside casing of a wood-heating stove, and for a top ornament to take the place of urns, &c., suitable for a base-burning stove. The prizes for the best designs are quite liberal in amount, and are, for the three items named above, $100, $50 and $25 respectively. The competition is advertised to close on the 1st day of October. A circular containing full particulars, including scale and diagrams of the working parts of the stoves, which are required to be incased, can be obtained by addressing James C. Bayles, editor of *The Metal Worker*, No. 83 Reade street, New York. The committee of judges to consider the designs and award the prizes is composed as follows: James C. Bayles (address given above); E. M. Wheelright, architect, Albany, N. Y.; and Thomas Buckley, decorator, Troy, N. Y.

The Model Foreman.

A man, to be an entire success as a foreman, must make up his mind to be virtually a student for life, and use every means within his power to acquire knowledge. The education of his heart should never be sacrificed to that of his head, but proper discretion should be observed in all cases. While the brain may be overworked by too close application to study, the health should be carefully considered and the physical constitution kept up to a proper standard.

A Frame Dwelling.—Fig. 4.—Side Elevation.—Scale, 1/8 Inch to the Foot.

A foreman should read upon chemistry, natural philosophy and the sciences in general. We would also recommend that he read other useful literature, such as histories, narratives, and especially study mechanical drawing, which is indispensable. This course will develop the perceptive faculties, as they are called. He will not discharge a good workman for a slight offense and retain the poorest man. A good foreman, instead of giving his orders to a man verbally and imperfectly, will always carry a sketch block or pad in his pocket, and, where drawings are not used, will give his orders upon paper, together with a rough pencil sketch, if required. He should then require the workmen to file away those orders, thus putting him in possession of the necessary evidence to defend himself in case there should be any fault with the work when completed.



A Frame Dwelling.—Fig. 5.—Second Floor Plan.—Scale, 1-16th Inch to the Foot.

A foreman should realize that his workmen are entitled to his respect, and he should conduct himself in such a manner that when he moves about among his men they will feel in duty bound to show him all the courtesy that pertains to his position. His personal habits should be such as may, with profit, be imitated by every man in the shop. If a workman gets into trouble over a piece of work, a kind and sympathetic foreman will always help such a person out of his difficulty.

It is wise for a foreman to use only the best language toward his men, for the use of profanity not only creates an enmity between the foreman and the workmen, but also destroys the ambition and interest which the latter should always manifest in their work.

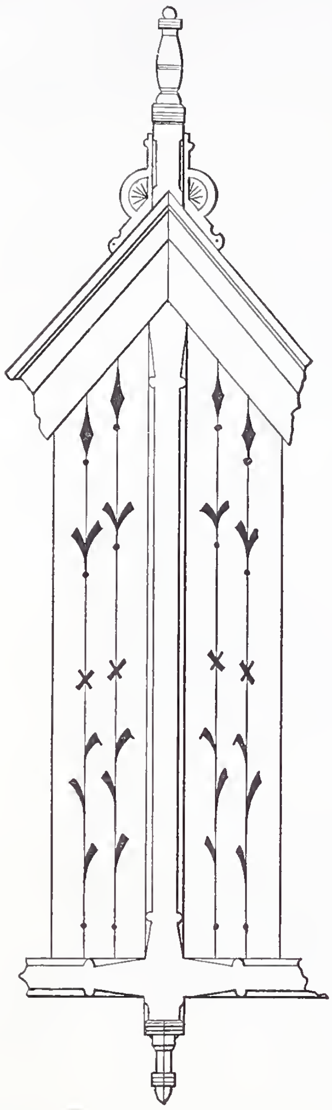
A foreman should be systematic, and wherever a standard or a certain routine can be applied to any branch of work, it should be done. Tools, instead of being left scattered over the floor, should each have a particular place. Thus, both the foreman and workmen are saved the aggravating annoyance of searching for them.

When a piece of work is given to a mechanic he should always be allowed to finish it, for one of the most disagreeable things, and one of the most humiliating to the workman, is to commence a piece of work and then have the foreman take it to some one else to finish.

Finally, a model foreman should endeavor to make himself so useful to his employers that they cannot well do without him, taking the same interest in managing the shop, and studying economy with as much care, as if his own capital were invested in the business. The manufacturing world are looking for artisans of this kind, and any person who has followed the opposite plan will, by adopting the principles herewith outlined, be agreeably surprised in a short time to find that he can make progress with so much greater satisfaction to himself than ever before.

The Use of Wood Screws.

At a recent meeting of the Polytechnic Club, the subject of wood screws was brought up for discussion and a considerable number of interesting facts were presented. Some of the speakers claimed that an ordinary wood screw had nearly the same hold on the wood when driven nearly home with a hammer and then given a few turns with the screw driver, as it would have if driven all the way with the screw driver. One builder, doing a large business both in New York and Brooklyn, said they held just as well when set in this manner. This is a common opinion among builders who work with a small margin of profit and look out for every point at which a penny can be saved. Doubtless the cheapness of the operation has much to do with forming their opinions. When a screw is driven into soft wood a distance equal to the plain part of the shank there is little injury, though the fiber of the wood is undoubtedly very much bruised around the screw, and the job is not as tight as it would be had a hole been bored for the screw. One of the members of the Polytechnic Club made tests, and found that it took 28 pounds to draw a screw which had been nearly set home with a hammer, and nearly 52 pounds for its mate which was driven all the way by a screw driver. This would seem quite conclusive. The fact seems to be that to get the greatest possible resistance from a screw driven in hard wood, the hole to receive the plain shank must be a tight fit. For the thread part, the hole should be smaller and just the size of the "wire," leaving the thread of the screw to cut its own way into the solid wood. In soft wood probably the greatest resistance can be got by making the hole the size of the wire for its whole depth, and allowing the wire of the screw to expand the outer portion of the hole. Some people, however, claim that in soft woods, such as pine, the best way is to merely enter the screw with a small brad-awl hole, and then allow



A Frame Dwelling.—Fig. 6.—Detail of Work in Upper Part of Front Gable and Finial.—Scale, ½ Inch to the Foot.

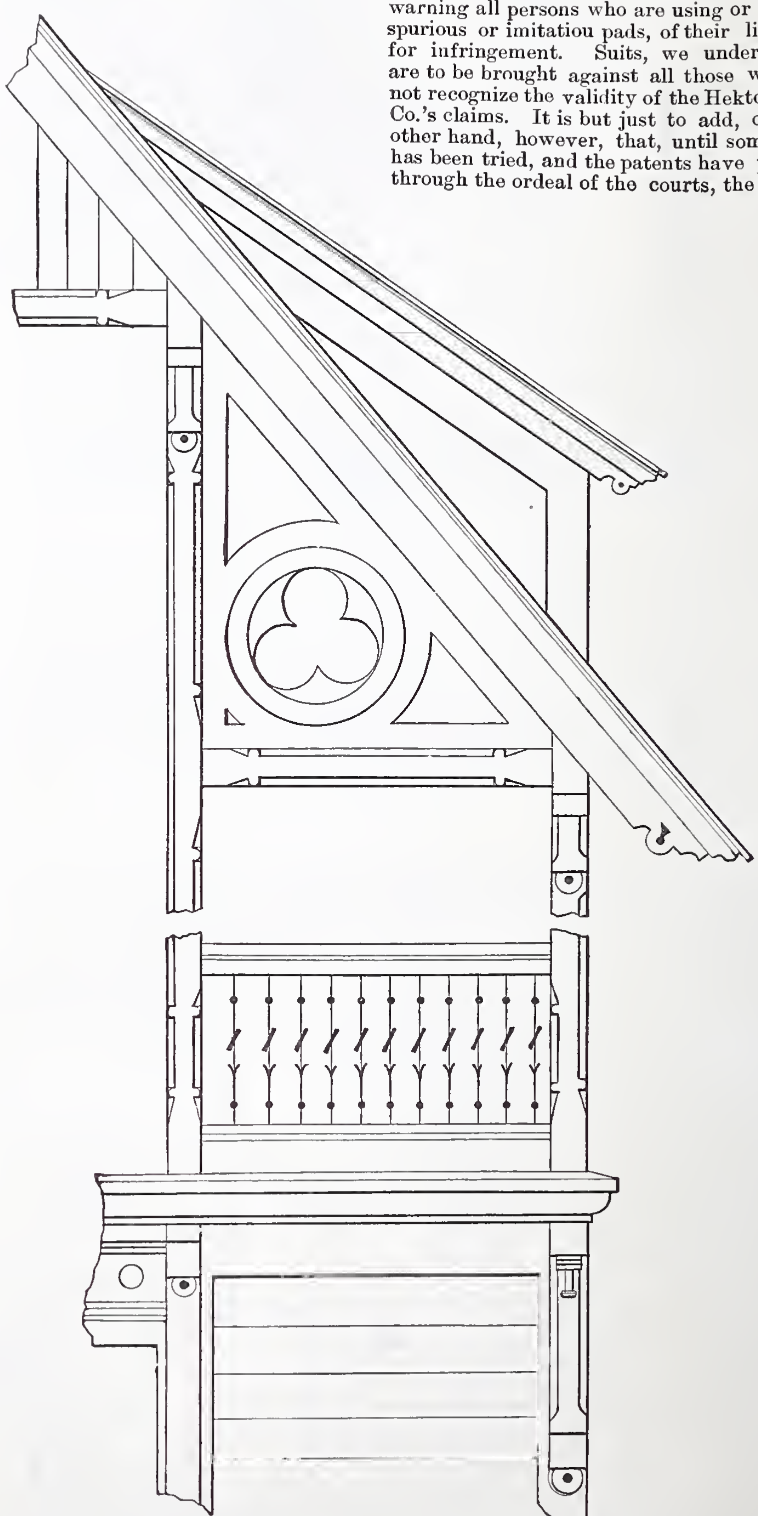
it to force its way into the wood. We have seen work put together with screws which were driven in the whole distance with the hammer. We think the value of such work is demonstrated when an attempt is made to take out a screw thus driven with a nail puller. A great deal is said about the value of locking the grain of the wood with the projections of the screw. Practically, we think that this does more harm than good, by completely destroying the tenacity of the wood for a considerable distance around the screw. We should consider the barb nail vastly superior to any wood screw we have ever seen, if the screw was to be driven with the hammer.

Where it is desired to set the screw in a plastered wall or in mortar where no hold whatever can be obtained for the threads, a little plaster of Paris mixed and pushed into the hole, and the threads of the screw at the same time filled with plaster, will give a most excellent hold. We have sometimes drilled a hole in brickwork, filled it up in this way and inserted a screw, and found that we had as firm a hold as though the screw had been fastened in a piece of hard wood.

Drilling Glass.—Take a common drill and run a little fast; do not press on—the weight of the drill press is enough. Drill from both sides, keeping the glass and drill wet with turpentine. Be very careful, when the two holes meet, not to let the drill catch. After a hole is made large enough for a small round file, file to the desired size, keeping the file and glass wet with turpentine.

The Dry Copying Process.

There are very few of our readers who have not at least seen, if not personally used, one or another of the numerous dry copying pads which, during the past year, have been quite extensively put upon the market. The essential element of this process for reproducing drawings and writings is a gelatine pad, commonly put up in a tin case. The writing is done upon ordinary paper, with an analine ink, and is transferred to the pad by simply spreading the paper upon it. After this preparatory work has been done, as many as 100 duplicates, or copies, may be taken from it. The process of copying, or printing, consists of placing a clean piece of paper upon the im-

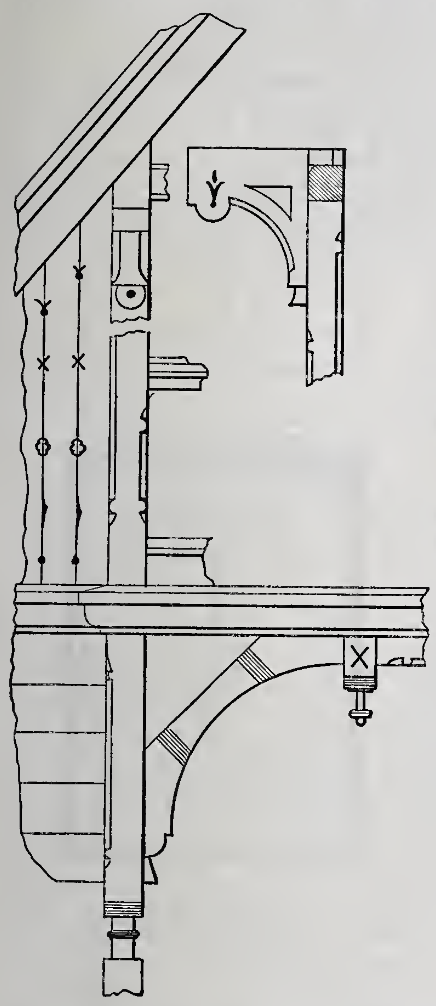


A Frame Dwelling.—Fig. 7.—Detail of Work at Sides of Front Gable and of Balcony.—Scale, ½ Inch to the Foot.

pression on the pad and smoothing it down with the hand. So simple is this operation, and so manifest is its utility, that a very large sale for apparatus of this kind sprung up immediately after its introduction. From the outset various claims were made as to originality. Some asserted proprietorship by reason of invention or discovery, while others contended that the idea was old and could not be covered by patents. So long as no patents were issued for it in this country, there did not seem to be much chance of the controversy being decided, and there appeared a reasonable probability that the process would become public property in any event.

On the 1st of June last, however, two patents were issued by the government, which, by casual inspection, seem to cover the process in every essential particular, and which would seem to establish the rights of the alleged inventor or discoverer beyond dispute. These patents, by assignment, have become the property of the Hektograph Co., of this city, who have issued a circular warning all persons who are using or selling spurious or imitation pads, of their liability for infringement. Suits, we understand, are to be brought against all those who do not recognize the validity of the Hektogragh Co.'s claims. It is but just to add, on the other hand, however, that, until some suit has been tried, and the patents have passed through the ordeal of the courts, the question of their validity will hardly be admitted as fully established.

Irrespective of the legal phases of the matter, we have a word to add with reference to the Hektograph pad. We have experimented with the dry copying process to a considerable extent, having made our own pads from the raw material, and having bought and used the pads of a number of different manufacturers. As the result of our experiments, we have no hesitation in saying that so far we have found nothing quite as satisfactory as the Hektograph. We are at present using a Hektograph pad of large size for the duplication of mechanical drawings. We find it to be more durable than any other we have tried. It requires working over, or remelting, less frequently, and admits of more easy erasure, or cleaning, after using than those we had in use previously.



A Frame Dwelling.—Fig. 8.—Details of Front Gable and Balcony.—Scale, ½ Inch to the Foot.

Made from Paper.

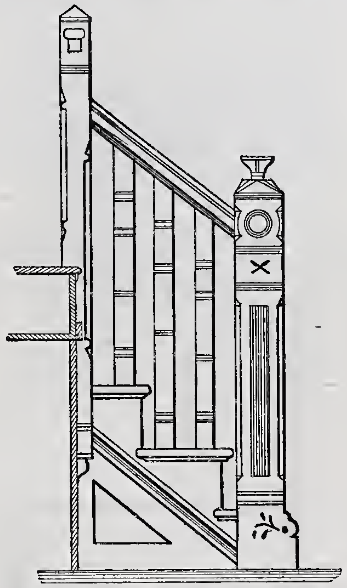
We have so long cherished a well-founded prejudice against paper as a flimsy and unsubstantial substance, that we are surprised at its recent utilization in many ways where strength and durability are the important requisites. Many articles, if we learned that they were made entirely or in part from paper, immediately lost favor in our eyes, and we looked at them askance. When the soles of our shoes soon wore out, the fact was often attributed to the use, by the unscrupulous maker, of shoddy strips of paper in the place of inside layers of double leather, and this is only a single illustration among many that might be given to show to what miserable, if not despicable, uses paper has been put. The daily tearing of newspapers and light wrapping paper for the purpose of doing up parcels has also done much to impress us with the fragility of the frequently handled material. It was natural that we had come to regard paper as a cheap and unreliable substance.

As a consequence, we cannot readily conceive of the successful application of paper where great strength, tenacity to withstand powerful strains and durability are required of it. But the one process of compression, enormous in its power, gives all these highly desirable constituents to a solid, compact substance, which, although harder than wood and taking, to some extent, the place of iron, is formed of the same material that makes the fragile newspaper sheet.

Paper car wheels are successfully manufactured and used ; paper bricks are becoming desirable as a building material. Prof. Green, of the Troy Polytechnic Institution, has erected a great revolving dome whose light framework is covered with hard enduring *papier maché* only one-sixth of an inch thick. Paper has been successfully employed as an anti-fouling sheathing for iron vessels, and in other things almost as unexpected.

It must be observed in connection with paper, however employed, that it possesses two very manifest advantages—lightness and cheapness—and when compressed into a solid substance it is also as hard and durable as several other strong and more costly materials. No one will hesitate to employ paper instead of iron in any construction, provided that the former can be shown to be sufficiently strong, for its lightness and cheapness are most important considerations in its favor. The range and mutability of paper are remarkable. The same material that forms the delicate valentine enters into the stalwart car wheel that sustains the weight of tons, holding the steel tire firmly in its place and enduring unlimited pounding for years until the tire itself is fairly worn out. According as paper may be prepared, it ranks among the most fragile or the stoutest substances.

Harder than wood and impervious to water. Just think of it ! How people fifty years ago would have been surprised at such accomplishments. But being established facts, they are fraught with great significance. They have enlarged the possibilities of paper wonderfully. They have opened a wide field for experiment and invention. Paper is destined to take the place of many substances that will be found inferior to it, while its application in numerous undeveloped ways wherein nothing else can be used, may be confidently expected.

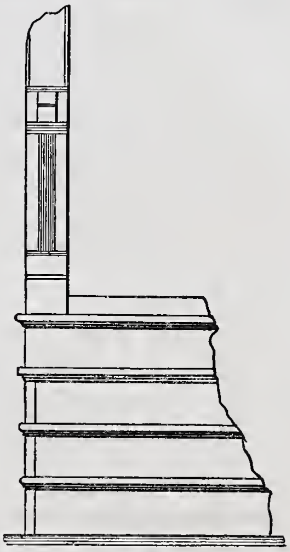


A Frame Dwelling.—Fig. 9.—Front Stairs as Viewed from Vestibule Door.—Scale, ½ Inch to the Foot.

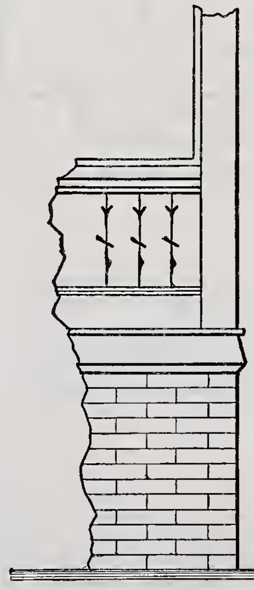
A Desirable Catalogue.—We have received from Messrs. J. B. Shannon & Co., No. 1009 Market street, Philadelphia, a copy of their illustrated catalogue of building hardware, which is, we believe, the first illustrated catalogue ever issued especially for the building trade. Besides containing a full description of the specalties manufactured by this firm, it contains a fair assortment of general hardware entering into buildings manufactured by other first-class firms. Accordingly, the carpenter or builder who possesses a copy of this catalogue has for himself a fund of information for which otherwise he would be dependent upon the local hardware dealer of his neighborhood. A price list is issued accompanying the catalogue, thus making it doubly valuable as a work of reference. This firm make a specialty of attending to mail orders and have issued this catalogue in order to facilitate trade of that character. There are very few among our readers who will not profit by having a copy of this catalogue. Accordingly, we advise all to send for it.

National Peculiarities.

A French writer says : "The man of the north is a house carpenter—his work always smacks of house framing. The Englishman—excellent cabinet maker—sacrifices everything to comfort. The German —skillful carver—loves squat and heavy forms. The Spaniard, as well as the Italian, shares the influence of the south ; for them interior comfort is an accessory, home the exception. The first, under the influence of a common rule, sometimes mingles two contrary elements, northern and southern—Flanders and Spain ; but the ill-assorted union could be neither fruitful nor lasting, and each soon resumes its own liberty. The Italian knows nothing of these compromises —he is a frank meridianal ; he has seen Gothicism pass by without making any advances to it, and has always maltreated it. An out-of-door man, able decorator and full of dash, he loves expeditious methods, searches for effect, and disdains all beside."



A Frame Dwelling.—Fig. 10.—Detail of Front Porch and Steps.—Scale, ½ Inch to the Foot.

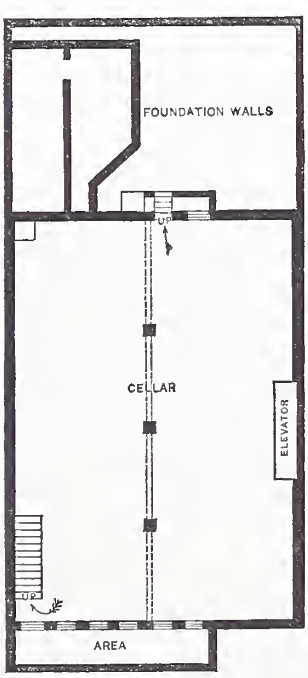


A Frame Dwelling.—Fig. 11.—Detail of Bay Window.—Scale, ½ Inch to the Foot.

A correspondent says, in regard to fast buildings in Western towns, that they raise and cover the first day, put in the lights the second day and the liver the third

A Model Wood-Working Establishment.

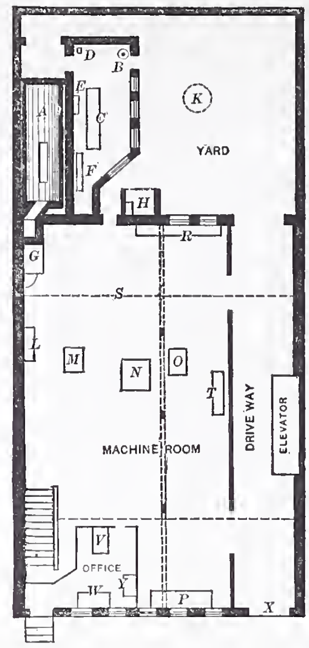
As likely to be of considerable interest to many of our readers, we propose to describe the arrangement and equipment of the establishment of C. Graham & Sons, Nos. 305 and 307 East Forty-third street, this city. Their business, as may be known to many of our readers, is that of stair building and fine cabinet finish for houses. They have recently built a new shop, the building being 50 feet front and 100 feet in depth and comprising five stories and a basement. The exterior features of the building have no special interest, it being factory architecture in style—four plain brick walls surmounted by a cornice of sufficient projection and covered by a gravel roof. In going through the establishment we made sketches of each of the several floors, and in order to make our description better understood, we have engraved the same and present them herewith. The office, it will be seen, is at the front of the first floor (Fig. 2). The entrance is by means of a vestibule, one door opening into the office and another leading directly into the shop. All communication with the shop is through this vestibule. The door leading into the shop is open at proper intervals for the entrance and exit of the workmen, and is locked during working hours, thus compelling every one who enters the shop to pass through the office. By this means a desirable check upon the movements of the workmen themselves and of visitors to the workshop is effected. Passing from the



A Model Wood-Working Establishment.—Fig. 1.—Basement Used for Storage of Lumber.

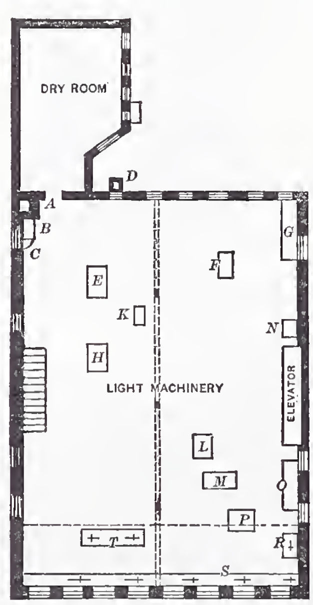
office, we first entered the basement by means of the stairs shown in the engraving. The basement is used for the storage of lumber, and, in order to prevent mustiness and to maintain an equable temperature at all times, is supplied on the four sides with steam pipes, placed in the angle of the floor and the side walls. The floor is finished in cement, and the whole apartment, by means of the pipes just referred to, is kept sweet and pure. A buzz saw for converting lumber is located in about the middle of this room. A stairway leads from the cellar up the rear area into the yard. The elevator, which is a prominent feature of this establishment, runs from the basement to the top floor. In size it is 17 feet long by 4 feet wide, being ample for conveying 16-feet lumber as may be required, and was furnished by Messrs. Brigham & Webb, of No. 186 Wooster street, this city.

From the cellar we passed into the yard at the rear of the first story. This yard is surrounded by a high wall surmounted by an iron railing, and is used for the storage of lumber, coal, &c. The yard is provided with a cement floor, in the center of which (indicated by K, Fig. 2) is a cistern or cesspool,



A Model Wood Working Establishment.—Fig. 2.—First Floor. A, Lowe Boiler. B, Lowe Heater. C, Buckeye Automatic Engine. D, Engineer's Closet. E, Worthington Duplex Pump. F, Fly Wheel. G, Water Closet. H, Shavings Chute. K, Cistern or Cesspool. L, Jointer. M and N, Molding Machines. O, Pony Planer. P, Bench. R, Swing Cut-Off Saw and Bench. S S, Line Shafting. T, Saw. V Y, Desks in Office. W, Drawing Table. X, Gate to Drive Way.

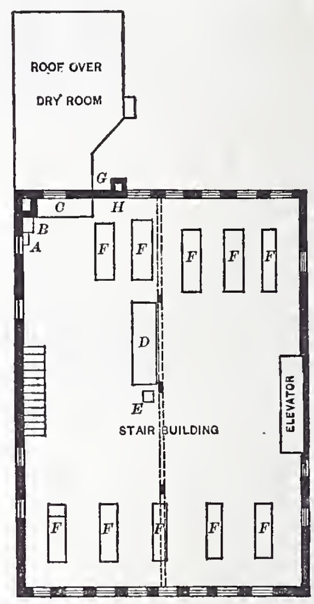
into which is collected the condensed water from the escaped steam from the engine. An open iron grate covers this cistern and affords a ready means of dispos-



A Model Wood-Working Establishment.—Fig. 3.—Second Floor. A, Door to Dry Room. B, Water Closet. C, Sink. D, Shavings Chute. E, Pony Planer. F, Band Saw. G, Bench. H, Saw Bench. K, Variety Machine. L, Grindstone. M, Boring Machine and Miter Saw. N, Machinery for Running Elevator. O, Fluting Machine. P, Sandpaper Machine. R, Lathe for Turning Circles. S and T, Benches with Turning Lathes.

ing of the snow, which accumulates in such a yard in the winter time. The arrangement of the boiler and engine house, together with the pump, heater, &c., is clearly shown by the reference letters in the engraving. The boiler is Lowe's patent, manufactured by the Bridgeport Boiler Works. The engine is rated at 45 horse-power and is of the automatic pattern, manufactured by the Buckeye Engine Company, of Salem, Ohio. There is nothing whatever about the boiler and engine room which can be burned except the sash, window and door frames. The floor is of cement. The ceiling above, which forms the floor to the drying room, is composed of iron beams with hollow flat arches. E, in Fig. 2, indicates the position of a Worthington duplex pump and B the location of a Lowe heater. D is a closet for the accommodation of the tools, &c., of the engineer.

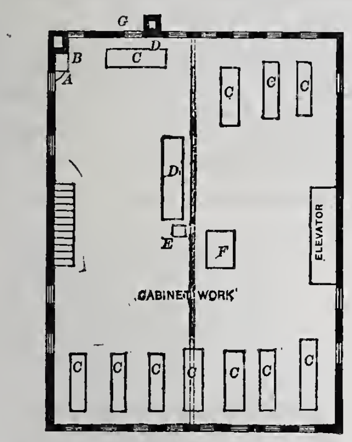
A special feature of this establishment is the chute for taking the shavings from the several floors and conveying them to the yard below, where they are used for fuel.



A Model Wood-Working Establishment.—Fig. 4.—Third Floor. A, Sink. B, Water Closet. C, Hardware Closet. D, Heater for Cauls. E, Steam Glue Pots. F, Benches. G, Shavings Chute. H, Iron Door Communicating with Shavings Chute.

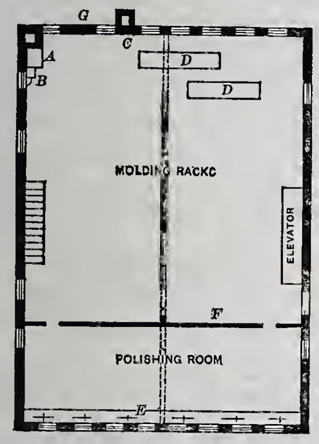
This chute is a brick shaft, indicated by H in Fig. 2, which is carried up very much after the manner of a chimney. The openings into it on the several floors are closed by iron doors. It is enlarged at the bottom sufficiently to receive a basket on wheels, which, when filled, is drawn around in front of the furnace for use. The opening at the bottom of the chute is closed by a heavy iron door. By this arrangement of parts, should fire by any accident get among the shavings thrown from the different floors, the draft up the flue would be the same as up a chimney, and it might burn out in safety, not injuring the building in the least. Should one of the iron doors be open the draft would be inward from the shop, thus preventing any danger of the fire communicating with the shop.

Another feature of the lower floor is the drive-way, by which it is possible to reach the yard with a wagon. Like all other city lots, the ground upon which this establishment is located is shut in on three sides, and accordingly communication with all parts must be made from the street in front. By examining the plan of the first floor, it will be seen that a wagon may be driven directly alongside the elevator either for receiving or unloading lumber, and may be driven through to the yard for like purpose or for the delivery of coal. We shall not stop to describe the machines on this floor, because they are sufficiently indicated by the reference letters in the caption of the engraving. We have also indicated approximately the location of the line of shafting. Ascending to the second floor, we found the front of the room occupied by turning lathes; the center portion of the room is devoted to the ordinary light machinery peculiar to this line of business, and at the rear is the dry room, coming directly above the engine and boiler room already described. The floor of this dry room we have already mentioned. Upon the hollow arches and beams is placed a considerable thickness of cement. Steam pipes are carried along just above the floor, and lumber is placed above them on suitable racks provided for the purpose.



A Model Wood-Working Establishment.—Fig. 5.—Fourth Floor. A, Sink. B, Water Closet. C, Benches. D, Heater for Cauls. E, Steam Glue Pot. F, Saw Bench. G, Chute for Shavings. E, Iron Door Connecting with Shavings Chute.

A sliding iron door works on the inside of the dry room, while a hollow iron door swings into the main shop. The result of this arrangement is that the dry room is shut off from the main shop by means of two iron doors and an intervening air space. The thermometer in the dry room when we entered it registered 133 degrees, although some of the windows were open. A steam pipe is carried from the boiler into this



A Model Wood-Working Establishment.—Fig. 6.—Fifth Floor. A, Water Closet. B, Sink. C, Iron Door to Shavings Chute. D, Benches. E, Bench with Polishing Lathes. F, Partition. G, Shavings Chute.

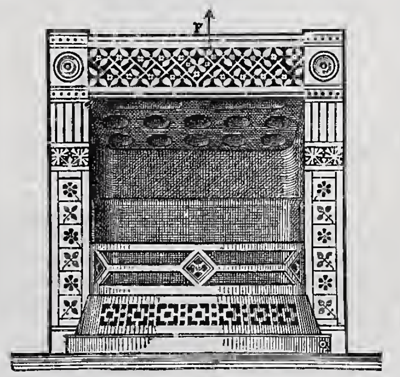
room, and is so arranged that, in case of a fire occurring in it, live steam may be poured into the room to smother the fire.

A feature of special importance, and which is peculiar to all the floors, may be mentioned here. A water-closet and urinal is provided in the rear left-hand corner of the room, indicated in the engraving of the second floor (Fig. 3) by B. A sink or wash basin is located just outside, indicated in the same engraving by C. The smoke stack is carried in this corner of the building, and the pipes supplying the water-closets, &c., run beside it and are thereby protected from frost. A tank is located in the upper story and is provided with a tell-tale, by which the engineer always knows its condition. This is kept full of water and a hose connection is provided on each floor. Since the city water works do not provide sufficient pressure to carry water to the top of the building, each floor is provided with a hand pump, which is used by the workmen as they may have occasion. We call special attention to these features, because we consider them in themselves very good, and because intelligent care as to the comfort and convenience of workmen always results in an advantage to the proprietors of any establishment. The protection and precaution against fire in this concern are pronounced by many who have examined them to be the best of any in the city among concerns of its class. We at least have never seen their equal.

The third floor (Fig. 4) is called the stair shop. It is provided with benches, as indicated in the engraving, and in the center is an arrangement for warming cauls for veneering, indicated by D on the engraving. This affair consists of a series of steam pipes running along the bottom of the inclosure, communication with which is had by iron doors, which hoist, thus opening in such a manner as to admit of pieces being inserted or withdrawn with the least possible escape of heat. At the end of the caul heater is a steam arrangement for heating glue pots, indicated by E on the engraving. The roof over the dry room comes even with this floor, as may be seen on the engraving. A hardware closet is provided also on this floor, indicated by C on the engraving.

The fourth floor (Fig. 5) is devoted to cabinet work, and the arrangement of benches, &c., in it is sufficiently indicated in the engraving to require no extended description.

The front of the fifth floor (Fig. 6) is used as a polishing room, a row of polishing lathes being located across the front. The remainder of this floor is used for the stor-



The Warming and Ventilation of Dwellings.—Fig. 1.—Front Elevation of the Jackson Ventilating Grate.

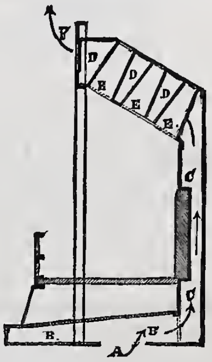
age of moldings and for work ready to send out. A couple of benches are used in the back portion, as may be seen by the engraving.

What impressed us most in passing through this establishment was the simplicity of its arrangement in all respects and the intelligent care with which every possible convenience for doing work has been provided, the precautions taken to guard against fire and the general utility of all the arrangements. Messrs. Graham & Sons, as a firm, enjoy an enviable reputation in this vicinity for doing good work, and we feel certain that, with their new shop and its equipment, they are likely to attain for the future even a higher position than they have occupied hitherto.

A noticeable feature about the building was its freedom from vibration. It is a well-known fact that the extreme rapidity of motion of wood-working machinery is very trying to any building of whatever construction, and it is seldom that one is found in which there is not a very perceptible tremor. We feel certain that very few can be found with less tremor than the one we have described, some features of the construction of which may be of interest to our readers. The first and second floor joists are 4 x 14 inches, placed 14 inches between centers. They are supported by the walls and the girder which runs lengthwise of the building through the center, and of course are carefully bridged. The floors are 2 inches, single thickness, and afford sufficient foundation for fastening any machine that may be required. Above the second floor the joints are 3 x 14 inches in size. The posts supporting the girders are 10 x 12 inches, and the girders themselves are 10 x 14 inches. The shop is designed to accommodate 85 men. When we passed through it about 75 were at work.

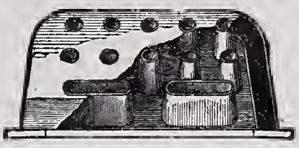
The Warming and Ventilation of Dwellings.

Whoever has given a moment's thought to the subject of heating and ventilating dwellings, must have been struck with the vast difference there is between the old-style open fire-places which were common in the days of our grandfathers, and modern air-tight stoves. While with the first there was no complaint about the lack of fresh air—the trouble ordinarily being too much ventilation, so called—with the latter there is a decided lack in this respect. Ventilation is not provided by means of the stoves themselves, but must be furnished by other means. There is something cheerful about



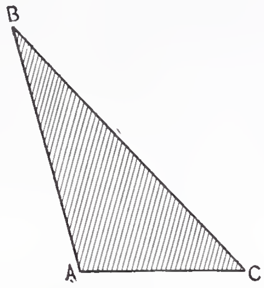
The Warming and Ventilation of Dwellings.—Fig. 2.—Vertical Section through the Jackson Ventilating Grate.

an open fire which makes men loth to give it up, and hence many have been the experiments made to devise some way in which the advantages of the open fire may be preserved, while the disadvantages are abolished. A person standing before the open fire of a grate intercepts the direct rays of heat and is warmed by them. The surrounding air, however, does not become heated in the same way. It has no power to arrest the heat and utilize it. Air is warmed only by its particles coming in contact with heated surfaces—as, for instance, the walls of a room and the objects which may be in the room. These, having received heat from direct radiation, become secondary heating surfaces, and from them alone is warmth imparted to the air. In this fact lies one of the greatest objections to the ordinary open fire. In common parlance, while one's face is being roasted, his back is freezing. Since all the occupants of a room who are not in a position where the direct rays from the fire may strike them are dependent upon the warmth of the air for comfort, it is apparent that heating a room by means of an ordinary open fire is not at all economical. In common grates or fire-



The Warming and Ventilation of Dwellings.—Fig. 3.—Construction of the Chamber above the Fire.

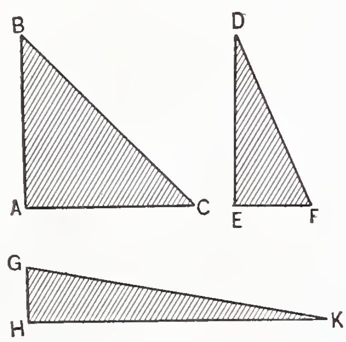
places, at least one-half of the fire surface of the mass of fuel rests against the sides and back of the grate basket; hence, a very large amount of the whole heat generated must be dissipated and lost in the brickwork of the chimney. Since the principal surface of the body of incandescent fuel in open fire-places of ordinary construction is directly under a large opening into the chimney-flue, another considerable portion of the heat escapes in this way and is lost. Finally, the small portion of heat which is actually radiated into the room becomes capable of heating the air only by means of heating the walls and such objects as may be in the room. Since walls are good conductors of heat, allowing it to pass through them freely and rapidly, there is another source of waste in this direction. Careful experiments with ordinary open fires has demonstrated that in many cases five-sixths of the entire heat product of combustion passes up the chimney, and of the remaining one-sixth, a considerable part is lost by leakage through the walls of the building, so that, in reality, only about one-eighth of the entire heat of open fires is utilized for comfort. Hence the popular belief that open fires,



Stair Building.—Fig. 9.—A Triangle.

wherever fuel is an item of any consideration, are very expensive luxuries.

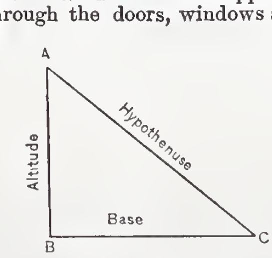
A modification of the open fire-place proposed by Count Rumford, and that form of it represented in the celebrated Franklin stove, did much toward remedying this enormous waste. These improvements, however, were but the forerunners of a long train of inventions, which have tended more and more to the economical use of fuel. From the open fire-place of the last century we have reached the opposite extreme, culminating in the modern air-tight stove, in which, says Hawthorne, "that brilliant guest,



Stair Building.—Fig. 10.—Right-Angled Triangles.

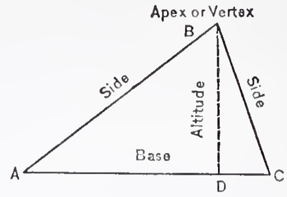
that quick and subtle spirit whom Prometheus lured from heaven to civilize mankind and cheer them in their wintry desolation, has been thrust as into an iron prison, and compelled to smolder his life away on a daily pittance which once would have been too scanty for his breakfast."

One of the desirable features attendant upon the use of the open fire-place is the rapid change of air which takes place. The large opening into the chimney flue gives admission to a considerable volume of air, which, being drawn from the room, entirely changes the body of air in it at short intervals. Fresh air is supplied to the room through the doors, windows and wall



Stair Building.—Fig. 11.—Names of the Sides in a Right-Angled Triangle.

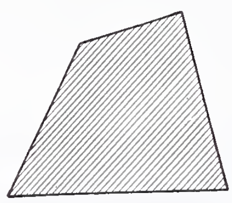
crevices. With most stoves of modern construction, by reason of the very principles upon which they are based, this process of exhaustion proceeds very slowly, becoming, in many cases, almost imperceptible. Apparatus of this kind, therefore, heat and reheat the same air in rooms, and hence are required to supply only an amount of heat sufficient to equalize the loss through the walls, doors and windows. The reason for the apparent economy in fuel in their use therefore becomes evident. With other forms of



Stair Building.—Fig. 12.—Names of Parts of Triangles.

modern heating apparatus, viz., the steam and hot-water systems, no air is taken from the rooms, but that with which they were originally supplied is heated over and over again. The atmosphere of a room treated in this way becomes more and more vitiated by respiration and contaminated by constant exhalations from the bodies of the occupants. Hence the objection to heating by any of these systems.

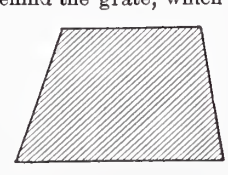
While the several forms of modern heating apparatus are certainly entitled to the name of fuel economizers, it is clear that they save fuel at the expense of health, and accordingly, we think, are justly chargeable with being the most unprofitable heaters that can



Stair Building.—Fig. 13.—A Quadrilateral Figure called a Trapezium.

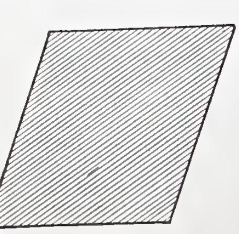
be employed. They spend the strength and health of the occupants of the house while saving something in money. Better by far is an open fire, even with its enormous wastage of fuel, considering its compensating advantages as a ventilator.

Such are the two extremes to be met with in heating devices. There is, we believe, middle ground which is entirely tenable. Dr. Wilson, in his excellent treatise entitled "Health and Healthy Houses," says: "The greatest improvement which has been made in the warming and ventilation of rooms of late years is the introduction of what are called ventilation grates. These are so constructed that a great portion of the fresh air entering a room is first warmed in a chamber behind the grate, which communi-



Stair Building.—Fig. 14.—A Quadrilateral Figure called a Trapezoid.

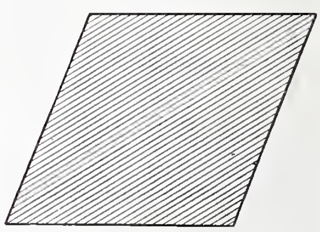
cates by a special flue or channel with the air outside. They are not much more expensive than the ordinary grates, and apart from their advantages from a sanitary point of view, they will, I have no doubt, come into



Stair Building.—Fig. 15.—A Parallelogram of the Variety known as Rhomboids.

general use at no distant date, on account of the great saving of fuel which they insure. These grates were devised by Captain Douglas Galton, more especially for the warming and ventilating of millitary barracks, and they are now manufactured of various patterns to suit every kind of rooms." While the Galton grate, which is an article of English manufacture, is entitled to all the praise bestowed upon it, it doubtless possesses some features which are capable of improvement. The grate shown in the accompanying illustrations is an example of American effort in this direction, and is claimed by the inventor to possess all the desirable features of the Galton grate, while it exceeds it in capacity as a heater and ventilator. It also has the advantage of being less complicated in its structure. It is manufactured by Edward A. Jackson & Bro., of 315 East Twenty-eighth street, New York.

By examination of Fig. 1 it will be

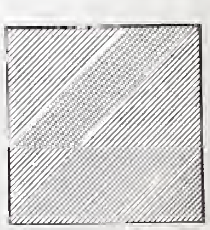


Stair Building.—Fig. 16.—A Parallelogram, known as a Rhombus or Lozenge.

seen that this grate presents the general appearance of the ordinary grates in use, so much so that the casual observer would hardly distinguish between the two. It is inserted into the ordinary chimney flue without changes. No ventilating shafts are required, and the grate is complete within itself as supplied to the customer. Its essential features may be understood by examination of Figs. 2 and 3. It will be seen that fresh air is admitted from out doors by means of a flue discharging immediately below the grate, as shown at A, Fig. 2. The air is partly warmed in the chamber B, and then passes upward from chamber C, receiving additional heat; thence to the chamber marked D, where it plays around the heated flues or tubes E E, the construction of which is shown in Fig. 3, absorbing their heat and passing thence through openings, as shown in front of frame at F, into the apartment as through a register. By the unceasing admission of pure, warm air in this manner, the atmosphere of the room is

Stair Building.—Fig. 17.—An Equiangular Parallelogram, called a Rectangle.

heated and at the same time is being constantly changed, the vitiated and colder air being drawn through the open flue of the fire-place and escaping through the chimney. It is claimed by the inventor that nearly three times the heat is produced in this grate that is produced by the ordinary grate, and that it works with entire satisfaction in all respects. It will be seen that the heat which is commonly spent in the fire-place



Stair Building.—Fig. 18.—An Equiangular and Equilateral Parallelogram, called a Square.

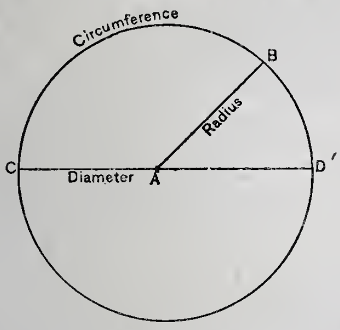
and chimney is here largely utilized for warming the air of the room.

By apparatus of this general kind the two conditions essential to health and comfort in dwellings—viz., thorough ventilation and perfectly heated rooms—are to be obtained. The ideal apparatus is automatic. It must be simple in construction, and should be of such character as to be easily introduced in flues of ordinary construction. We commend this subject to the attention of our readers as being well worth their careful thought and study.

Practical Stair Building.—II.

ELEMENTS OF GEOMETRY.—CONTINUED.

23. A diagonal is a straight line joining two opposite angles of a figure, as B A and C A of Fig. 8. (See August number).



Stair Building.—Fig. 19.—*A Circle, with the Names of its Parts.*

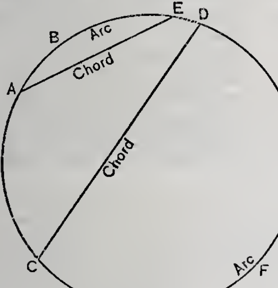
24. A triangle is a flat surface bounded by three straight lines (Fig. 9).

25. A right-angled triangle is one in which one of the angles is a right angle (Fig. 10).

26. A hypothenuse is the longest side in a right-angled triangle, or the side opposite the right angle (Fig. 11).

27. The apex of a triangle is its upper extremity. It is also sometimes called the vertex (Fig. 12).

28. The base of a triangle is the line at the bottom (Figs. 11 and 12).

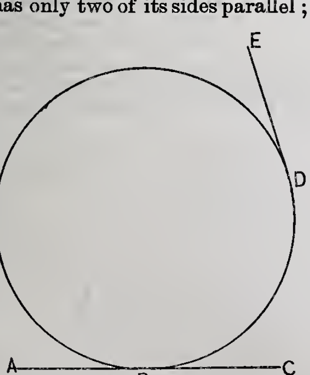


Stair Building.—Fig. 20.—*Arcs and Chords.*

29. The sides of a triangle are the including lines (Figs. 11 and 12).

30. The altitude of a triangle is the length of a perpendicular let fall from its vertex to its base (Figs. 11 and 12).

31. A quadrilateral figure is a surface bounded by four straight lines (Figs. 13 to 18). There are three kinds of quadrilaterals—the trapezium (Fig. 13), which has no two sides parallel; the trapezoid (Fig. 14), which has only two of its sides parallel; and



Stair Building.—Fig. 21.—*Tangents.*

the parallelogram, which has its opposite sides parallel (Figs. 15 to 18).

32. Of parallelograms there are four varieties—the rhomboid (Figs. 15 and 16), which has no right angle; the rhombus or lozenge (Fig. 16), which is an equilateral rhomboid; the rectangle (Fig. 17), which is an equiangular parallelogram; and the square, which is both equilateral and equiangular.

33. A circle is a plane figure contained by one curved line everywhere equally distant from its center (Fig 19).

34. The circumference of a circle is the boundary line of the figure (Fig. 19).

35. The center of a circle is the point within the circumference equally distant from every point in it, as A, Fig. 19.

36. The radius of a circle is a line drawn from the center to any point in the circumference, as A B, Fig. 30. The plural of radius is radii.

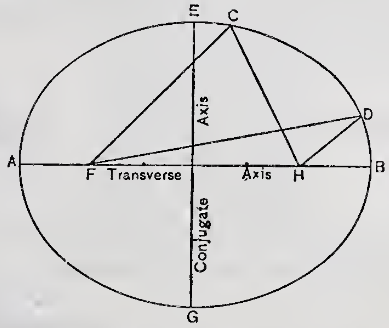
37. The diameter of a circle is any straight line drawn through the center to opposite points of the circumference, as C D, Fig. 19. The length of the diameter is equal to two radii.

38. A semicircle is the half of a circle, and is bounded by half circumference and a diameter.

39. A segment of a circle is any part of the surface cut off by a straight line, as A B E, Fig. 20.

40. An arc of a circle is any part of the circumference, as E B A and D F C, Fig. 20.

41. A cord is a straight line joining the extremities of an arc, as A E and C D, Fig. 20.



Stair Building.—Fig. 22.—*An Ellipse.*

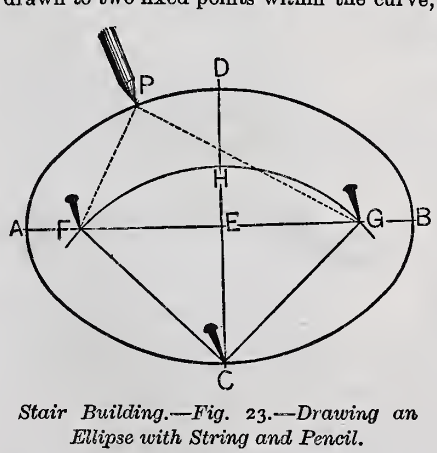
42. A tangent to a circle or other curve is a straight line which touches it at only one point, as E D and A C, Fig. 21.

43. The point at which the tangent tonches the curve is called the point of contact, as D and B, Fig. 21.

44. Circles are said to be concentric when described from a common center.

45. Circles are said to be eccentric when described from different centers.

46. An ellipse is an oval-shaped curve from any point in which, if straight lines be drawn to two fixed points within the curve,

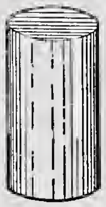


Stair Building.—Fig. 23.—*Drawing an Ellipse with String and Pencil.*

their sum will be always the same. Thus, in Fig. 22, the sum of F C and C H is equal to the sum of F D and D H. The two fixed points within the curve (F and H) are called foci. The straight line passing through the foci (A B) is called the transverse axis. The line perpendicular to the center of the transverse axis (E G), and extending from one side of the figure to the other, is called the conjugate axis.

47. What we have above designated as transverse axis and conjugate axis are also known as major axis and minor axis, and are familiarly called the long diameter and short diameter of the ellipse.

48. The rule for drawing an ellipse in accordance with the above definition is illustrated in Fig. 23. This rule was given in connection with other methods of projecting the ellipse in the issue of *Carpentry and Building* for January, 1879, page 14, to which any of our readers who desire to investigate this subject further are referred. Draw the long diameter A B, and at right angles to it draw the short diameter C D, making the center point E of C D fall on the center point of A B. Take the distance A E, or one-half of the long diameter, as radius, and with C as center strike the arc F H G. At the points at which this arc cuts the long diameter—or, in other words,



Stair Building.—Fig. 24.—*A Cylinder.*

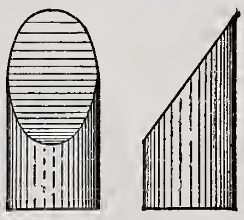
at F and G—drive pins, as shown in the engraving. Drive a third pin at C. Around these pins tie a string. Remove the third pin and substitute a pencil, as shown by P. By moving the pencil around the two foci F and G, keeping the string stretched, the ellipse will be produced.

49. The same results, so far as the curve is concerned, are obtained by the use of an ellipsograph, commonly known as a trammel. These two methods of drawing the ellipse produce the figure accurately. Various rules are in use for constructing the figure from arcs of circles. They, however, obtain only approximate results.

50. A solid has length, breadth and thickness, and therefore combines the three dimensions of extension.

51. A cylinder is a round solid of uniform thickness, of which the ends are equal and parallel circles. (See Fig. 24.)

52. A cone is a round solid with a circle

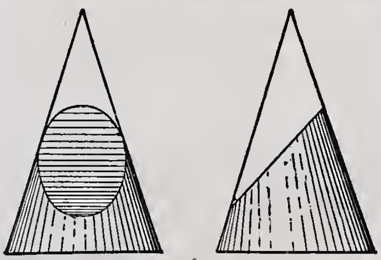


Stair Building.—Fig. 25.—*A Cylinder Cut through Obliquely, the Resulting Section being an Ellipse.*

for its base, and tapering nniformly to a point at the top.

53. An axis is a straight line, real or imaginary, passing through a body on which it revolves or may be supposed to revolve. The axis of a circle is any straight line passing through the center. The axis of a cylinder is the straight line joining the centers of the two ends.

54. When a solid—as, for example, a cone—is cut through transversely by a plane



Stair Building.—Fig. 26.—*A Cone Cut Obliquely through its Opposite Sides, the Resulting Section being an Ellipse.*

parallel or inclined to the base, the part next the base is called a frustum of a solid. Hence we have the term "frustum of a cone." (Fig. 26.)

55. A conic section is a curved line formed by the intersection of a cone and a plane.

When the cone is cut by a plane obliquely through its opposite sides, the resulting figure is an ellipse. (See Fig. 26.) When the cone is cut by a plane parallel to one of its sides, the resulting figure is called a parabola. When the cutting plane makes a greater angle with the base than the side of the cone makes, the resulting figure is called a hyperbola.

56. An oblique cut through a cylinder is illustrated in Fig. 25. An oblique cut through a cylinder and an oblique cut through the opposite sides of a cone produce the same figure—viz., the ellipse.

Carving Tools.—Fig. 1.—Straight Chisel.

Carving Tools.

The art of wood carving is a very ancient one. It was employed in Assyria, Babylon, Egypt and Greece when those nations were at the hight of their glory, for ornamenting chariots, furniture, weapons and various other objects. The Bible contains numerous accounts in which allusion is made to carving. Some 1500 years before Christ, Bezaleel, of the tribe of Judah, was specially selected for his skill as a workman in gold, silver and brass, and also as a wood carver, and was commissioned to execute the work upon the Tabernacle and its furniture. In the ornamentation of the Temple of Solomon, which was erected some 500 years later, we hear that a wood carver was employed who was of mixed Tyrian and Israelitish descent. His father was said to be a pattern maker and bronze founder in Tyre. The characteristics of wood carvings, in point of design and in manner of execution, are found to be similar at whatever period in history we examine them. The carved ornamentation of Solomon's day consisted of copies of natural objects, formerly associated, and somewhat resembling that which, arranged in conventional forms, gave a severe grace to Grecian architecture. Wood carvers of our own day derive their best designs from nature.

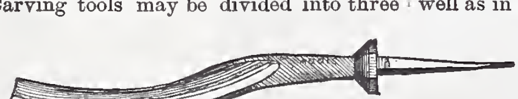
Carving Tools.—Fig. 2.—Straight Gouge.

The art called carving, when applied to wood, becomes chasing when applied to metals. It is called molding or sculpture when applied to plastic materials. While these several arts resemble each other in many respects, the manner of working and the tools employed necessarily differ. The tools used by wood carvers are comparatively few and are very simple. While undoubtedly those employed by the modern carver are far superior to those used by his predecessors of remote antiquity, their shapes and character are somewhat similar.

Carving Tools.—Fig. 3.—Straight Parting Tool.

After providing a suitable bench, a vise for holding his work—if its nature be such as to require that help—mallets for driving his chisels and an oil stone for sharpening his tools, the principal articles that a wood carver uses are shown upon this page.

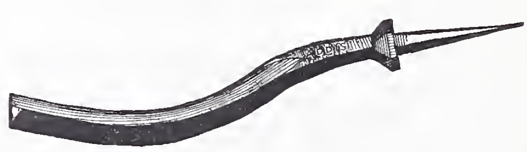
Carving tools may be divided into three general classes—chisels, gouges and parting tools. The latter are employed for making outlines, tendrils, stems, leaves, &c. Gouges, according to their sweeps, are used for cutting around those parts which are left in the finished object, and chisels are employed wherever plain straight cuts can be made available. Wood carvers' chisels may be divided into two general classes, straight chisels and short bent chisels. Each of these in turn are of two varieties with respect to their cutting ends. The first has a square end, as shown in Figs. 1 and 7, and as further illustrated by A in Fig. 10. The second has an oblique cut across its end, as shown by B of Fig. 10. Gouges, with respect to their general shape and use, may be divided into three classes: Straight gouges, an example of which is shown in Fig. 2; long bent gouges, of which there are two varieties, as shown in Figs. 4 and 5, and short bent gouges, as illustrated by Fig. 8. Gouges, with respect to their sweeps, are known as flat, middle and quick, their curves being respectively obtuse, medium or acute. A number of the sweeps to which gouges are made are shown in Fig. 12. Parting tools are divided into three general classes, known respectively as straight, long bent and short bent, examples of which are shown in Figs. 3, 6 and 9. The angles given to parting tools are shown in Fig. 11.



Carving Tools.—Fig. 4.—Long Bent Gouge.

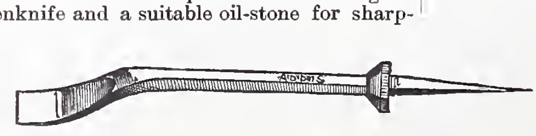
Carving Tools.—Fig. 5.—Long Bent Gouge.

The cuts which we have here employed were kindly furnished us by Messrs. Cassebeer, Reed & Co., No 229 Bowery, New York City, who make a specialty of wood carvers' tools, and to whom we are indebted for information furnished.



Carving Tools.—Fig. 6.—Long Bent Parting Tool.

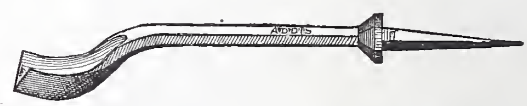
Since of late there is much interest manifested in wood carving, and many amateurs are inclined to undertake the art, a few words with reference to the tools adapted to a beginner's needs may not be out of place in this connection. The steel instruments which the beginner will find absolutely necessary are eight in number—viz., three straight chisels, three gouges and two parting tools, assorted in size, sweeps, &c., according to the design he undertakes to carve. He should also be provided with a good penknife and a suitable oil-stone for sharpening the tools. For his first pattern, he should select some design in low relief, and, after some little experience, may attempt foliage, flowers and fruit, all of which should be studied direct from nature, his taste and skill being displayed in the selection and general arrangement of the various objects as well as in their execution. Subjects in high relief should not be attempted until considerable proficiency has been attained. In the selection of wood upon which to experiment, a kind that is soft, with close grain, is to be preferred. Those who intend to make wood carving a regular occupation should take lessons from a master, but amateurs can derive much amusement from their own experiments, and frequently develop a degree of skill which would be creditable to professionals.



Carving Tools.—Fig. 7.—Short Bent Chisel.

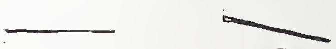
Speculative Plastering in Philadelphia.—The following extract is from a letter by a plasterer to one of the Philadelphia papers: "Let me show how plastering is done. A boss will put some boys to lathing who know nothing about it, and tell them to lath close in order to save material, thereby allowing the mortar no chance to 'key.' Then they do what is called 'laid-off work,' which is a thin coat run on the face of the lath without the proper key. Some very poor stuff is immediately applied, then ridged down with a short strip, called a 'darby,' and the brown work is called finished. Nonsense! Such work is good for nothing. You must have good lathing that will allow a good and heavy key for your first coat, which should be good, clean sand, well haired—no gravel. Then it should be well scored and allowed to get perfectly dry before applying the second coat; then dry again before white coating. Such a course will produce plastering like the Girard work. Such deception is practised by all other mechanics—carpenters, painters, bricklayers and plumbers. Now, let them step to the front and expose such work, and by and by we will be able to banish the evil of poorly-built houses by exposure."

Carving Tools.—Fig. 8.—Short Bent Gouge.



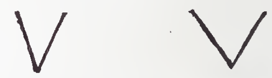
Carving Tools.—Fig. 9.—Short Bent Parting Tool.

Elongation of Trunks of Trees.—Experiments made at the Iowa Agricultural College show that the popular notion that the trunks of trees elongate is entirely erroneous. Tacks were driven into the trunks of various trees, and the distance between them accurately measured. At the end of the season they were found to have neither increased nor decreased their distances. In the experiment tree trunks were selected of all ages, from one year up to five or six, and in no case was there any change noticeable. It is only by practical experiments that popular fallacies are to be dispelled. Since experiments are so easy, it seems strange that errors of this kind are allowed to go so long unchallenged as is sometimes the case.

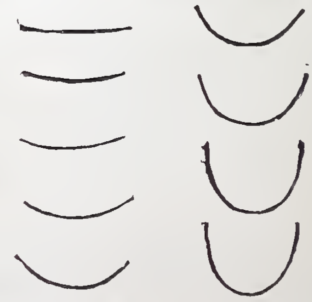


A B

Carving Tools.—Fig. 10.—End Shapes of Chisels.



Carving Tools.—Fig. 11.—Angles of Parting Tools.

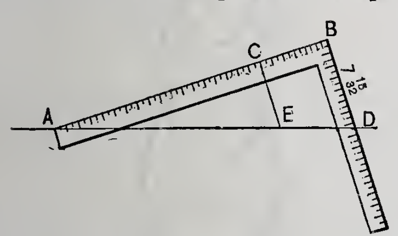


Carving Tools.—Fig. 12.—Sweeps of Gouges.

CORRESPONDENCE.

We are enabled to set before our readers this month what we believe will be considered a more than usually desirable assortment of letters. The most of them treat upon subjects of great practical interest, and all of them bear evidence of coming from men of thoughtful experience. S. F. F., who was taken to task by some correspondent for asking help in designing a cupola for a barn, and who, on page 140 of our July number, expressed his willingness to be forgiven, but "wanted the plans just the same, anyhow," will find in this issue three additional designs adapted to his needs, all of which have been sent in answer to his request and that of C. D. B., published in the same number. We have received still other responses and shall publish the designs in future numbers. The Problem of Equal Areas—two solutions of which appear in this paper—still attracts attention. While doubtless the naked problem is of very little practical interest and cannot be applied to any useful purpose, those who give attention to the solutions of it will have their attention called to certain mathematical principles, a familiarity with which is very desirable. One mistake which some of those have made who have attempted solutions has been that of confounding center of gravity with center of magnitude. We have thought that some of our sharp-eyed critics would notice the slip and proceed to read the delinquents a lecture. Perhaps this hint will have an effect in this direction.

How a mistake or a misunderstanding can be made profitable is well illustrated in the discussion of G. H. H.'s rule for Backing Hip Rafters, which occupies a considerable portion of the allotted space for this depart-

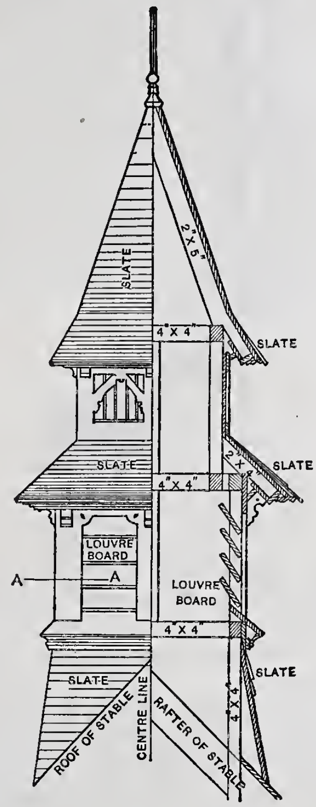


W. H. C.'s Rule for Finding Circumference from Diameter by the Square.

ment this month. If there is any reader of the paper who has followed this subject through all that has been published concerning it, including what appears in this issue, and the series of articles entitled "Some Problems in Framing," of last volume, and yet does not comprehend the principles upon which the operations are based, we shall be pleased to have a letter from him that we may learn what is still necessary to print. We do not mean by this that the subject has been exhausted, for doubtless there are several other ways in which the operation may be performed, and still other standpoints from which it may be viewed; but so much has been said and so much has been exhibited in diagrams that it seems fair to suppose that every intelligent mechanic who reads the paper has, before this, settled the matter in his own mind to his satisfaction. To the fact that G. H. H.'s rule, as originally presented, was misunderstood, we owe the letters from W. B. and others which have contained so much valuable information.

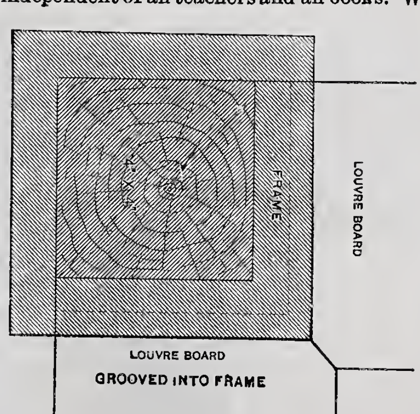
Our venerable friend, W. B., delivers himself of another chapter of wisdom, prefaced with some characteristic pleasantry, in which one or two sharp hits are made. We have published but a part of his letter. In addition to the manner of obtaining the cuts of jack rafters by the aid of a plan, he has sent us his method of performing the same thing by means of the square alone. Our space does not admit of the whole letter appearing. We therefore defer this part for another time.

A correspondent complains with reference to the series of articles on stair building commenced in the last number, that unless we give larger installments it will be a very long while before we reach anything "practical." From this we are justified in inferring that he does not consider the elements of geometry, upon which the whole art depends, as being practical. Of course they are not, if the word practical is restricted to mean those operations in which tools and material are used, but it is certainly quite practical for a man to understand the nature of the



Cupola Designs.—Fig. 1.—*Contributed by Barker and Nourse, Worcester, Mass.—Scale, ¼ Inch to the Foot.*

operations he is about to perform and to be well versed in the principles upon which they are founded. We believe the principal cause of so much difficulty being met by those who attempt any of the intricate parts of carpentry, as, for example, stair building, complicated framing, &c., is the lack of elementary education—the lack of familiarity with principles. In other words, we believe that if a mechanic is well grounded in principles he will work his own way out of all difficulties, whether he has ever seen the same operations performed before or not; he will make his own rules as he goes along, and therefore be independent of all teachers and all books. We



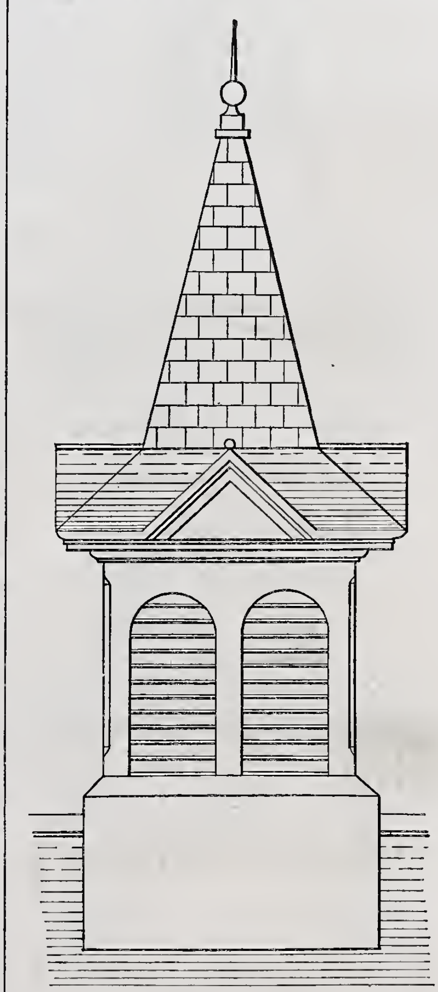
Cupola Designs.—Fig. 2.—*Details of Construction on Line A A, Fig.* 1.—*Scale, ¼ Full Size.*

shall give as large installments of stair building as a due consideration of other departments of the paper will admit, but we shall be in no hurry to leave the consideration of principles before all essential elements have been carefully canvassed and thoroughly comprehended.

It is not often that so large an array of typographical errors gets into one article as appeared in the captions describing the use of the several compartments in the tills of E. D. S.'s tool chest in the last number. A correction at this time is due our correspondent. The space B is for "gouges" and not gauges; E contains "chalk" spools, not check spools; I contains "dividers," not divisions; O contains a broad "gouge," not broad gauge; P has chisels and "gouges," not gauges; V contains "rasps," not roops, whatever they may be. In his letter there is the error of printing gauges for "gouges" in one place. We presume that many of our readers noticed the errors, and had a good-natured laugh at our expense.

Circumference from Diameter.

From W. H. C., *Orrillia, Ont.*—I was very much interested in Y. P.'s rule for obtaining the circumference from a diameter, published in the July number, and with your amendment of the same. I submit the inclosed drawing as being an improvement on both the rules given. Let A D be the straight edge of a board. Place the end of



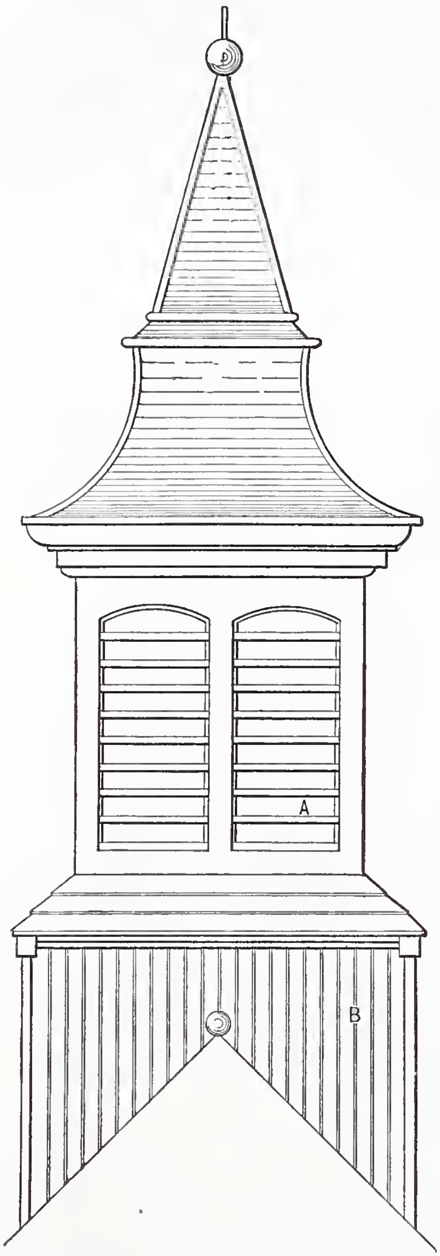
Cupola Designs.—Fig. 3.—*Contributed by J. A. H.—Scale, ¼ Inch to the Foot.*

the blade of the square at A and let D D on tongue be 7 15-32 inches. Take three diameters from A to C and square C E by A B; then A E equals the circumference. If the diameter be 8 inches, the blade itself will be just three times the diameter. A D then would be the circumference. Thus it will be seen that, having a right angle whose base is 24 and whose altitude is 7 15-32, any circumference can be obtained by taking three times the diameter on base and squaring from the hypothenuse; then the hypothenuse will give the circumference as explained by my sketch.

Cupola Designs.

From Barker & Nourse, *Worcester, Mass.*—We inclose you herewith a design for a cupola, in answer to the request of a correspondent in a recent number of *Carpentry and Building.* We trust it will be of some use to him, and that it will be of sufficient interest to your readers in general to warrant its publication. (Figs. 1 and 2.)

From G. W. B., *Chatham, N. J.*—I have noticed several times lately requests for a design of a cupola or ventilator for a large barn. The requests have been for something plain and neat and not costly. I send you inclosed a design which shows the manner of construction, and which I think is self-explanatory. If any of the inquirers can derive any benefit from it, they are quite welcome to it. A much more elaborate design might be prepared, but of course the cost would be increased. The roof of the design inclosed herewith may be covered with tin, slate or shingles. I should prefer



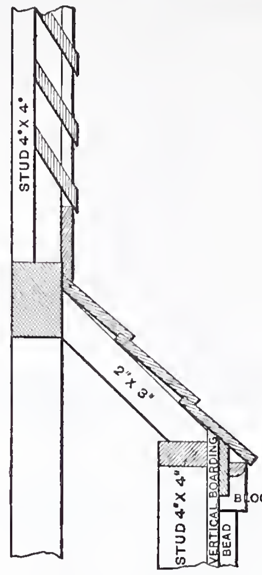
Cupola Designs.—Fig. 4.—*Contributed by G. W. B.—Scale, ¼ Inch to the Foot.*

using small slate with the corners clipped. The whole should be surmounted with a neat vane. (Figs. 4, 5, 6 and 7.)

From J. A. H., *Lockport, N. S.*—Inclosed please find a design for cupola or ventilator, which I trust may be of some use to the readers of *Carpentry and Building.* It was prepared with special reference to the wants of your correspondents, C. P. B. and S. F. F. (Fig. 3.)

Hight of Doors.

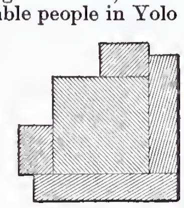
From C. W. S., *Alfred Center, N. Y.*—A correspondent, in a recent number of the paper, gives his rule for the hight of doors, naming three-quarters the hight of the room as the hight for the door. This rule may work under certain circumstances, but to lay it down as an absolute rule would seem to me to be quite impracticable. For example, a room having a ceiling 8 feet high would have a door only 6 feet high, which, evidently, is not high enough. A room with the ceiling 9 feet would have a door only 6 feet 9 inches. From this I infer that there can be no invariable rule established. I think that each mechanic, of necessity, must



Cupola Designs.—Fig. 5.—*Vertical Section from A to B, Fig.* 4.—*Scale, ¾ Inch to the Foot.*

use his own judgment and taste in such matters.

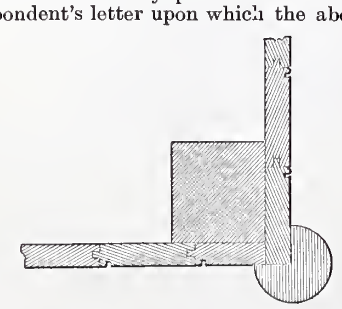
From Fore Plane, *Fulton, N. H.*—In the July number of *Carpentry and Building* I noticed an article from G. W. C., Yolo Yolo, Cal., in respect to the size of doors. He says: "For a 10-foot ceiling I use, in the case of front doors, 28 x 68 inches, and in case of inside doors, 26 x 66 inches." Does your correspondent mean to say that he uses for a front door one that is 5 feet 8 inches, and for an inside door one that is 5 feet 6 inches in hight? If so, I think they must be a very humble people in Yolo Yolo.



Cupola Designs.—Fig. 6.—*Horizontal Section at A, Fig.* 4.—*Scale, 1½ Inches to the Foot.*

According to my observation in this section of the country, a door for a room having a 10-foot ceiling should be 6 feet 10 inches high and 2 feet 10 inches wide. For a room with the ceiling 9 feet high, it should be 6 feet 8 inches by 2 feet 8 inches. For single front doors, the width should be 3 feet and the hight 7 feet.

Note.—It is barely possible that our correspondent's letter upon which the above is

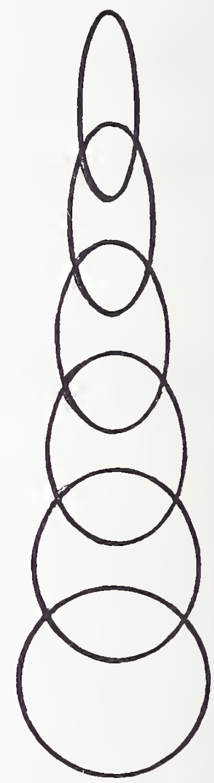


Cupola Designs.—Fig. 7.—*Horizontal Section at B, Fig.* 4.—*Scale, 1½ Inches to the Foot.*

a criticism was misapprehended, that instead of the hight of his doors being 68 inches and 66 inches, respectively, he intended 6 feet 8 inches and 6 feet 6 inches. We offer this only as a possible explanation of the discrepancy. The original writing is not at hand by which to verify the statement.

Drawing Ellipses.

From J. P., *Maysville, N. Y.*—In the January number of *Carpentry and Building,* 1879, my attention was particularly drawn to the different ways of producing the ellipse. Some of the plans there shown have been familiar to me for a long time, while others were new. The rule for producing the ellipse from a circle by intersecting lines was entirely new to me. I refer to the subject now in order to call attention to a method which I have in use of producing a true ellipse, of any length or width, from any given circle, provided that the length of the required ellipse does not exceed the diameter of the circle. A slight change in the instrument will produce a tapering or egg-shaped ellipse, or, in other words, an oval. I inclose you herewith some examples of lines drawn by this plan, and submit them as a problem for the readers of *Carpentry and Building* to study out. I shall not offer a reward to the one who discovers the plan by which they are drawn, but shall request him to explain the method as he understands it. Fig. 1 of the inclosed sketches shows five ellipses of different widths, but all the same length and all produced from the



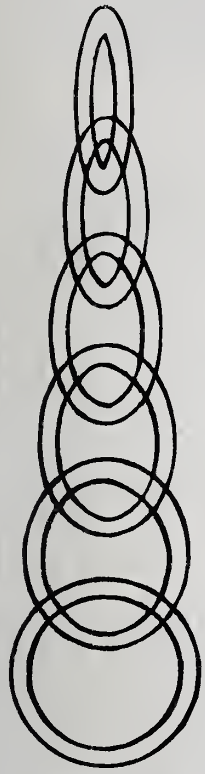
Drawing Ellipses.—Fig. 1.—*Ellipses of Different Widths, all Produced from the Same Circle.*

circle. Fig. 2 shows the same set drawn with parallel lines. Fig. 3 shows tapering or egg-shaped figures drawn with the same instrument. On another slip of paper inclosed I have drawn a star with 16 radiating points, the rays of the stars being composed of tapering elliptical or oval figures, all drawn from one central circle.

Note.—The sketches sent in by our correspondent are certainly matters of considerable curiosity. We have engraved three of them, and present them to our readers herewith. We have the promise of our correspondent that at no distant date he will reveal the method by which they are drawn. In the meantime, as he requests, we have no doubt that some of our readers will speculate as to the method of their production. The star diagram which he sends is too large for engraving full size, and will not readily admit of reduction. Accordingly we have not attempted to present it.

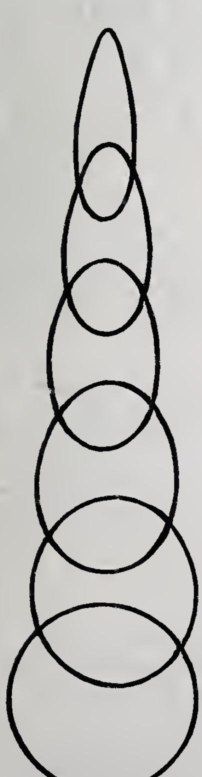
Honor to Whom Honor is Due.

From H D. C., *Philadelphia.*—My attention has been called to T. S. B.'s rule, published in a recent number of *Carpentry and Building,* for getting the bevel cuts for a hopper or box with slanting sides. The rule is quite correct, and a very good one for the purpose. Of this I can speak from experience, since I have been using the same for at least 12 or 15 years with quite satisfactory results. I desire to inform your correspondent T. S. V., and also other readers of the paper who may be interested, that the



Drawing Ellipses.—Fig. 2.—Parallel Ellipses, all Produced from the Circles at Bottom of Figure.

author of this rule is the well-known Robert Riddell, of Philadelphia. I think that justice should be done to every man, and accord-



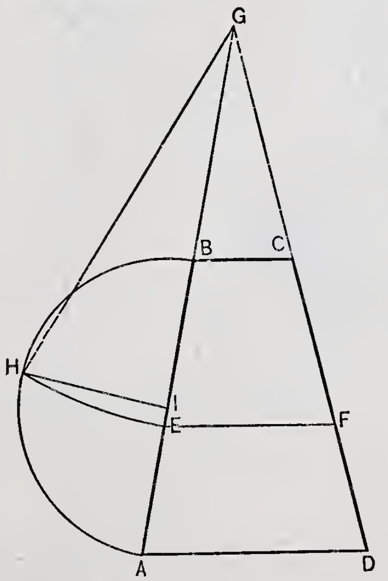
Drawing Ellipses.—Fig. 3.—Ovals of Different Proportions, all Produced from the Same Circle.

ingly I pen this communication. I have no doubt that the author (Mr. Riddell) is able to give all necessary explanation in reference to the rule.

Problem of Equal Areas.

From T. W., *Pulaski, Tenn.*—I send you a solution to T. V. D.'s problem in the May number. Continue the lines A B and D C, Fig. 1, till they meet at the point or vertex G. Bisect A B at I, and, with a radius equal to one-half of A B, from the point I as a center, describe the arc A H B. From I erect a perpendicular to A B, intersecting the arc A H B at H, and from the point G, with a radius equal to the distance from G to H, describe the arc H E, obtaining the point C. A line drawn through the point E, parallel to the base of the trapezoid, will divide its surface into two equal parts.

Note.—The method given by our correspondent of bisecting a trapezoid by drawing a line parallel to the base is correct, and he is the first one who has solved the problem by lines in accordance with the original stipulations of T. V. D. Now, if



Problem of Equal Areas.—Fig. 1.—Solution Offered by T. W.

T. W. will favor us with the mathematical reasons for the steps he has taken, he will be in order. Such a communication would doubtless prove of interest to many of our readers.

From A. H. B., *Baltimore, Md.*—I think this is the solution of T. V. D.'s problem: Draw the lines A O and B P, Fig. 2, perpendicular to A B. This gives you the parallelogram A O P B. Find the center of gravity of this, which will be the center point or E. Next find the center of gravity of each of the triangles. Having found the same, connect the three points forming the triangle E M L. Find the center of gravity of this triangle, which will be N, and, by drawing the line Q R through the point N parallel to C D, it will divide the trapezoid into two equal parts.

Note.—Without challenging the truth of A. H. B.'s method of bisecting the trapezoid in question, we call attention to certain omissions in his demonstration which are of primary importance. To make his demonstration clear and entirely satisfactory, his method of finding the center of gravity of the three triangles involved in his solution should be given. When this is done, we shall feel at liberty to say more respecting his demonstration. The aim of correspondents in the solution of problems for these columns should be to go to the bottom of them, or, in other words, to furnish an analysis so complete that the reasons for each step will be clearly apparent.

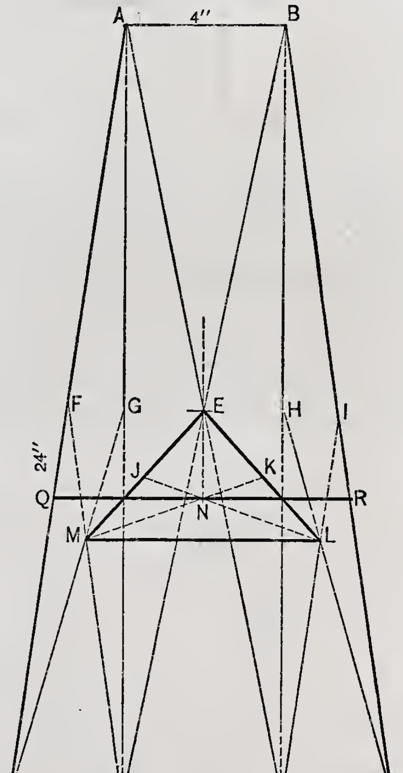
From F. E. K., *late of New York.*—When I read your note inserted below my communication, and that of A. J. Z., in the July number, I was quite astonished, for I knew that the method I gave was recognized by all mathematicians as a correct method of finding the center of gravity of a trapezoid. But, after thinking more about the matter, I discovered that my error lay in considering that a line drawn through the center of gravity of the figure would divide the figure into parts of equal area, which I see is not true. This can be more readily seen in the case of the triangle. My method, and that of A. J. Z., are correct for finding the center of gravity, but do not apply to the problem in question.

A line drawn through the center of gravity of any figure will divide it into parts of equal area only when those parts are symmetrical. In this example, a line drawn vertically through the center of gravity would divide it into two equal parts, but no other line drawn through that point would.

Questions Concerning Heating and Ventilation.

From S. J. B., *Menominee, Wis.*—Your correspondent L. S. C., in the February number, treating on the subject of ventilating school rooms, touched upon a perplexing subject and one hard to remedy. It is difficult to heat without wasting more or less heat. For my part I would prefer the ventilating register at the base of the room and arranged so as to be regulated to suit any number of occupants. Right here comes the rub. How shall we get persons with sufficient sense to understand how to regulate it in this respect? The subject seems to be a perplexing one, for there is a diversity of theories and opinions. I hope to hear from others. A little practice sometimes knocks fine theories all to pieces.

I desire to refer some questions to the practical readers of *Carpentry and Building.* What can I use to color air so that I can observe its currents as it comes from the furnace and as it courses through the room until it leaves by way of the ventilator? I desire to conduct some experiments on a small scale. Another question—is top ventilation necessary except to carry off foul air or cool off overheated rooms? Is there not a downward current all over a room where the ventilating register is at the bottom, save



Problem of Equal Areas.—Fig. 2.—Solution Offered by A. H. B.

only directly over the register from the furnace? If so, is not the purest air always at the top of the room, and by opening windows at the top is there not a direct waste of heat and also a waste of pure air, instead of receiving thereby pure air from the outside, as is commonly supposed to be the case? This last question is based upon the supposition that the ventilating arrangements are ample for changing the air in a room in less than one hour. What is the best way to build a ventilating flue? Shall I carry up an iron pipe in the center of a large flue for smoke or put in brick partitions, the brick being set on each? Does a check draft in a pipe for stoves or furnaces prevent creosoting and dripping, or does it tend to increase it.

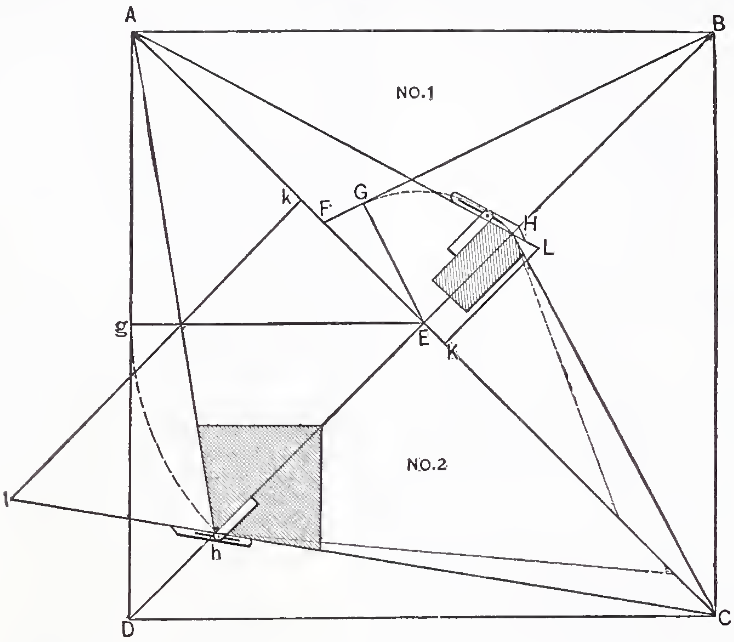
In our cold latitude I find a great deal of trouble in heating school rooms and other public buildings, from the fact that teachers and others will persist in opening windows to get, as they claim, fresh air. Such action causes a waste of heat and necessitates an overheating of the furnace, thus destroying the vital portion of the air, and in a short time ruining the furnace. It occurs to me that janitors ought to regulate the register in the room as well as the fuel in the furnace. There seems to be a wonderful amount of ignorance in regard to hot-air heating. I am a mechanic, engaged in putting in furnaces to some extent; consequently I am called upon when anythiug is wrong with heating arrangements. I meet with but little trouble iu private residences and with intelligent janitors who are allowed to follow instructions, but in public buildings where the janitor crams in the fuel, and teachers, professors or judges, as the case may be, open windows and shut registers, and when too cold send down word for more fire in the already red-hot furnace, I am almost driven to despair. In such cases it is frequently claimed that furnaces are a fraud. They make the air impure, they spoil furniture, are expensive in fuel and wear out in a short time. I sincerely hope that many of your readers will contribute their ideas upon this important subject. I am seeking light and am ready to receive it, I care not from what source it comes.

G. H. H.'s Rule for Backing Hip Rafters.

From A. S. L., *Concord, Mass.*—Quick rules that are correct are so scarce that mechanics generally look upon them with distrust. So when G. H. H.'s rule for backing hip rafters was published, I set it down as among the impossibilities.

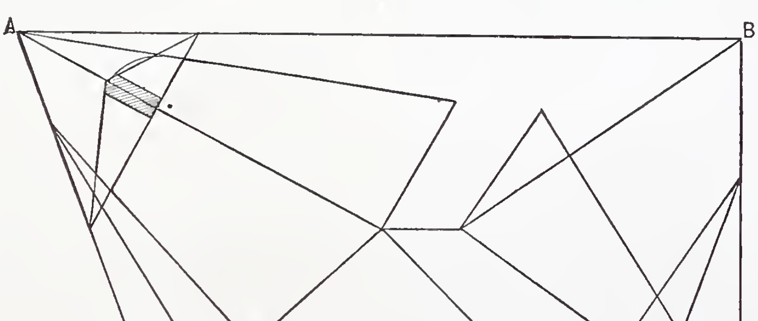
When G. H. H. issued his challenge to W. B., I decided to try it. I tested it from 1-inch pitch to the foot to 48, and in every instance the result was a correct backing for the hip rafters. Having proved the rule correct, I expected to see an apology from W. B., but instead came that remarkable letter in which he brands the rule as shaky.

You also speak of it as G. H. H.'s fallacious rule, and acknowledge letters all apparently in condemnation of it, but not one word in its defense, not even from G. H. H. himself.



Backing Hip Rafters.—Fig. 1.—An Old but Desirable Rule, shown in Two Applications.

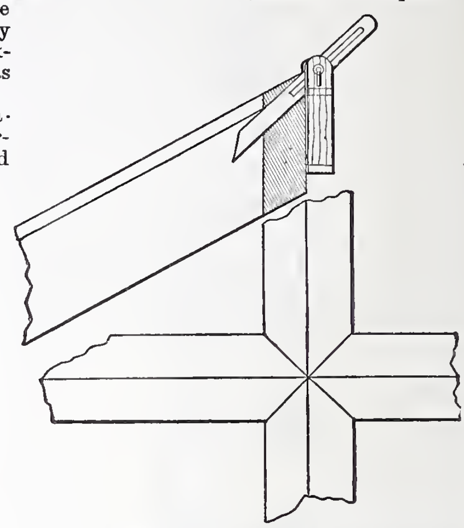
Now, Mr. Editor, and you, W. B., will you please suspend judgment until the evidence is all in? Before I proceed with my demonstrations, let me say that I think there is a general misunderstanding of the rule, because, as in W. B.'s illustrations, it would be simply impossible to produce lines so much at variance with the true lines. The mistake lies in taking the straight edge to represent the top edge of rafter before backing. Now, if you will turn to the rule in the November number, you will see that the bevel is set on the acute angle formed by the straight edge and tongue of the square; this bevel is used on the diagonal line, or what is equivalent, its opposite or obtuse angle on the side of the high rafter, as in common use.



Backing Hip Rafters.—Fig. 2.—Method of Obtaining the Backing for Irregular Rafters Recommended by A. S. L.

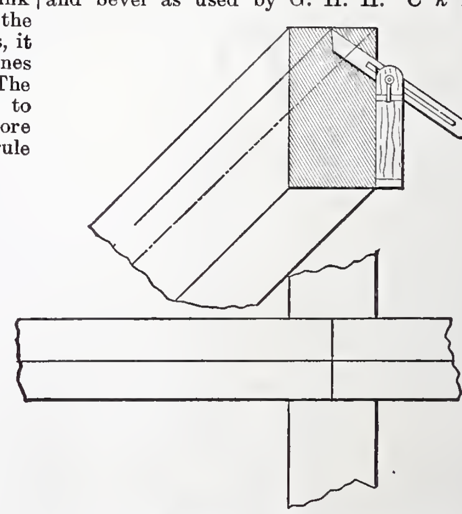
The following method for obtaining backing lines is old, but I think it has its merits, especially for accuracy where a scale drawing of roof is made:

A B C D, Fig. 1, is plan of roof; draw the diagonals A C and B D, over which hip rafters rest when in position. On the line A C for pitch No. 1, make E F equal to hight of roof; connect F B, which is length of hip rafters; make E G perpendicular to F B. On line E B, make E H equal to E G; connect A H C. The inclosed triangle will be a section of roof formed by a plane cutting from line A C at right angles with hip rafters. The shaded figure at H shows the position of hip rafter and manner of setting bevels. To prove G. H. H.'s rule, make A K equal to length of hip rafter, and K L equal to hight of pitch; connect A L. The angle at L being equal to angle at H, proves the rule to be correct on a flat pitch.



Backing Hip Rafters.—Fig. 3.—Intersection of Four Hips. The Down Bevel for Top of Common Rafter Applied to the End of Hip Rafter.

On the lower side of line A C, pitch No. 2, I have made the hight equal to E A. A D is the length of hip. E *h* is equal to E *g*, and C *h* A is section of roof as before. I have placed the hip rafter as in the tank problem and bevel as used by G. H. H. C *k* is length of hip; *l k* is hight of pitch, the angles at *l* and *h* being equal as before. If these results are not satisfactory to W. B., let him get his backing lines his own way at any pitch; let the tongue of square represent the side of rafter—the blade for the base and the straight-edge the top of rafter. After backing, the result will be all the proof he needs.



Backing Hip Rafters.—Fig. 4.—Hip Rafters Cut to Butt against each other. Bevel set to the Run, Rise and Length of Hip Rafters.

Fig. 2 is a method for backing irregular hip rafters, for which no further explanation is necessary.

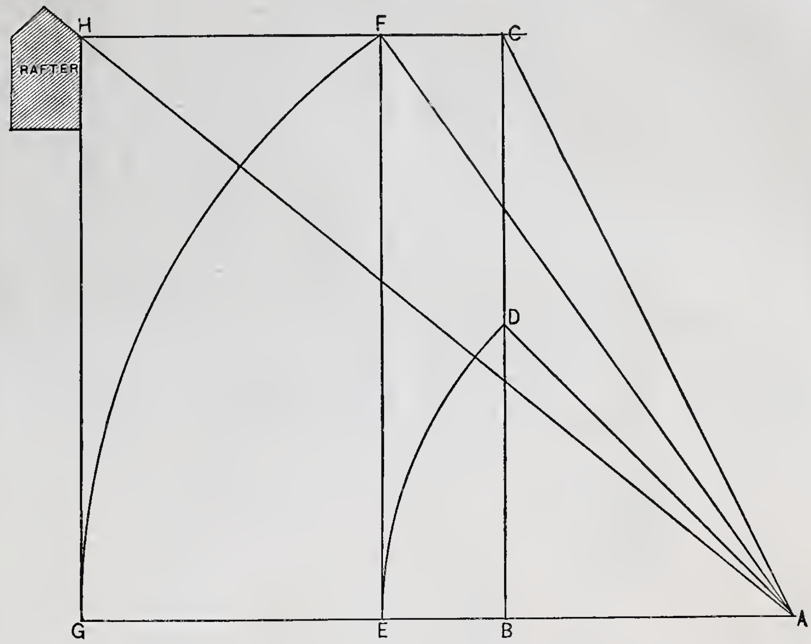
And now a word for W. B.'s correction. He says "the strip taken from a regular rafter in the process of backing will represent the triangle formed by the run, rise and rafter." Would he have us believe that the run, rise and common rafter would give the bevel for backing? It would, but not in the way he shows it. If the four hips were cut to meet at the top, as in Fig. 3, the down bevel for top of common rafter would, if placed as shown in Fig. 3, give the necessary amount for backing.

But in scaling W. B.'s Fig. 2, I find 7 and 12 inches to be the run and rise for the hip rafter and not the common rafter. Now, if the tops of the hips were cut to butt against each other, as shown in Fig. 4, the run, rise and hip rafter would give a bevel which, placed as shown in Fig. 4, would give the amount of backing. But W. B. has not used his square in this manner. Instead of getting a bevel with his run and rise (as he would have to do in order to have his strip correspond with the run, rise and rafter), he has taken the rise on the tongue and the length of hip rafter on the blade, and given G. H. H.'s rule inverted; for the angle formed by the blade of the square and the side of rafter is exactly the same as the angle formed by the tongue of the square and the straight edge.

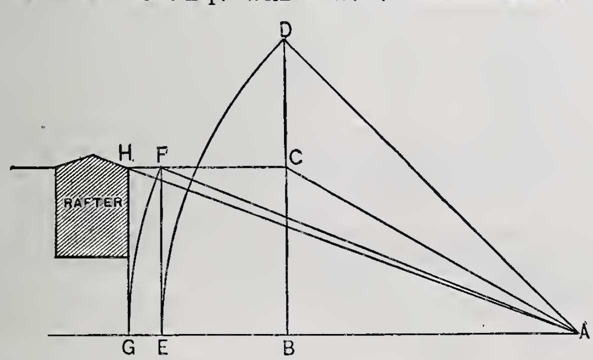
Backing Hip Rafters.—G. H. H.'s Explanation.

From G. H. H., *Philadelphia*.—I am sorry to disturb my old gray-haired friend, W. B., again, but may be his grand-daughter is home by this time to help him. I have given him ample time for his little noontide nap. With him I have been awaiting the verdict in the matter between us. It seems that the jury has left us both in the cold—at least, so far as I can learn. I cannot for the life of me see what W. B. and the rest are trying to do with my rule for backing hip rafters. I have studied, wondered, dreamed and laid awake nights, trying to find out the drift of the matter. W. B. tried to tell me how to back a hip rafter; but while he was so delighted to tell me the particulars of the operation, he continues to back after the manner shown in Fig. 2 of the sketches shown on page 118 of the June number. I suggest to W. B. that he examine Fig. 2, to see if he has not backed a side rafter instead of a hip rafter.

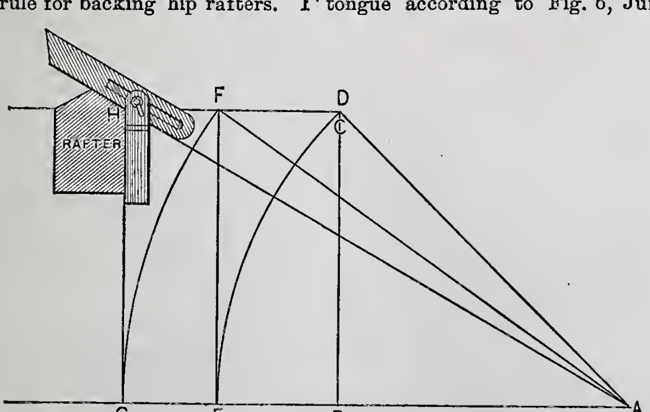
W. B. makes the assertion that the piece that comes off the hip rafter in backing corresponds with the angle formed by the run, rise and pitch of the side rafter, and says that if I had said to take the length of the rafter on the blade and the rise on the tongue according to Fig. 6, June number (which is the side rafter, as I understand it), his letter need not have been written. Now, it strikes me that that is pretty good. In reply to W. B., I would say that I am very glad that I did not assert such a foolish thing, and, further, I say that the piece taken off in backing, as above described, will not exactly represent any angle formed by the rafter or hip. W. B. and others say that, by my rule, as the rafter rises the backing diminishes. This is another most ridiculous assertion, as any one can see by the sketches which I inclose herewith.



Backing Hip Rafters.—Fig. 7.—Application of Rule to Rafters Having 2 Feet Rise to 1 Foot Run.



Backing Hip Rafters.—Fig. 5.—Application by G. H. H. of his Rule to Rafters of 7-Inch Rise to 1 Foot Run.



Backing Hip Rafters.—Fig. 6.—Application of Rule to Rafters Having 1 Foot Rise to 1 Foot Run.

Now, my rule says: "Take the length of the hip rafter on the blade of a square and the hight of the pitch on the tongue, Fig. 1 (Fig. 9 of accompanying illustrations). Apply these figures to a straight edge, scribe along the tongue and put the stock of the bevel to the straight edge. Set the blade to the scribe mark, and the resulting angle gives the required cut for the backing. The application is made clear by Fig. 2 (Fig. 10 of accompanying illustrations)."

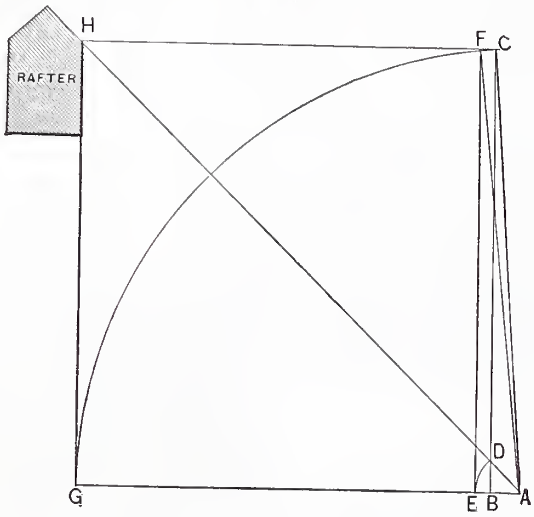
Referring now to the sketches which I inclose, Figs. 5, 6, 7 and 8, for a vindication of the rule—A B represents the run, B C the rise, A C the rafter, A D and A E the run of hip rafter and A F and A G the length of hip rafter. A H and G H now represent the backing bevel taken on the square end of the rafter, as shown in different sketches. Now, to represent the bevel by the square, let A G in Fig. 6 be the blade, G H the tongue and A H the straight edge. The bevel shown in that sketch is set in just as the rule originally specified, but in a manner which amounts to the same thing. It also shows the application of the bevel to the rafter.

Figs. 7 and 8 illustrate the increase of backing with steeper pitches. It will be readily seen in Fig. 7 that as the rafter rises the lines A C and B C become nearer the same length. This, I claim, shows very clearly that my rule takes more off in backing as the roof rises.

Not being satisfied that a trial on paper was a sufficient demonstration of the truth of my rule, I have made a model to test it, working closely and carefully to the lines. I have found it correct in all particulars. Since sending my original communication to the paper, I have had two occasions to use the rule in practical work, in both of which it came out all right. With all respect to W. B. (for I do respect gray hairs at all times) for his criticisms and comments, I cannot understand how he applied my rule so erroneously. I hope to hear from him again. I shall be pleased to see his initials often in the paper. I have shown the rule to several persons, and all seem to catch it at once. Why the readers of the paper did not understand it I cannot tell. I shall be glad to find out the blunder, that I may be more careful hereafter. I have rules on the same principle for getting all the cuts on a roof where the hips stand at right angles to plates, and also for irregular roofs.

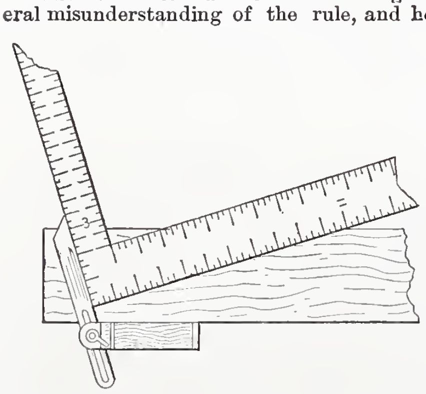
Note.—In order to make this matter clear to many of our readers who may not be in possession of a copy of the November number of last year's volume, we have brought forward Figs. 1 and 2 of G. H. H.'s communication, published in that number, and have incorporated them with the sketches here presented as Nos. 9 and 10. In G. H. H.'s letter above, he has quoted the rule as originally laid down, and therefore the entire subject is presented to the readers of this number in a way to enable them to judge of the merits of the case. The general interest manifested in this discussion seems to warrant some attention from us at this time, rather than to wait until future numbers permit W. B. to make reply, which we are very certain he will be ready to do after reading the letters above published.

Referring to A. S. L.'s letter, wherein he says that we have spoken of G. H. H.'s fallacious rule, and have acknowledged letters which condemn it, and have not published one word in its defense, not even from G. H. H. himself, we would say that A. S. L.'s letter is the first and only letter we have received in support of G. H. H.'s rule, and that the communication from G. H. H. himself was not received until after our August number went to press.



Backing Hip Rafters.—Fig. 8.—*Diagram showing Close Approach to Perpendicular. The Backing of the Rafter is at an Angle of almost* 45 *Degrees from the Side of the Rafter.*

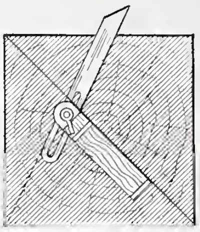
A. S. L. asserts that there must be a general misunderstanding of the rule, and he further inclines to the opinion that the mistake lies in taking the straight edge to represent the top edge of the rafter before backing. Admitting that a misunderstanding of this rule does exist, and which the above letters are likely to clear up, we think our correspondent is altogether wrong in his location of the error. Without an exception, those of our readers who have written concerning this rule have understood the application, as shown in Fig. 10, to be the bevel applied to a diagonal line drawn through a square section on the end of a rafter. In other words, that the shape shown in Fig. 10 represented the thickness of a rafter taken on its depth, and a diagonal line drawn, against which the stock of the bevel is applied. Now, if G. H. H., in his original communication, had said apply the bevel set according to Fig. 9, to the side of the rafter, as shown in Fig. 6 of the sketches he now sends in, or if he had said that Fig. 10 showed its application to a square post, we think there would have been no misunderstanding of his rule, and, consequently, no controversy concerning it.



Backing Hip Rafters.—Fig. 9.—*Method of Setting the Bevel as Originally set Forth by G. H. H.*

It seems to us that G. H. H. is entirely unwarranted in supposing that Fig. 2, page 118, of the June number, represents the backing of a side rafter. In the first place, side rafters are not backed, and, in the second place, W. B. was very careful in his letter to specify exactly what he was doing. We quote: " Fig. 2 shows backing of hip rafter obtained by this method, the rise of which is 7 inches to 1 foot." Hence it would appear that when G. H. H. quotes from W. B. as saying that the angle formed by the run, rise and pitch of the *side* rafter corresponds to the piece that comes off the hip rafter in backing, he lays himself open to the imputation of carelessness.

The same remark applies to A. S. L. He asks: Would W. B. "have us believe that the run, rise and *common* rafter would give the bevel for backing ?" Here is evidently another misunderstanding or perversion. W. B. said (top of second column, page 118, June number), "The triangular strip taken off from a regular rafter in process of backing (and a regular one only), exactly represents the triangle formed by the run rise and rafter." At the bottom of the preceding column, on the same page, he defined a regular rafter as follows: "Its plan lies at an angle of 45 degrees from both plates, as shown in Fig. 4." Correspondents, in criticising communications, in taking exceptions to rules which are laid down, and in replying to the letters written by their fellow readers, should take care that mistakes of this kind do not creep into their communications. While we are very loth to believe that either A. S. L. or G. H. H. have wilfully perverted W. B.'s meaning, the way in which they have referred to some of his assertions leaves them in an awkward position, to say the least. We presume G. H. H. by

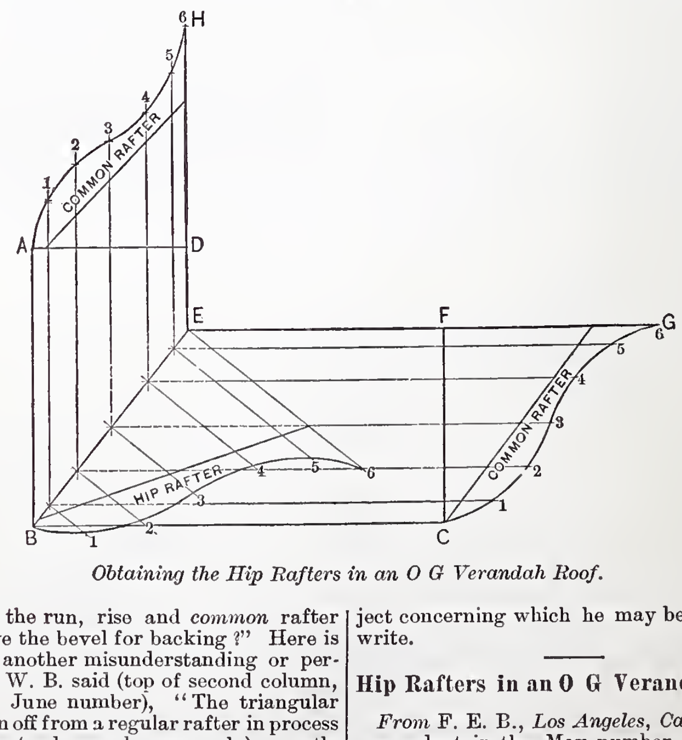


Backing Hip Rafters.—Fig. 10.—*Applying the Bevel to the Square End of Rafter as described by G. H. H.*

this time has discovered the blunder to which he refers in the last clause of his letter, and that he now knows why we termed his rule fallacious. His explanation of Fig. 6, wherein he says the cut shows the bevel set not just as the rule says, but in a manner amounting to the same thing, is naïve, to say the least.

Both of these correspondents seem inclined to criticise the assertion of W. B., that "the triangular strip taken off from a regular (hip) rafter exactly represents the triangle formed by the run, the rise and the rafter." We shall not attempt to show either the truth or fallacy of this statement at this time, for we believe there is a mixture in it; but will remark, in passing, that we have received another "shingle" from W. B., arriving too late to be engraved for this number, which has direct reference to this point. We will allow our correspondent to show, by means of diagrams in the next number, his exact meaning. When his position has been so stated as to be clearly comprehended, and to rest without the possibility of a misunderstanding, criticisms will be in order.

A. S. L. has displayed considerable ingenuity in his explanation of G. H. H.'s rule, and no doubt what he has written and the diagrams which he sent will be fully appreciated by our readers. We shall be pleased to hear from him again whenever it may suit his convenience and upon any subject concerning which he may be pleased to write.



Obtaining the Hip Rafters in an O G Verandah Roof.

Hip Rafters in an O G Verandah Roof.

From F. E. B., *Los Angeles, Cal.*—A correspondent in the May number requests a rule for obtaining the hip rafters for an O G verandah roof when the pitches on the two sides are different. I enclose you a diagram containing the explanation of what I think your correspondent requires; A B C F E C represents the plan of the roof. F C G represents the profile of the wide side of cove rafter. First, divide this cove rafter G C into any number of parts—in this case six. Transfer these points to the miter line E B, or, what is the same, the line in the plan representing the hip rafter. From the points thus established in E B, erect perpendiculars indefinitely. With the dividers take the distance from the points in the line F E, measuring to the points in the profile G C, and set the same off on corresponding lines, measuring from E B, thus establishing the points 1, 2, &c.; then a line traced through these points will be the required hip rafter.

For the common rafter on the narrow side, continue the lines from E B parallel with the lines of the plan D E and A B. Draw A D at right angles to these lines. With the dividers as before, measuring from F E to the points in G C, set off corresponding distances from A D, thus establishing the points shown between A and H. A line traced through the points thus obtained will be the line of the rafter on the narrow side.

W. B. Honors the Draft and Gives Attention to Some Other Matters.

From W. B., *Springfield, Mass.*—You may say to E. H. C. that I am not "one of them"—those funnyography fellows—though it must be very funny to be able to write five or six shingles full on one shingle and then have room to spare. I came on the stage before that and a number of other labor-saving devices were much in use. But my little grand-daughter, who has just got through with geography, I intend shall learn funnyography and all the other 'ographies; then I can pour the wisdom in her ear as one talks in the telephone, and it will come out from the ends of her fingers in hieroglyphics, to be read by the learned ones.

The correspondents' department in *Carpentry and Building* is very interesting to me, affording both instruction and amusement. Some of the criticisms remind me of the discussion of mathematics by an amateur convention assembled in front of a country school house, which ran somewhat in this way: The first (S. F. D., page 159, August number) said the rule is "decidedly incorrect which says 2 and 3 are 5, for my teacher says 3 and 2 are 5, and I tried it and found it right." Another said: "You are wrong; for my book says 2 and 2 and 1 are 5, which, by trial, I found right." Then a big boy (J. M. J., page 152, August number) spoke up and said: "You may all be right, for aught I know; but why make so many figures? Why not save 'worry of mind' and say 5 is 5, and put down a big figure 5 and have done with it!" This reminds me of the Irishman who said, "Why not stop the organ with one big stop, instead of 32 small ones?" I would advise J. M. J. to hire a small boy, with but little mind to be "worried," to read that last communication of mine, and if he cannot see, with a very little "headwork," that the plan represented by me is founded on the very thing recommended by him, he should discharge the boy and hire one with less mind and smaller head.

The unkindest cut of all is from S. F. D., in saying that W. B. is "decidedly incorrect." If he had told me this some 25 or 30 years ago, when I first commenced practicing the system, it might have done some good; but at this late day, after I have taught it to some hundreds of men, and have employed it on a large number of difficult structures and in making the patterns for some of the most prominent public buildings in the country, it comes over me like a wet blanket. The situation is, to say the least, very discouraging. What to do I don't know. The men I have taught may see, by his communication in *Carpentry and Building*, that the thing will not work, and thus be saved from harm. But I am afraid the owners of the buildings will not allow them to be taken down, simply because the principles on which the framing was done are "decidedly incorrect." Accordingly, they must stand as monuments of the imbecility of W. B.

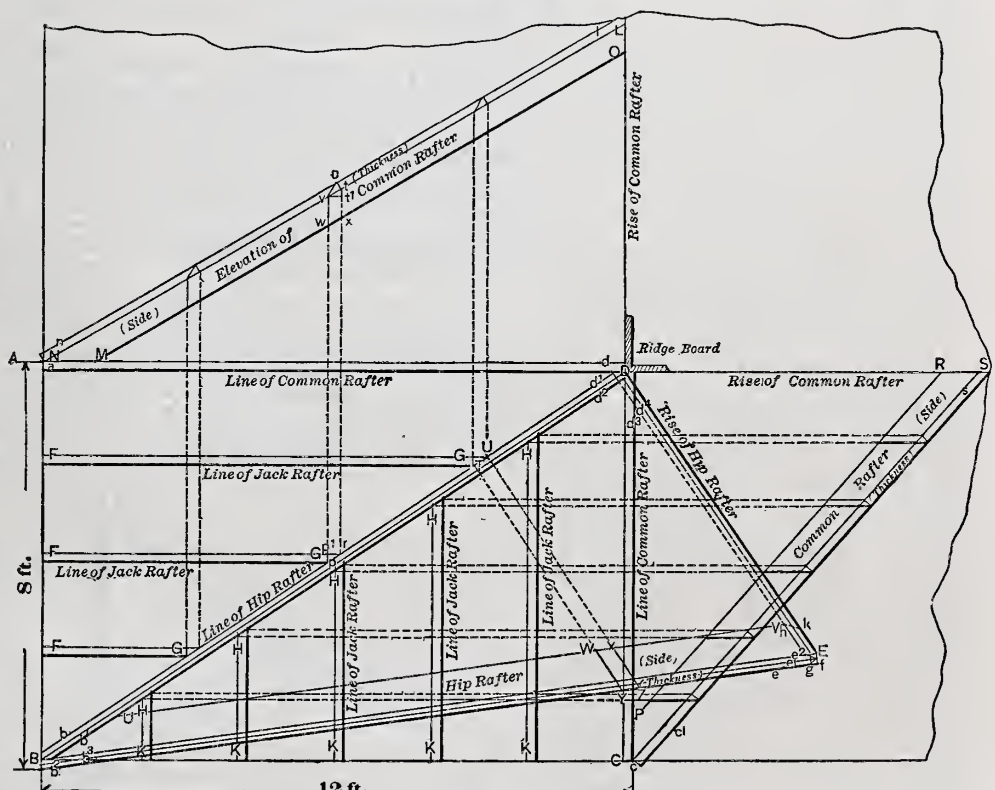
My object in writing at this time is to honor the draft of C. H. R., who, in the August number, asks for my manner of getting lengths, bevels, cuts, &c., of the hip shown in Fig. 5 of my last communication. The pitch of the hip rafter in that sketch was assumed to be 7 inches to the foot. The hip rafter was the only one under discussion the common rafters not being referred to at all. In order to avoid troublesome fractions, and also to present the problem in the way that it would naturally come up, I shall take, for sake of illustration, a ground plan, 8 by 12 feet, all as shown by the accompanying sketch. I have given my rafters a rise of 7 feet, which comes very nearly to the pitch assumed in Fig. 5 of the June number. Presenting the problem in this manner will, I think, answer the requirements of your correspondent, and instead of performing some of the operations backward, as would be necessary to take the problem as left in my former letter, I will be presenting it in the ordinary manner in which it comes up in practice.

First draw the lines of the plate as represented by A B and B C. From B on B C set off 12 feet; then square up C D. In like manner from B on B A set off 8 feet and square up A D, meeting C D in the point D. Next draw the diagonal B D, which will be the line of the hip rafter. Each side of B D lay off half the thickness of the hip rafter, which in this case is assumed to be 2 inches, thus obtaining the lines $b\ d^1\ b^1\ d^2$. Parallel to A D draw *a d*, making the distance between the two lines equal to the thickness of a common rafter, which, in this instance, is also assumed to be 2 inches. In like manner, parallel to C D lay off $c\ d^3$, making the space between the lines 2 inches, thus representing the thickness of common rafter. Having thus constructed a plan of the roof, locate the line of jack rafters in the position that they are required to occupy, all as shown by F G in the upper portion of the plan and H K in the lower portion of the plan. In this instance I have placed them 2 feet from centers, and have represented them to be 2 inches thick.

From the line *a d*, which represents the run of the longer of the two common rafters, square up the rise 7 feet, all as indicated by *d* L. Draw N L, which then will represent the length of the common rafter. Parallel to N L, and below it, draw M O, making the distance between the lines equal to the width of the rafter. Also parallel to N L, and above it, draw *n l*, making the distance between these lines equal to the thickness of the rafter. In like manner, from $c\ d^3$ square up 7 feet for the rise of the common rafter on the short side of the roof, all as shown by D S. Connect S *c*, which will represent the length of the shorter common rafter. Draw parallel lines, as already described in the preceding instance, representing the width and thickness of the rafter. In like manner, on B D square up 7 feet for the rise of the hip rafter, all as shown by D E. Connect E B, which will be the length of the hip rafter. Parallel to E B draw U V, making the distance between the lines equal to the width of the rafter, which in this case is 8 inches. Also parallel to B E draw $b^2\ e$, making the distance between the lines equal to the thickness of the rafter. Between the two parallel lines thus drawn draw $b^3\ E^1$, which represents the center line of the edge of the hip rafter.

For the lengths and cuts of the jack rafters, proceed as follows: From the heel and toe of the jack rafter F G, as shown by *p r*, square up to the upper edge of the common rafter, thus obtaining the points *v* and *t*. From *t*, square across the edge of the common rafter, thus obtaining the point *u*. Connect *v* and *u*, which gives the cut across the top of the jack rafter. Then the entire cut of the upper end of the jack rafter is represented by W V on the side and V *u* on the top. The length of the jack rafter is obtained by measuring from the foot of the common rafter up to the line or cut just established. The jack rafters for the opposite side of the roof are obtained in the same manner, squaring up from the intersection of the line of the jacks with the line of the hip rafter across the side of the common rafter, all as indicated by dotted lines.

In case it is necessary to know the point at which the jack rafter will strike the hip rafter, the lines may be obtained by squaring up from the heel and toe of the jack rafter, as indicated by T W Y and U X Z. The same general principles may be applied to obtaining the cut of the end of the hip rafter, where it fits between two common rafters, all as indicated by dotted lines in the sketch. The long bevel is shown by *h k f* e^2, and the short bevel by *g f*.



The Cuts of Jack Rafters in a Roof Having Irregular Hips.—Contributed by W. B.

This plan of framing may perhaps be made more clear by a familiar illustration. Imagine that each rafter, including the hip rafter, sets above a ceiling beam or joist, and that we square up from the beam to the rafter. In other words, the lines of the jack rafters F G are carried against the lines of the hip rafter $b\ d^1$, as though these lines represented joists in a ceiling. From their intersection with the hip we square up to the rafter, thus getting the proper cuts, as shown by W V U.

Calculating the Strength of Material.

From G. M. ALVES.—Mr. F. E. Kidder, in the July issue, urges the propriety of using different constants for different kinds of

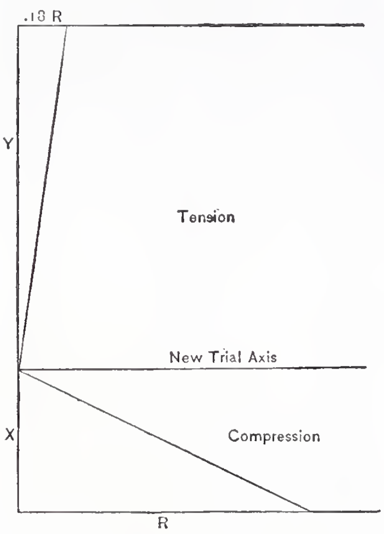


Diagram of Tension and Compression Accompanying Letter from Mr. Alves.

woods, and gives a table of the same, as though all authorities were agreed upon the subject. The truth is that no table of constants of the strength of material can be used with full confidence in its precision. In the first place, authorities differ; and in the second place, we have no assurance that a given piece of material will exactly resist the amount given in any table. Exposure and other conditions of growth have much to do with the strength of the wood from any given variety of tree. There is not as much difference in the strength of the wood from trees of the same variety as there is in the strength of men of the same race, but it will serve as some comparson. Hence, it will be seen that it is unreasonable to expect precise results without carefully testing the particular material used, which is seldom or never done in ordinary work, but which should always be done in very important structures and bold designs.

Mr. Kidder, in his table, gives yellow pine about double the strength of hemlock. Mr. Trautwine, the most commonly accepted authority in America, gives the transverse strength of yellow pine as 500, and of hemlock as 400 pounds. This difference is not sufficiently great to be noticed in common practice, where such large allowances are made for safety, and particularly where the latter material is not used for very important structures.

Mr. Kidder's method of finding the transverse strength from the ultimate or tensile strength, although frequently employed, is founded upon an erroneous hypothesis. If we assume the neutral axis to be in the center of the beam, it may then be shown by demonstration that the transverse strength is one-eighteenth of the tensile strength. But the fact is, the neutral axis cannot be in the center of the frame unless the resistance to crushing and the resistance to rupture by tension of the material are equal—a fact seldom found.

It is not the part of wisdom for an engineer to resort only to analysis when nature may be readily appealed to by direct and easy experiment, and therefore it is more satisfactory to obtain the transverse strength of material by direct test than to calculate it from the other resistances of the material. But if we are to calculate it, let us assume at least a probable hypothesis. Let us assume, not that the neutral axis is invariaby in the center, but at a point where the moments of tension above will equal the moments of pressure below. Any other asumption is unnatural and antagonistic to the economy of nature. To solve the problem, it thus becomes necessary to know the crushing as well as the tensile strength.

Let us exemplify the two theories. The strength of American cast iron is usually taken as follows:

	Pounds.
Tension	18,000
Compression	100,000
Transverse	2,100

According to the theory which Mr. Kidder holds to, the transverse strength should be 1-18th of 18,000 = 1000 pounds—less than one-half of its strength as given by experiment. Let us now try the other theory. We will first find the position of the neutral axis. Let the annexed figure represent a horizontal cast-iron beam secured at the end $x\ y$ and loaded at the other.

Let $x =$ the distance of the neutral axis from the bottom.

Let $y =$ the distance of the same from the top.

Let R = the crushing strength of the material.

Then will .18 R = the tensile strength of the material.

$x \times \frac{R}{2} \times \frac{2x}{3} =$ the sum of the moments of the resistance of the material to compression.

And $y \times \frac{.18\ R}{2} \times \frac{2\ y}{3} =$ the sum of the moments of the resistance of the material to tension.

Now, as the sum of the moments of compression and the sum of the moments of tension are in equilibrium, we have:

$$x \times \frac{R}{2} \times \frac{2\ x}{3} = y \times \frac{.18\ R}{2} \times \frac{2\ y}{3}$$

Whence $x = y\ \sqrt{.18} = .424\ y$.

Supposing the depth of the beam to be unity, we have the equation $x + y = 1$.

By substitution $.424\ y + y = 1$.

Whence $y = .70$ and $x = .30$.

Having found the position of the neutral axis, let us now find the strength of the beam. Let us take the resistance to compression.

We have $.30 \times \frac{R}{2} \times .20 = .03$ R; but as the resistance to tension is the same, we have for the whole beam .06 R. As R by agreement = 100,000 pounds, we have 6000 pounds as the strength of a beam 1 inch square and 1 inch long. Now, as a beam 1 inch square and 3 inches long, fastened at one end and loaded at the other, has the same condition of strength as a beam 1 inch square and 12 inches long supported at both ends and loaded in the middle, we have $\frac{6000}{3} = 2000$, a near approximation to that given by direct experiment.

According to the theory held to by Mr. Kidder, a stone lintel would hardly sustain its own weight.

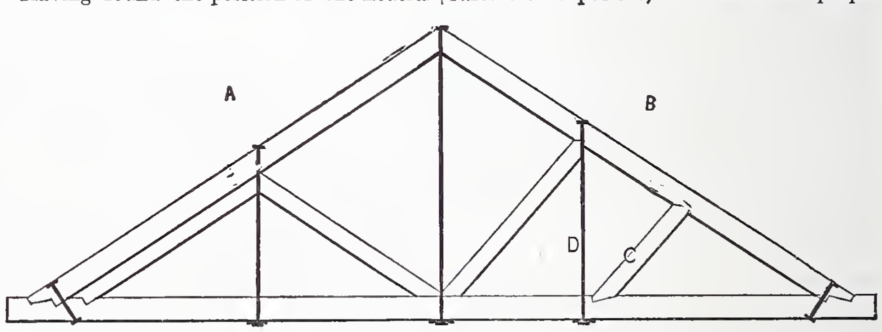
It may be said that the above theory was not intended for cast iron or stone, but only for timber. But it may be reasonably answered that if it is a principle, it must be absolute and applicable to all material. If we may assume the neutral axis of a wooden beam to be in the center, we may also assume it to be in the center of a cast-iron or stone beam.

It is true that in wood the hypothesis does not create such error as in the latter materials, but it is only because the ratio between the resistance in wood to tension and compression is much less.

Comparison of Roof Trusses.

From GENE.—I have been very much interested in the roof truss discussion; so much so that I cannot keep my fingers out of the pie. Inclosed please find a sketch of two trusses combined in one in order to make a comparison easy. The side marked B is from the truss contributed by T. S. McV., in the July number of *Carpentry and Building*, and the one marked A is one in common use in this section of the country. A is much the stronger, because it is a double truss. B is wrong. The braces marked C cause too great a strain on the rod D. In my opinion, the brace C is worse than useless. If I am wrong I am ready to be corrected.

Note.—Our correspondent is in error, and we will attempt quite briefly to show wherein he is wrong. A and B are both good trusses. B is, however, better adapted for wide spans, for the reason that the rafter is supported so that an extra purlin may be placed upon it over the second brace C. Should the rafters support purlins placed at short intervals without regard to the points of support of the rafters themselves, as is sometimes done, then the rafters would bear the cross strain; and supposing the spans to be the same, the rafter B would be able to bear this cross strain over A in the ratio of 3 to 2; *i. e.*, B would bear 1½ times as much cross strain as A. It is true that where purlins are placed directly over or very nearly over where the rafters receive a support, even in large spans the truss A would be as strong as the truss B, but would require much larger "little" rafters and much larger purlins, so that the roof, as a whole, would be less economical and less skillfully proportioned than would be B. Large "little" rafters and large purlins are for obvious reasons objectionable, and hence the first point in designing a truss is to take moderate-sized "little" rafters and purlins, estimate their proper



Comparison of Roof Trusses.—Diagram Accompanying Letter from Gene.

bearings and then support the main rafters with braces whereby the purlins are required to be placed. It thus appears, in designing roof trusses, that we have to regard not only the necessary strength of the truss itself, but also to give proper attention to the number of points at which the truss should receive the load, in order that the timbers above the truss shall not be too heavy.

In the light of the foregoing, the proposal to do away with the brace C as "worse than useless," is absurd. The objection of its throwing the strain upon the tie-rod D is ill taken, for the reason that it simply compels D to take its legitimate burden. Further, D may be more economically proportioned to do its work than probably any other member of the truss.

Substitute for Prepared Blackboard Paint.

From W. A. J., *Canyon City, Oregon.*—Some time since a correspondent asked for a cheap method of making a blackboard, and I would reply as follows: When you cannot obtain the proper blackboard paint which is commonly sold for the purpose, plane the board to the proper shape, apply two coats of paint made of equal parts lamp black, japan and spirits of turpentine. Don't use any oil in the mixture, as it will cause the board to be glossy. A trial of a board prepared in this way will be found entirely satisfactory.

Foundations.

From F. E. Kidder.—The following general directions, taken from "Trautwine's Pocket Book for Civil Engineers," pp. 313, 314 and 321, may be of use to A. M. F., who asks what is essential to make a good foundation for brick and rock walls:

"If the soil on which the foundation is to rest is firm for a depth of from 4 to 8 feet, the foundation wall may be built of stone, resting on the soil. In starting the masonry, the largest stones should, of course, be placed at the bottom of the pit, so as to equalize the pressure as much as possible; and care should be taken to bed them solidly in the soil, so as to have no rocking tendency. The next few courses should be of large stones, so laid as to break joint thoroughly with those below. The trenches should be refilled with earth as soon as the masonry will permit, so as to exclude ra n, which would injure the mortar and soften the foundation. It is well to ram or tread the earth to some extent as it is being deposited.

"If the soil is too soft to support the masonry, but is not exposed to running water, then the pits should be made considerably wider and deeper, and afterward be filled to their entire width, and to a depth of from 2 to 4 or more feet (depending on the weight to be sustained), with rammed or rolled layers of sand, gravel or stone broken to turnpike size, or with concrete in which there is a good proportion of cement. On this deposit the masonry may be started. The common practice, in such cases, of laying planks or wooden platforms in the foundations for building upon is a very bad one; for if the planks are not constantly kept thoroughly wet they will decay in a few years, causing cracks and settlements in the masonry.

"In 'made soil,' or soil which is soft to a great depth, piles should be used to support the stonework. Piles for this purpose are generally round, from 9 to 18 inches diameter at top, and should be straight and clear of bark and projecting stubs. White pine, spruce, or even hemlock, answer very well in soft soils, good yellow pine for firmer ones, and hard oaks, elm, beech, &c., for the more compact ones. They are usually driven from about 2½ to 4 feet apart each way from center to center, depending on the character of the soil and the weight to be sustained."

The following, from sections 3 and 4 of the Laws Relating to Buildings in the City of New York, may also be of value:

§ 3. All foundation walls shall be laid not less than 4 feet below the surface of the earth, on a good solid bottom, and, in case the nature of the earth should require it, a bottom of driven piles, or laid timbers, of sufficient size and thickness, shall be laid to prevent the walls from settling, the top of such pile or timber bottom to be driven or laid below the water line.

§ 4. The footing, or base course, under all foundation walls, and under all piers, columns, posts or pillars resting on the earth, shall be of stone or concrete; and if under a foundation wall, shall be at least 12 inches wider than the bottom width of said wall; and if under piers, columns, posts or pillars, shall be at least 12 inches wider on all sides than the bottom width of the said piers, columns, posts or pillars, and not less than 18 inches in thickness; and if built of stone, the stones thereof shall not be less than 2 by 3 feet, and at least 8 inches in thickness; and all base stones shall be well bedded and laid edge to edge; and if the walls be built of isolated piers, then there must be inverted arches, at least 12 inches thick, turned under and between the piers, or two footing courses of large stone, at least 10 inches thick, in each course. All foundation walls shall be built of stone or brick, and shall be laid in cement mortar, and if constructed of stone, shall be at least 8 inches thicker than the wall next above them, to a depth of 16 feet below the curb level, and shall be increased 4 inches in thickness for every additional 5 feet in depth below the said 16 feet; and if of brick, shall be at least 4 inches thicker than the wall next above them to a depth of 16 feet below the curb level, and shall be increased 4 inches in thickness for every additional 5 feet in depth below the said 16 feet.

I think the above will answer A. M. F.'s first question, and in answer to the second, I would say, perfect workmanship under the above requirements.

Durability of Shingles.

From C. E., *Kentucky.*—Your correspondent, E. H. C., asks me "why a shingle would not last as long as any part of the building if dipped in paint?" I answer, in the first place, because it is more exposed than any other part of the building, and, in the second place, because, from the peculiar way it is used in construction, it takes considerable time to dry after being wet. If painted shingles would last as long as painted weather boarding, then it would be fair to conclude that unpainted shingles would last as long as unpainted weather boarding, which is known to be untrue.

Where Sheeting Boards Should be Placed.

From J. E. W., *Royalton, Wis.*—In answer to W. Y. P., Berea, Ohio, I would say that if I could only sheath a house on one side, it should be on the outside. I use tarred paper a good deal between sheathing and siding with good effect. After the house is finished inside the smell is not noticed.

Lack of Inducements for Young Men to Learn Carpentry.

From R. W., *Cape May City, N. J.*—I have taken *Carpentry and Building* since the first number, and have written one or two letters which have appeared in the correspondents' columns. Of late I have not written much, for I observed that the correspondents' department was already crowded. A letter from R. S T., of New York, has touched upon a subject which I have given much thought, and upon which I intended to write you. Your correspondent, R. S. T., has struck the key-note. The trade of the house carpenter is a failure financially. I will illustrate this by a statement of my own experience. At 16 I went into a carpenter shop and served there a four-years' apprenticeship. After that I commenced the study of architecture, and have followed the latter, more or less, ever since. I am 38 years old now, and have worked in every department of the trade as journeyman, foreman and builder. I have designed and erected some very fine houses, but the business has never brought me much of this world's goods, nor will it to any one as a rule. Of course, there are exceptions. Occasionally a carpenter succeeds, but usually through some other business connected with his trade. I agree with R. S. T., and go even further than he does. I say that to fully understand how to build a first-class house, supplying everything from the original design and drawings through to its ultimate completion, requires quite as much brain as is necessary to make a fair lawyer or doctor. Carpenters are certainly of quite as much use in the community as professional men. How are they paid? Just enough to furnish bread and meat to the family, and nothing more. Because nine out of ten carpenters do not succeed financially, it will not do to say that as a class they are without brains—that they are inferior to the average lawyer. Carpenters, as a class, are the real bone and sinew and brain of the community. The question then arises, why are professional men paid so liberally and mechanics so meanly? I certainly think there is a reason for it, and possibly a remedy. I know of no better way of discovering the reason and finding the remedy than for mechanics of all trades to unite in discussing the matter.

The questions thus raised are certainly of more importance and of greater interest than brace rules or day's work at shingling. Were the discussion to be fairly incorporated into *Carpentry and Building*, I think it would attract more attention than anything that has appeared in its columns. Let the matter be fully ventilated; how the master builder is obliged to contract for houses at cost, and how trouble always follows with such work; how people who build employ mechanics without stopping to inquire as to their capacity or reliability; how many of the great accidents that occur almost daily are caused by the incompetency of the mechanics employed. Of course, the American father does not want his son to spend the best years of his life in learning a trade that is worth nothing financially. He naturally prefers that the boy should learn some profession, simply because it pays better. I think there is no finer trade than that of the house carpenter, and none that requires a clearer head or more brains; but unless there is some change with respect to it, a few years hence it will be difficult to find a first-class journeyman carpenter.

From J. W. R., *Chicago.*—I desire to say something concerning R. S. T.'s letter on the lack of inducements to learn trades. Thirty years ago I went to serve an apprenticeship of five years to learn the carpenter's trade in one of the larger Eastern cities. At that time it was customary to work moldings by hand and to make doors and sashes also by hand—indeed, to do everything in the shop without machinery, except working flooring. The men who then worked at the trade were almost all of them natives of this country. If a foreigner was employed it was necessary for him to be a man equal in mechanical skill to the native workman. If he was inferior, he had the choice to work under instructions at lower wages or hunt another job. Since that day machinery has been gradually introduced, which has taken away in part the necessity for skilled labor. This has broken down the carpenter's trade and has made it only necessary for journeymen to know how to put up such work as the mill can't do. When I was a boy a mechanic was respected. He was considered a person who, by dint of skill, could design work and build all the separate parts required in the best house. Not only this—he knew how to be a gentleman, and he gave attention to that which elevates and makes a man respected. He respected himself enough to keep himself clean and avoid low places. At present all this is changed. Go into any shop in any city and you will find almost as many tongues as there are men. The quality and quantity are both inferior. It is performed by men, many of whom in their native countries were little better off than were the Southern slaves before the war. Not having such advantages of training as our youth, they are mentally and morally inferior, and are of a character that our boys, who are better educated and have a higher moral standard, don't desire to associate with. It is the proper ambition of every parent to so instruct his children that they shall not have the same difficulties to contend with as he had. He tries to place them in conditions where, if they fail to provide a competence for old age, they will have no one to blame but themselves. To sum the matter up, our American youth are not willing to learn a trade that pays as small wages and offers as few inducements for the future as the carpenter's trade. Our American youth are not idlers; they have active brains and aspirations equal to the best, and because they fail to discover a road to success by learning a trade, they are careful not to start in that direction and who can blame them?

Rule for Scroll Sawing.

From E. D. B., *Delaware, Ohio.*—Your correspondent J. H. K., of Huntington, W. Va., asks for rules for scroll sawing. In reply I would advise him to keep his saw sharp and follow the mark.

Covering for Spire.

From J. K. S., *Waterbury, Conn.*—If your correspondent J. T., of Davenport, Iowa, will cover his spire with 8 x 14 Bangor slate, cut hexagon pattern, having them well laid, he will have a covering very much better than shingles or iron.

Correction of an Error.

From E. W. C., *Randolph, Mass.*—In my letter published on page 134, July number of *Carpentry and Building*, there is a mistake which I should like to see corrected. For the miter joint in a hopper, I should have said: "By taking C L on the tongue and C B on the blade, the miter cut for the hopper would be obtained." C B should be substituted for C A, as printed. Likewise, in the next paragraph, for backing a hip, take C L on the tongue and C A on the blade. Here C A should be substituted for C B, as printed.

Sea Side Cottage.

From H. N. & Son, *Philadelphia.*—We shall be pleased to see in *Carpentry and Building* a design for a cottage suitable for the seashore, to cost from $2000 to $3000. There should be about four rooms on the first floor and three above.

Answer.—The design published in this number of *Carpentry and Building*, although not exactly corresponding to our subscriber's specification, is quite suitable for the seaside, and will, we believe, serve a good purpose. In various numbers of *Carpentry and Building*, through the last 15 months, we have published designs which, although not specifically called seaside cottages, were suitable for that purpose. Their estimated cost has ranged from $1000 upward.

Why Carpentry and Building Pleases.

From J. W. R., *Chicago.*—I consider *Carpentry and Building* a good paper. I like it, because of the absence of learned and abstruse terms. It is a useful help to the most humble and illiterate artisan. It encourages him to strive for a greater efficiency in the prosecution of his daily avocation. This is not the only merit of which the paper is possessed. It addresses itself to mechanics who, having passed the period of apprenticeship in which bare rudiments of construction were learned, have by years of experience reached the more exalted position of masters. Articles prepared with this end in view have been read by me, not only with pleasure, but with great profit. Allow me to say that an editor who, in this busy age, conducts a mechanical paper, and fills it only with the technical productions of an exquisite few, will be like a tree in autumn dropping its leaves upon the ground to be trampled by the crowd hurrying past.

Source of Supply of Red Cedar.

From R. D. B., *Jamaica Plain, Mass.*—I noticed in a recent number inquiry for red cedar. I beg to inform your correspondent that by sending to Bermuda he can get the best red cedar in the world. The steamers run there every week.

Octagon Rule on Steel Squares.

From Inquirer, *Boulder, Colorado.*—Will *Carpentry and Building* please explain a rule found upon the center of the tongue of steel squares? The space down the center of the tongue is divided by dots, five of the spaces making a little more than 1 inch. They are numbered 10, 20, 30, 40, &c.

Answer.—Our correspondent evidently refers to the octagon scale to be found upon most steel squares, which was fully explained in our article on the steel square, page 12, January number of the present volume, to which we refer him.

"Striking Force" of Falling Bodies.

From H. C. L., *Fredonia, N. Y.*—Answering the question of L. B., I would say that a ball weighing 5 pounds will have to fall 18 inches to obtain a striking force of 10 pounds. Any body falling the same distance will have a striking force equal to double its weight.

An Omission Supplied.

From G. H. H., *Philadelphia.*—A typographical error in my communication upon the cuts in a hipped roof, which appeared in the August number, requires correction. In the last column, on page 155, immediately below Fig. 1, the sentence reads as follows: "Then, as the rafters are 2 feet from centers, one jack is 2⅞ inches longer or shorter than its neighbor." It should read as follows: "Then, as the rafters are 2 feet from centers, one jack is 2 feet ⅞ inch longer or shorter than its neighbor."

Estimating the Cost of Stairs.

From T. S. W., *Cleveland, Ohio.*—I noticed in *Carpentry and Building* a short time since an inquiry concerning the best method of estimating the cost of stairs. The following is a plan I employ on ordinary work:

To estimate the cost of ordinary stairs, either open or boxed, first calculate the number of feet per straight step, counting the step and riser and the strings adjacent, allowing generally 1 foot in length of string for each riser. Allow for timbering underneath such a part of the actual number of feet as may be required to represent its value when figured at the same price as the other lumber. After ascertaining the number of feet in one straight step, as above, multiply by the whole number of risers in the stairs, allowing three for each winder or swelled step. An allowance of two will be enough when there is no furring underneath. Allow four for quarter platforms and six for half platforms. No allowance need be made usually for landings. Double the cost of dressed lumber. Figure pine at 4 cents per foot. Figure oak at 5 cents per foot, costing 3½ cents. Figure walnut at 8 cents per foot, costing 5 cents. For ornamental brackets of pine allow 15 cents each, or per foot or facia. For oak or walnut allow 20 cents each, or per foot of facia. For plain railing put up, multiply number of square inches on cross section by 3 cents, which will be the price per foot. Figure crooks at three times their length; for small rails or toad-back rails add 10 per cent.

Figure ordinary turned ballusters, smoothed and dovetailed, 2-inch walnut, at 14 cents; 2¼-inch walnut, at 17 cents; 2½-inch walnut, at 20 cents; 2-inch oak, at 10 cents; 2¼ inch oak, at 13 cents and 2½-inch oak, at 16 cents.

Figure plain turned newels, walnut, 40 cents per inch of diameter (bases dressed); oak at 30 cents per inch of diameter (bases dressed); octagon newels (bases dressed), walnut, at 60 cents per inch of diameter, and oak at 50 cents per inch diameter; octagon paneled shaft, walnut, 80 cents per inch of diameter, and oak, 70 cents per inch of diameter.

The foregoing is a rather rough sketch of a plan of figuring, which in my experience seems to work out quite satisfactorily. Special designs may be figured somewhat in the same manner, varying, however, as the design seems to require.

ACKNOWLEDGMENTS.

We are in receipt of diagrams illustrating a plan of framing for a bank barn, employed by D. F. W., of Danville, Pa. The same correspondent also sends us the framing used in a school-house.

S. P. S., of Joliet, Ill., incloses a drawing for obtaining the hip rafter of a concave or convex Mansard roof, which we do not find it necessary to publish, because it is very nearly identical with rules which have already appeared in these columns. We are much obliged to our correspondent, and trust that next time he will be in better season with his favors.

REFERRED TO OUR READERS.

Another Problem of Equal Areas.

From H. D. C., *Philadelphia.*—Since one problem of equal areas has attracted so much attention in *Carpentry and Building*, I will propose another, thinking it may be a matter of interest to many readers of the journal.

Mr. Smith and Mr. Jones entered into partnership to carry on a building business. They purchased a grindstone in the name of the firm. After a time Mr. Smith observed that the partnership was not a paying one, and therefore he resolved to proceed on his own account. Accordingly, he proposed to Mr. Jones to take one side of the shop while he retained the other, and in this way to conduct separate businesses. Jones was willing to agree to this proposition, but raised the question as to the disposition of the grindstone. Smith's idea was for Jones to use the stone until it was half worn out. Jones was agreeable to this, and was willing to take the other half. Now, the question is that of striking the line on the stone which shall divide it into equal areas, in order that each one shall have as much of the stone as the other. Will some reader of the paper furnish the answer?

What is the Correct Brand in this Case?

From A. S. L., *Concord, Mass.*—*Apropos* of backing hips, will it be impertinent to inquire concerning the rule published on page 207 of last year's volume, November number? In my estimation it is incorrect. I shall be pleased to hear from others upon this point.

Note.—If our correspondent had pointed out wherein he supposes the rule to be incorrect we would had have some chance of answering him. As it is, we must wait his specification.

Further Explanation Wanted.

From J. E. W., *Royalton, Wis.*—I would like to say that A. H. F., of West Meriden, Ct., has not made his letter on placing the foot of valley rafter to accommodate the different pitches of roofs, sufficiently clear for my comprehension.

Cement Sidewalks.

From W. R. J., *McConnellsville, Ohio.*—Will some of the practical readers of *Carpentry and Building* furnish me with information with regard to making sidewalks with Portland cement, or whatever is the best cement for such purpose?

Method of Putting on Sheeting.

From R. W. Mc., *Rocksbury, Kansas.*—Will some of the readers of *Carpentry and Building* give me their opinion as to the best method for putting sheeting on to a building? I have always been accustomed to putting it on the inside, but I believe that the outside is best.

A Bead in a Segment and Circle.

From F. A., *Milton.*—Will some reader of *Carpentry and Building* show me how to get the cut of a stick or bead in a segment and circle?

How to Remove Lime Stains from Brick Fronts.

From S. O. C., *Bellaire, Ohio.*—I desire to learn what will remove lime stains from a brick wall. The walls of my house were washed by rain, and the mortar not being dry, discoloration of the brick was the result.

From G. F. N., *Cincinnati, Ohio.*—Will some reader of *Carpentry and Building* please make known the best method of cleaning down pressed-brick walls?

The Breaking Weight of a Beam.

From D. A. McL., *New York.*—Will some of the practical readers of *Carpentry and Building* furnish me an answer to the following: What is the breaking weight of a beam 20 feet long and 8 x 10 in size?

Note.—Our correspondent, in propounding the above, has omitted one very important particular, viz., the material of the beam. We publish his question as sent in, leaving our correspondents to furnish their own specification along with their answers.

CARPENTRY AND BUILDING

A MONTHLY JOURNAL.

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Designs for Newel Posts.

We take occasion this month, by means of our first page illustrations, to supply what has been asked for by several of our readers, viz., some designs for newel posts adapted for use in the better class of houses. We are indebted for the engravings presented herewith to Messrs. C. Graham & Sons, of Nos. 305 and 307 East Forty-third street, New York city. The gas fixtures, which are shown in connection with the newel posts are from the establishment of Messrs. Mitchell, Vance & Co., of No. 836 Broadway, New York. The body of the post shown in Fig. 1 is intended to be made of pine, glued up, and to be embellished by veneers of whatever kind of wood may be desired. Those parts which are turned are to be made of solid wood. The round post shown in Fig. 2 is glued up solid, of 2-inch stuff, thoroughly kiln-dried. The panels of Fig. 1 are finished with veneered faces. The moldings are inlaid with solid wood. The engravings, which were made from photographs, so clearly indicate the parts and workmanship that a more extended description is not necessary.

Fig. 1.

Fig. 2.

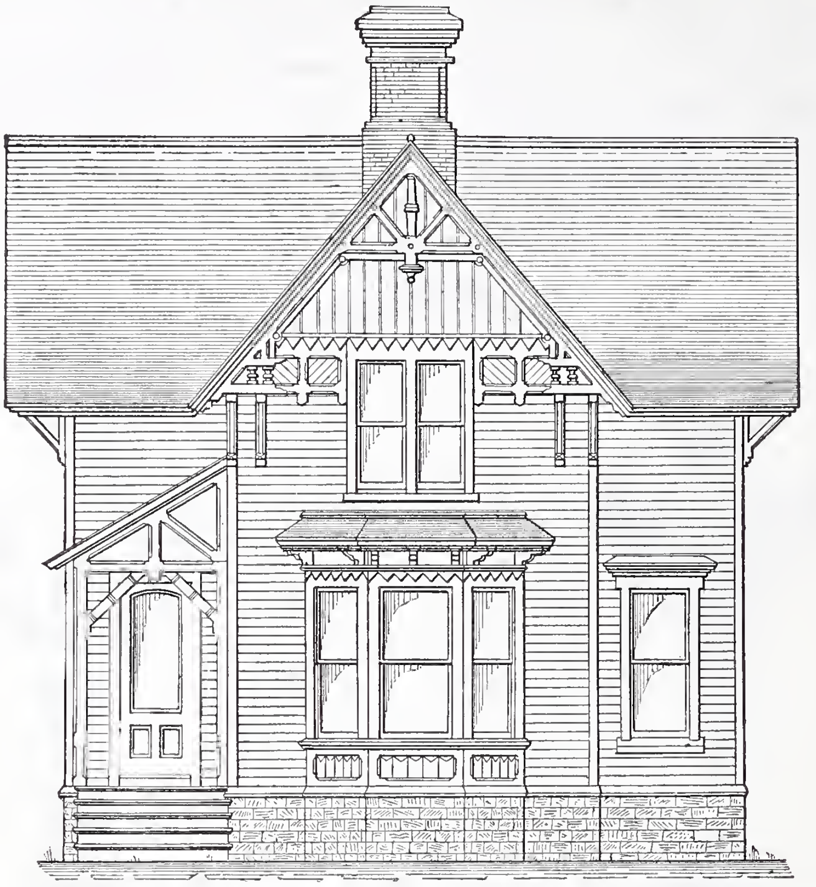
Newel Posts, Designed and Built by Messrs. C. Graham & Sons, New York.

A Novel Panel Decoration.

Inlaying, marquetry, or *intarsiatura*, as it is variously known, has long been used for the decoration of cabinet work, and in some of its many forms has always been a favorite. For ornamenting expensive table tops, there is probably no more beautiful material than a choice marquetry, made from the various bright-colored woods, inlaid in a handsome piece of French walnut. Most of the marquetry cutters in America are either Italian or French, and they have brought with them from their own countries traditional motives for their designs, that are almost always full of exceptional grace. Indeed, there is hardly any other department of cabinet work that so closely adheres to the spirit of the best period of the Renaissance, and so well unites vigor with grace and beauty. Of late, white holly marquetry, cut into Renaissance, Arabesque, or geometrical forms, has been much used for decorating panels in chamber work. Its use has been confined, however, to work of the higher grade, the expense of marquetry precluding its application to common furniture. An effective substitute has lately been invented, and can be produced at a price that will permit it to be generally used. The substance is a compound of secret ingredients, and is prepared in thin, flexible sheets, closely resembling white rubber in texture, although in color almost the exact counterpart of white holly. The operation of applying it is simply a method of embossing. The panel to be ornamented or inlaid with a sheet of the embossing material is passed through a pair of rolls, the upper one of which has a design engraved upon it. As the panel passes beneath the engraved portion of the roll, the design is cut clean and smooth out of the superimposed embossed material, and subjected to a pressure which firmly incorporates it in the wood, so that it cannot easily be removed. The fiber of the wood is not injured in the least. After the design has been embossed the article is finished, and the closest inspection is necessary to detect that the ornament is not a white holly inlay. The process is a recent invention of Mr. Adams, of Grand Rapids, Mich. This invention is likely to be of considerable importance in the manufacture of furniture, and no doubt goods finished in this manner will soon be in the market.

A Frame Cottage.

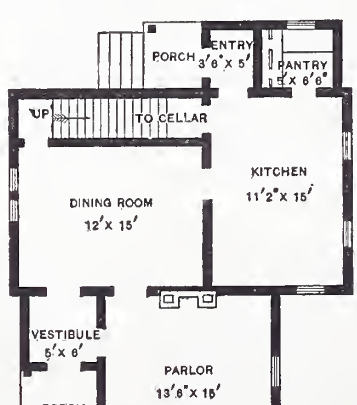
We present this month the plan for a very neat and well-arranged story-and-a-half frame cottage. The architect is Mr. T. I Lacey, of Binghamton, N. Y. By examination of the floor plans, which are shown in Figs. 2 and 4, it will be seen that the house is composed of six good-sized rooms. A vestibule, 5 x 6 feet in size, communicates with the front stoop, out of which a door leads to both parlor and dining room. The stairway leading to the chambers opens out of the dining room, while the stairs to the cellar are placed directly under and open into the kitchen. The kitchen is a room of convenient size. Immediately back of it is placed the pantry, which is 5 x 6½ feet in size. A rear entry, 3½ x 5 feet, affords means of entrance to the house from the back porch. In the second story there are three good-sized bed rooms, all very nearly square, and each provided with a closet of convenient size. A central passageway, which is lighted by a low window in the rear, affords means of communication with the several rooms. Space has been fairly economized throughout in the planning of this building, and the shape of the several rooms is such as make them quite desirable.



Frame Cottage.—Fig. 1.—Front Elevation.—T. I. Lacey, Architect, Binghamton, N. Y.—Scale, ⅛ Inch to the Foot.

According to the architect's specifications, a cellar 6 feet 6 inches in the clear is intended to extend under the entire building. A cistern is to be built under the pantry, the excavation for which is required to be 1 foot deeper than that of the cellar. A sink is to be provided in the corner of the kitchen next to the pantry, which is to be fitted with a pump connecting with the cistern. The foundation work below the ground is intended to be of field stone, while that above the ground is to be of quarry stone, the walls to be 1 foot 6 inches thick. All the rooms, with the exception of the rear chamber, are to be accommodated by the one central chimney, which is to be provided with a suitable stone foundation, laid 6 inches below the cellar bottom, and built of good, hard burnt brick. A half low-down grate is to be provided for the parlor, thimbles being inserted for the dining room, kitchen and the two front chambers. The frame of the building is to be of sound hemlock lumber, the principal sills being 4 x 8 inches in size, and the cross sills 6 x 10 inches. The joists are to be 2 x 9 inches, placed 16 inches between centers, and to have one course of bridging through the center. The studs for corners, windows and doors to be 4 x 4 inches; all others to be 2 x 4, and placed 16 inches between centers. The rafters are to be 2 x 4, placed 16 inches between centers. Valley rafters are to be 3 x 7 inches. Collar beams to be 2 x 6 inches; all timber work to be well nailed or spiked together.

The exterior is to be sheeted with sound, seasoned and surfaced hemlock boards, over which is to be put a simple course of 8-pound rosin-sized building paper. Good white-pine siding forms the outside finish. The roof of the bay window is to be covered with tin, while the main roof is to be laid of the best quality of sawed white-pine shingles, 18 inches long, and laid 5½ inches to the weather. The roof is, preparatory for shingling, to be sheeted with hemlock boards laid with 1½-inch open joints. The cornice, window frames, corner boards, porches, bay windows and all outside cases and trimmings are to be made of good white-pine lumber thoroughly seasoned. The glass required is to be of the best quality of American, single thickness. The sashes are to be 1½ inches thick, and to be fitted with pulleys, cotton cords and weights. The outside doors are to be 1¾ inches thick. The inside doors, with the exception of closets, to be 1½ inches thick, and the closet doors 1¼ inches thick. All are to be four-paneled doors, excepting the porch doors, which are to have glass above the middle rail, as shown in the elevations. The hardware used about the doors is to be the best of its kind; the lower doors to be hung with



Frame Cottage.—Fig. 2.—First Floor Plan.—Scale, 1-16th Inch to the Foot.

three butts each and to be provided with two tumbler mortise locks, with brass bolts and keys. The doors for the front vestibule, parlor and dining room are to be fitted with jet knobs, with bronze rose and escutcheon, all others to have white-porcelain knobs, with porcelain escutcheons. The doors are to be of white pine, kiln dried.

For inside finish the specifications call for white pine in the parlor for all parts except the mantel, which is to be of white oak. The dining room is to be fitted with ash wainscoting and face casings, with cherry plinth, cap and moldings. The kitchen and other rooms will be finished in white pine. The casings for the bedrooms are to be 4½ inches wide, with a 2½-inch face mold and 1¾ back and base mold. The base will be 5 inches wide. The pantry is to be sealed up 2 feet 6 inches high to the counter shelf. Above the counter shelf there are to be placed four shelves, supported with rabbeted cleats. A cupboard is to be constructed under the counter shelf, having two shelves. Each closet in the house is to be provided with three shelves, put in two tiers of cleats. Double wardrobe hooks are to be provided, placed eight inches between centers.

The lathing is to be of No. 1 hemlock, free from knots or bark. The plastering is to consist of a scratch coat, a brown coat and a finishing coat, put on in the best manner and of the best material.

The exterior woodwork is to be painted with three coats of the best lead and oil, the color for the body to be a light greenish drab, with trimmings a few shades darker. The window blinds are to be of a color between the two just described, while the bevels of the outside work are to be a dark brown. The inside work is to be painted in drabs, in three colors, excepting the dining room, which will be finished in shellac. The mantel in the parlor is also to be finished in shellac.

The following is the architect's schedule of quantities of material for the building, according to the accompanying plans:

250 yards excavation.
76 perch of stone.
6400 feet of timber in frame.
2000 feet of sheeting.
1850 feet of siding.
20 squares of sheeting paper.
150 feet lineal of cornice.
3 ornamental gables.
15 windows.
16 doors.
2400 brick.
1300 feet flooring.
8000 shingles.
26 feet of valley tin.
1300 feet roof boards.
1 bay window.
2 porches.
2 flights of steps.
575 yards of plastering.
1 sink pump.
1 ash mantel in parlor.
Painting exterior and interior.

From the above schedule our readers will have no difficulty in estimating the cost of a building erected to these plans and specifications in their own localities. Built in the neighborhood of Binghamton, it was estimated to cost a short time since, when the plans were prepared, about $1000. The advance which has taken place, both in the cost of labor and of building materials in the interval would probably advance that figure somewhat.

High Buildings.

The gradual approach to completion of the new city buildings, Philadelphia, brings up by way of comparison the hights of the various tall buildings of the world.

The crown of the hat of the statue of William Penn, which is to surmount the tower of the new public buildings of Philadelphia, will be just 535 feet above the pavement. This is 10 feet 1 inch higher than the highest towers of the Cologne Cathedral as they now stand. The Penn square tower, however, will ultimately be overtopped by the Cologne towers 41 feet 9 inches, their intended hight being 576 feet 9 inches. The hights of the other chief lofty buildings of the world are given as follows :

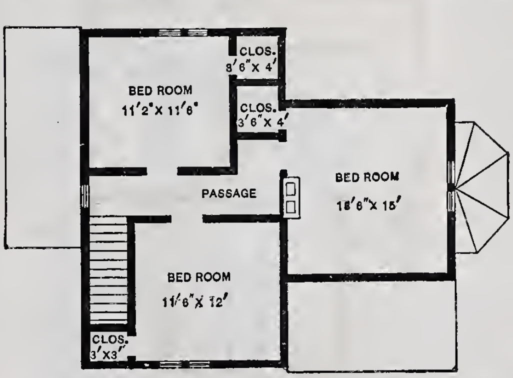
Frame Cottage.—Fig. 3.—Side Elevation.—Scale, ⅛ Inch to the Foot.

Tower of St. Nicholas' Church. at Hamburg, 473 feet 1 inch ; cupola of St. Peter's, Rome, 469 feet 2 inches ; cathedral spire at Strasburg, 465 feet 11 inches ; pyramid of Cheops, 449 feet 5 inches ; tower of St. Stephen's, Vienna. 443 feet 10 inches ; tower of St. Martin's, Landshut, 434 feet 8 inches ; cathedral spire at Freiburg, 410 feet 1 inch ; cathedral of Antwerp, 404 feet 10 inches ; cathedral of Florence, 390 feet 5 inches ; St. Paul's, London, 365 feet 1 inch ; ridge tiles of Cologne Cathedral, 360 feet 3 inches ; cathedral tower at Magdeburg, 339 feet 11 inches ; tower of the new Votive Church, at Vienna, 314 feet 11 inches ; tower of the Rath-haus, at Berlin, 288 feet 8 inches ; Trinity Church, New York city, 284 feet ; and the towers of the Notre Dame, at Paris, 232 feet 11 inches.

Fire-Resisting Qualities of Building Stones.—Dr. Cutting, State Geologist of Vermont, has concluded a unique series of tests of building stones with reference to their fire-resisting qualities. He sums up the result in a recent number of the *Weekly Underwriter*. He declares, in substance, that no known natural stone deserves the name fire-proof. Conglomerates and slates have "no capability" of withstanding heat ; granite is injured beyond cheap or easy repair by even so mild a heat as that which melts lead ; sandstones, including the variety called brownstone in this city, are better, and limestones and marbles are perhaps the best in this respect. But even they are injured by a continuous heat of 900 degrees, and at 1200 are changed into quicklime. Therefore it would seem that no stone buildings are fire-proof, and some of them, Dr. Cutting even says, are as much damaged by fire as wooden structures are. Brick, on the contrary, is usually uninjured, and is often rather improved by heat until it is melted. But as most brick buildings are trimmed with iron or stone, the damage is often considerable, even when the walls stand. To avoid this, Dr. Cutting recommends soap-stone trimmings, which are open only to the objection of expense. But although brick stands heat so well, it is objectionable, because its power to resist pressure from dampness or frost without crumbling is less than that of stone. Nevertheless, as brick is in fact only a kind of artificial stone, the search for an ideal building material is not hopeless, but it must be prosecuted rather by the maker than by the quarrier of stone.

Rendering Wood Incombustible.

At a meeting of the British Association



Frame Cottage.—Fig. 4.—Second Floor Plan.—Scale, 1-16th Inch to the Foot.

recently held at Sheffield, Col. De la Sala exhibited non-inflammable wood, shavings, &c., treated by a process invented by him, which might be employed in finishing woodwork under ordinary varnish, though the cost would be rather heavy. The inventor thus explains his peculiar method, which is already patented :

" Though all alkaline compounds reveal the property of rendering vegetable matter more or less pliable and non-inflammable, I preferably make use of carbonates of fixed alkalies in the following way : I dissolve in cold or warm clear water carbonates of potash or soda, or I make use of them in a solution of filtered water heated to the boiling point, and add hydrate of lime to this solution, graduating the strength so as not to exceed a specific gravity of 1.060 if potash is used, or 1.050 when soda is used In the first case the strength of the solution corresponds to about 30 grains of hydrate of potash to the fluid ounce, or about 20 grains of hydrate of soda to the fluid ounce. Wood to be used in naval construction, and in buildings or structures of wood on land, as well as vessels and land buildings already constructed, can be rendered fire-proof by saturating the floors and decks and all exposed woodwork with alkaline lyes, and when dry the wood may be whitewashed, painted or varnished in the usual way.

"For boards, planks or thicker pieces of timber, I graduate the time of immersion so as to form a coating of from 1-16th to ⅛ of an inch, which can be obtained in from 4 to 12 hours, according to the more or less porous nature of the wood, or the compactness of its fiber. I consider a coating of about ⅛ inch deep to be a sufficient fire protection for all kinds of timber for building purposes, as the spread of fire and great conflagrations generally orginate in relatively small causes, such as burning cinders, dropped sparks from fire-places, matches accidentally ignited, inflamed liquids, candles left burning, &c. ; but the fire-proof coating can be made deeper, or even to go through the whole timber, in the event of its being considered desirable to combine great flexibility with absolute non-inflammability. In this case I make use of hydraulic or other pressure, so as to force the alkaline lyes through the wood to the extent desired."

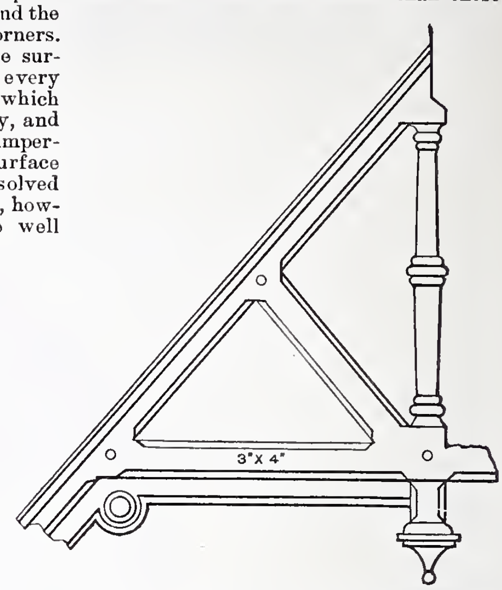
Still another process, invented by a Frenchman, claims to effect the same result. The chemical compound is said to be as follows : Sulphate of zinc, 52 pounds ; potash, 22 pounds ; alum, 44 pounds ; oxide of manganese, 22 pounds ; sulphuric acid of 60 degrees, 22 pounds ; water, 54 pounds. All of the solids are to be poured into an iron boiler containing the water at a temperature of 45° C. or 113° F. As soon as the substances are dissolved, the sulphuric acid is to be poured in little by little, until all the substances are completely saturated. For the preparation of the wood, it should be placed in a suitable apparatus, and arranged in various sizes (according to the purposes for which it is intended) on iron gratings, care being taken that there is a space of about half an inch between every two pieces of wood. The chemical compound is then pumped into the apparatus, and as soon as the vacant spaces are filled up, it is boiled for three hours. The wood is then taken out and laid on a wooden grating in the open air, to be rendered solid, after which it is fit for uses of all kinds, as ship-building, house-building, railway carriages and trucks, fence posts, wool paving—in short, for any kind of work where there is any liability to destruction.

Water Supply of Country Houses and Farms.

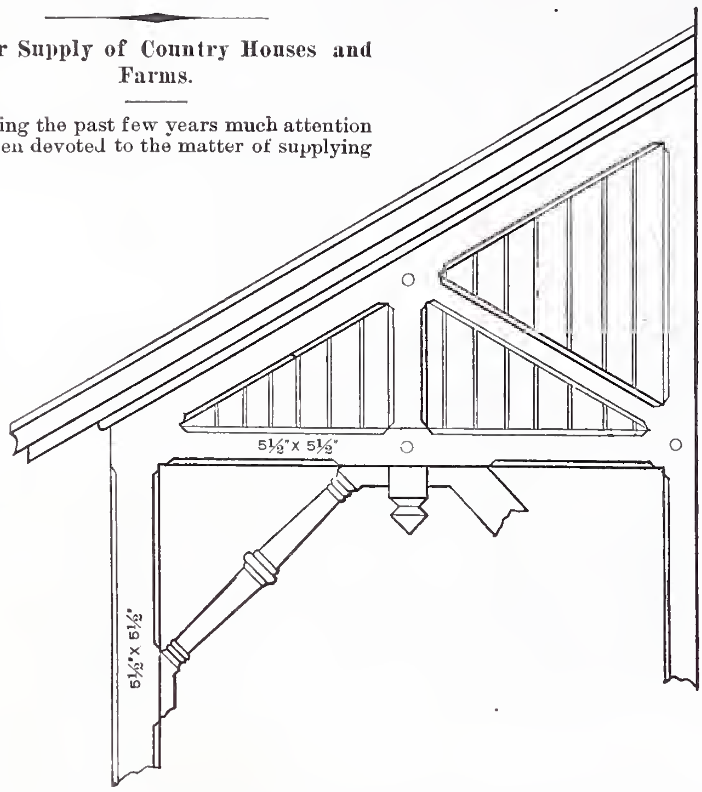
During the past few years much attention has been devoted to the matter of supplying large towns with an abundance of pure water. In some instances the water has been conducted 20 or 30 miles in order to obtain that which contains few impurities. Great attention has also been given to its distribution, so that the poor may have it in abundance and at a small cost. Numerous filters have been invented and brought into general use. Special pains have been taken to furnish pure running water, not only for horses, but for do s. In many cities costly fountains have been erected in parks and along the streets where there is the most travel, so that horses, dogs and men may at any time quench their thirst without trouble or loss of time. On most farms, however, there has been little improvement in the matter of supplying water for domestic purposes or for the use of stock. The pump has generally taken the place of the old-fashioned well-sweep and bucket, and the number of windmills for the purpose of raising water for stock has increased, particularly in the best dairy districts. Little attention, however, has been given to utilizing the water afforded by springs and streams. A large proportion of the wells on farms are in poor condition. Their walls are formed of round stones, and a space exists between the wall and the platform on which the curb rests. Through this leaves, grass, dust and small animals enter and contaminate the water. These wells are seldom cleaned out till their contents become so offensive as to attract general attention. The filth that is allowed to accumulate in farm wells that supply water, not only to stock, but to the members of the household, is too sickening for consideration. It consists of all kinds of decaying vegetable matter, including manure, as well as of animal matter in all stages of decomposition. Rabbits, rats, mice and various sorts of reptiles are not infrequently drowned in wells and remain there for many months.

The location of most wells that supply water for household purposes is most unfavorable for the purity of their contents. They are in many cases near the center of a space that has a privy, pig pen, cow yard, and the outlet of a sink spout on the several corners. There is no drain for carrying off the surplus water, saturated, as it is, with every variety of filth. The earth through which the well passes may be tenacious clay, and in that instance it may be so nearly impervious to moisture that little of the surface water, with the various substances dissolved in it, ever enters it. In many cases, however, the earth through which the well passes is sand, or largely composed of sand and gravel, which allows surface water to pass through it with the greatest readiness.

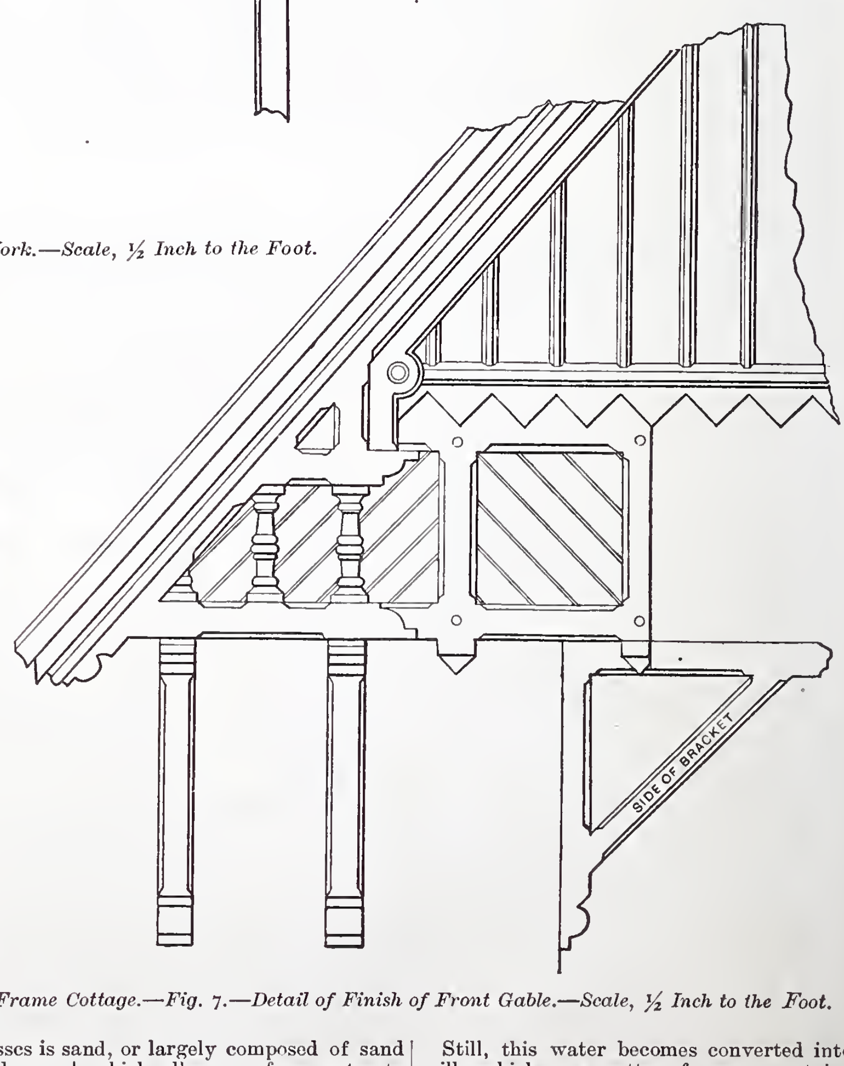
The location of wells from which water is drawn for the supply of domestic animals is infinitely worse than that of wells for furnishing water for human beings. These wells are ordinarily in some portion of the barn-yard, and are often in the center of it. On every side of them are pools of stagnant surface water, the urine of cattle, horses, hogs and sheep, and the leachings of dung hills. The walls, platforms and curbings of these wells receive less attention than those of the wells from which water is obtained for the use of the household. The well from which water is drawn for stock is rarely cleaned out till the water it furnishes becomes so vile that animals will not drink it, unless they are compelled to do so by being deprived of access to a well or stream.



Frame Cottage.—Fig. 6.—Detail of Ornament in Front Gable.—Scale, ½ Inch to the Foot.



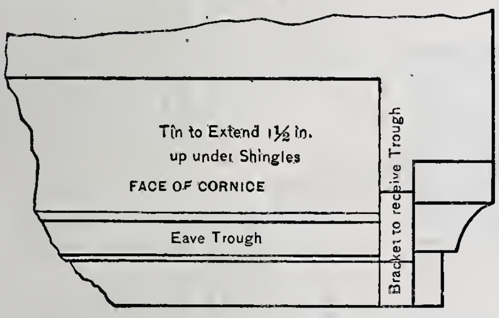
Frame Cottage.—Fig. 5.—Detail of Porch Work.—Scale, ½ Inch to the Foot.



Frame Cottage.—Fig. 7.—Detail of Finish of Front Gable.—Scale, ½ Inch to the Foot.

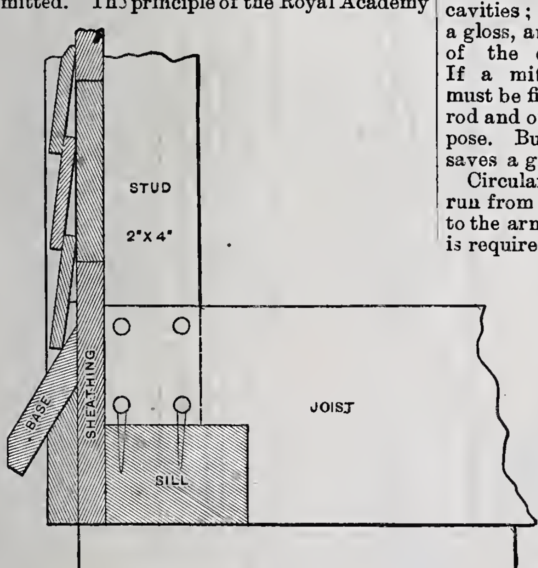
Still, this water becomes converted into milk, which, as a matter of course, contains all the impurities taken up by the cows with their drink. These impurities pass into cream and from that into butter. This being the case, it should be no marvel that most of the butter made on farms, and especially that made during the season that cows are kept in close quarters, has an unpleasant odor and flavor. The wonder is that its taste and smell do not cause it to be rejected altogether as an article of food. It is quite time that the interest in the matter of the water supply that has been recently awakened in large cities should extend to farms, from which the people of towns obtain their supply of food. Not only the people who live on farms, but those who reside in cities, are interested in the matter of pure water in the country.

American Tiles in England.—The manufacture of art tiles has always been considered a peculiarly English industry, and efforts to establish the industry here have met but little encouragement. But when American tile makers can exhibit in England and carry off the grand prize in



Frame Cottage.—Fig. 8.—Detail of Eaves.—Side Elevation.—Scale, 1½ Inches to the Foot.

competition with British makers, there is no little cause for congratulation among lovers of art. At a recent exhibition at Crewe, England, by the London, Manchester and Liverpool Agricultural Society, an award of the first prize—a gold medal—was made for the best art tile in relief and intaglio to Messrs. J. & J. G. Low, of Chelsea, Mass., who received the news of their good fortune by telegraph. Such recognition of American taste and skill cannot be rightly estimated unless it is understood how chary the English are of giving encouragement outside of their own people. It is no easy task for an American artist to get a picture into the Royal Academy, and it is almost impossible to get it in a good position when admitted. The principle of the Royal Academy



Frame Cottage.—Fig. 9.—Detail of Sill and Base.—Scale, 1½ Inches to the Foot.

is that of all English societies and men guarding their own interests. It is, therefore, remarkable that an American contributor should have carried off the prize in this competition, open as it was to the old and famous manufacturers of tile in England, while the Messrs. Low have only been producers in this special branch of pottery for the short period of 18 months.

Ornamental Plastering.

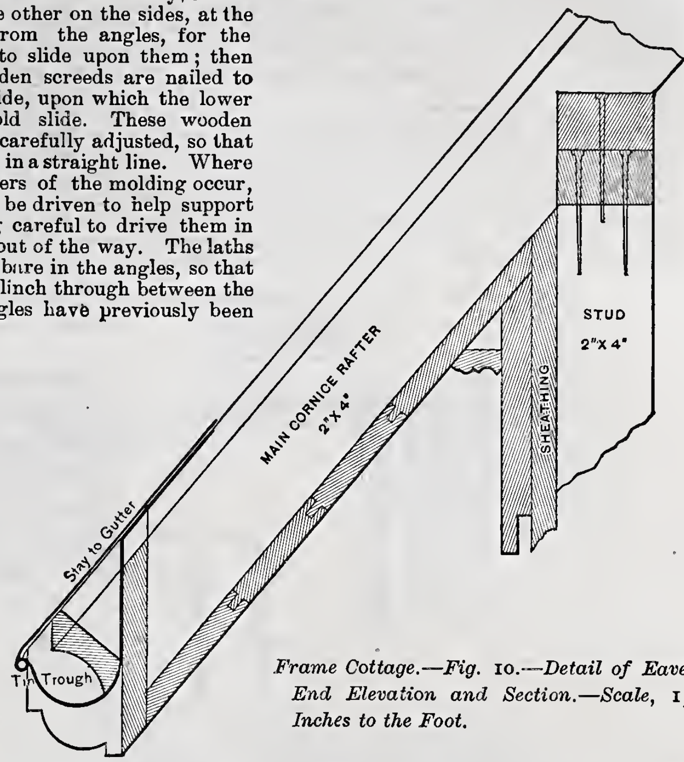
Moldings are made as follows: For cornice moldings, two plaster screeds are run with the trowel and straightened with the straight-edge and troweled smoothly, one on the ceiling and the other on the sides, at the proper distance from the angles, for the shoes of the mold to slide upon them; then thin, straight wooden screeds are nailed to the walls for a guide, upon which the lower shoes of the mold slide. These wooden screeds should be carefully adjusted, so that the mold may run in a straight line. Where very heavy members of the molding occur, rows of nails may be driven to help support the cornice, being careful to drive them in far enough to be out of the way. The laths are generally left bare in the angles, so that the molding will clinch through between the laths. If the angles have previously been plastered, cut the plastering away to the width of the molding.

Everything being ready, enough putty is gauged, with about equal parts of plaster, to run a strip of molding of convenient length, and the angle is immediately filled to about the thickness of the required molding; and then the mold is run over the piece thus prepared as quickly as possible, cutting away all the gauged stuff except the molding, and this process is repeated several times until the molding is filled out. The last time the molding should be wet with a wet brush before running the mold over it, in order to fill all small cavities; then finish with the brush to give a gloss, and then go on to the next piece of the cornice, and proceed as before. If a miter mold is not used, the miters must be filled out by hand with the mitering rod and other small tools made for that purpose. But the miter mold works easier and saves a great deal of time.

Circular and elliptic center moldings are run from a center, with the mold attached to the arm of a trammel, and only one screed is required for the mold to slide upon. Arch moldings, &c., are also put on in the same way. For a circular molding, the arm of the mold turns upon a pin or projecting gas pipe. For an elliptic molding, a trammel of the following description is generally used: Two pieces of wood are halved together, at right angles to each other; grooves are cut the whole length of each piece on the same side, so that the grooves intersect each other at the center. The length of these two cross pieces should be equal, and a little less than the short diameter of the required ellipse. The arm of the mold is similar to that used for a circle, except that it has several holes bored in it, besides the one at the opposite end from where the mold is attached. One pin is then put in the end hole, and the other in one of the other holes, close to or farther from the end pin, according as the ellipse is to be broad or narrow. These pins should just fit in the grooves in which they are to slide, one in each groove. The distance of the end pin from the mold will equal half of the long diameter, and the distance of the other pin from the mold will equal half of the short diameter.

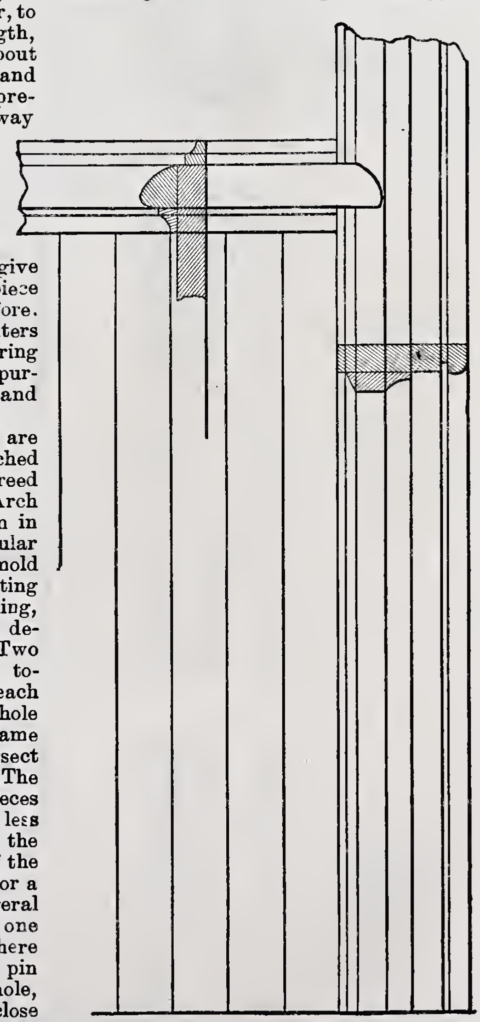
Niche moldings and panel moldings are run by screeds or trammels, as the occasion may require.

Cast centers, rosettes, brackets and other such ornaments are made in molds which



Frame Cottage.—Fig. 10.—Detail of Eaves. End Elevation and Section.—Scale, 1½ Inches to the Foot.

are put together in sections, with an orifice in which to pour the plaster, which is made thin enough with water to pour readily, no

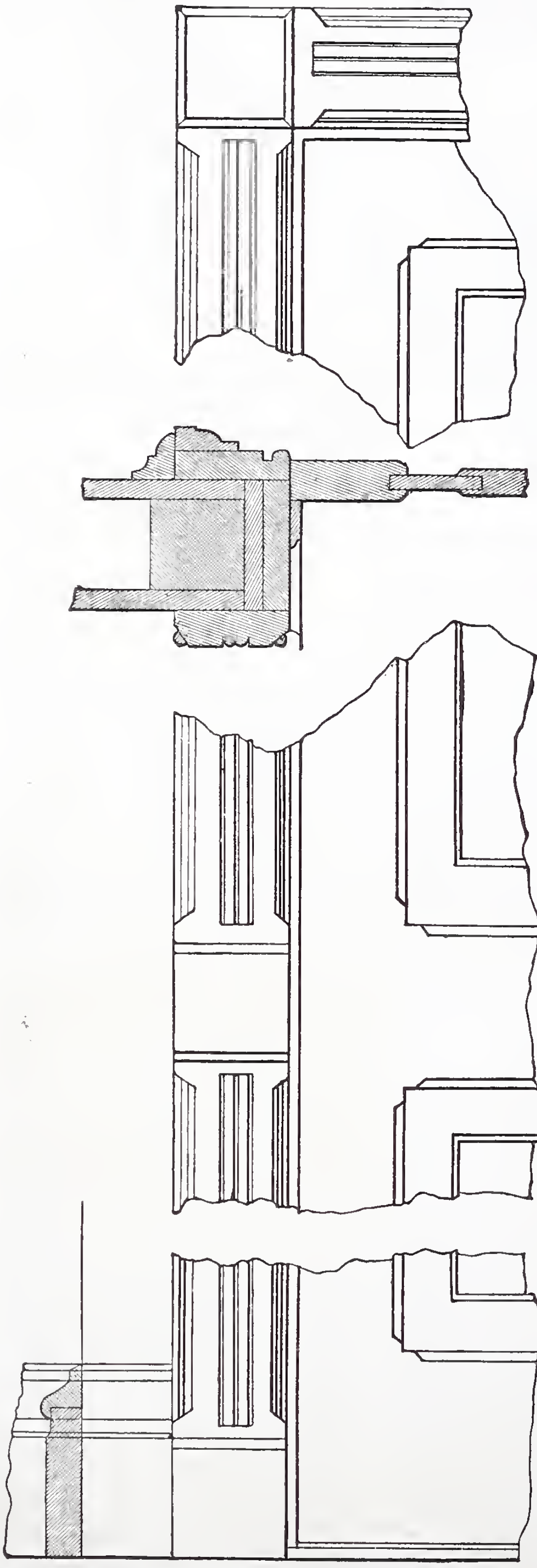


Frame Cottage.—Fig. 11.—Wainscoting and Trimming in Kitchen.—Scale, 1½ Inches to the Foot.

lime being used. *Basso relievos*, &c., are run in open molds, made all in one piece. These molds should always be oiled before using.

Most of these molds are made of plaster, hardened with glue or shellac, but molds for *basso relievos* are often made of beeswax. Plaster ornaments are fastened up in their places with fresh gauged plaster, and sometimes a few screws to help hold up the heavier ones. When screws are used they should be countersunk, and the heads should be covered with plaster, so that they will not be seen.—*From Cameron's Plasterer's Manual.*

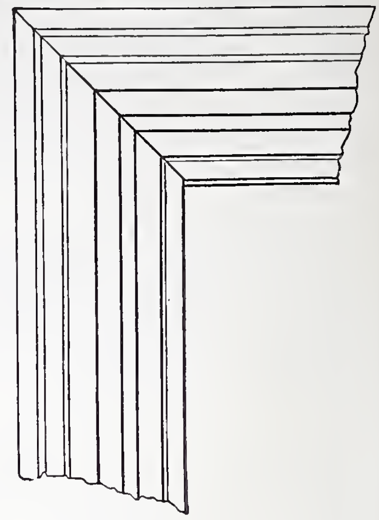
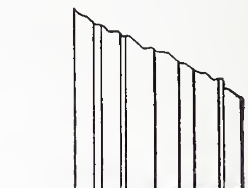
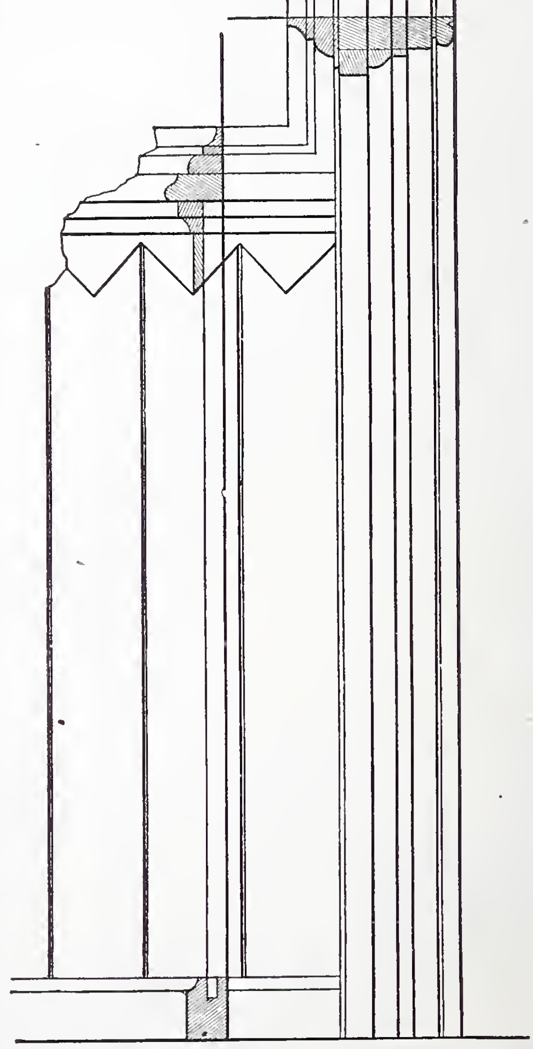
Preserving Timber in Ground.—In speaking of the well-known methods of preserving posts and wood which are partly embedded in the earth by charring and coating with tar, a well-informed writer asserts that these methods are only effective when both are applied. Should the poles only be charred without the subsequent treatment with tar, the charcoal formation on the surface would only act as an absorber of the moisture, and, if anything, only hasten the decay. By applying a coating of tar without previously charring, the tar would only form a casing about the wood, nor would it penetrate to the depth which the absorbing properties of the charcoal surface would insure. Wood that is exposed to the action of water or let into the ground should first be charred, and then, before it has entirely cooled, be treated with tar till the wood is thoroughly impregnated. The acetic acid and oils contained in the tar are evaporated by the heat, and only the rosin left behind, which penetrates the pores of the wood and forms an air-tight and waterproof envelope. It is important to impregnate the poles a little above the line of exposure, for here it is that the action of decay affects the wood first, and where the break always occurs when removed from the earth or strained in testing.



Frame Cottage.—Fig. 12.—Finish of Parlor.—Scale, 1½ Inches to the Foot.

Charcoal and Its Uses.—Charcoal laid flat while cold on a burn, will cause the pain to abate. Tainted meat surrounded with it is sweetened; strewn over heaps of decomposed pelts, or over dead animals, it prevents any unpleasant odor. Foul water is purified by it. It sweetens offensive air if placed in shallow trays around apartments. It is so porous that it absorbs and condenses gases most rapidly. One cubic inch of fresh charcoal will absorb nearly 100 cubic inches of gaseous ammonia. Charcoal forms an unrivalled poultice for malignant wounds and sores. In cases of what is called "proud flesh," it is invaluable. It hurts no texture, injures no color and is a simple and safe sweetener and disinfectant.

Waxing Floors.—The following is a recipe for waxing floors and the method of application: Stir 25 parts of shredded yellow wax into a hot solution of 12 parts of pearl-ash in soft water. Keep the mixture well stirred until effervesence ceases; remove it from the fire and stir in 12 parts of finely ground yellow ocher. Pour into cans to cool. When wanted for use, one part of it is dissolved in five parts of boiling water. Apply warm with a paint brush. It dries in a few hours, when the floor is polished with a floor brush and afterward wiped with a woolen cloth. It is said that this wax coating will last for six months with ordinary use.

Frame Cottage.—Fig. 13.—Detail of Finish in Dining Room.—Scale, 1½ Inches to the Foot.

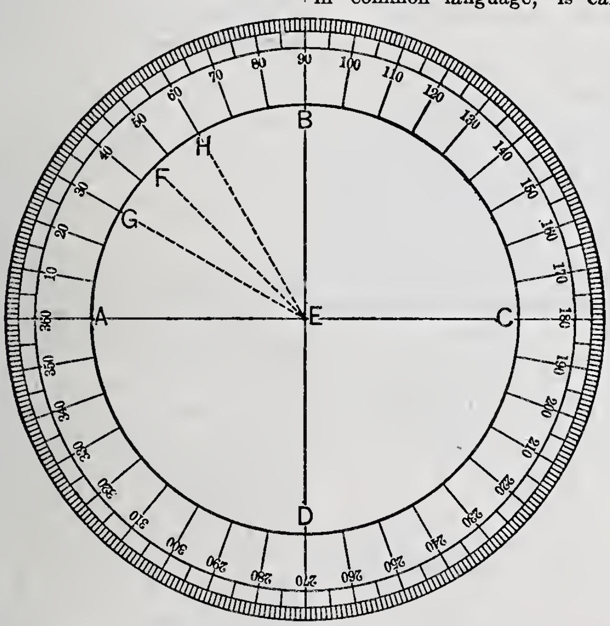
Practical Stair Building.—III.

ELEMENTS OF GEOMETRY.—CONCLUDED.

57. The circumference of a circle is considered as divided into 360 equal parts called degrees (marked °). Each degree is divided into 60 minutes (marked ′), and each minute into 60 seconds (marked ″). Thus, if the circle be large or small, the number of divisions is always the same, a degree being equal to 1-360th part of the whole circumference. The semicircle is therefore equal to 180 degrees and the quadrant to 90 degrees. In Fig. 27 is shown a circle divided in the manner we have just described. The semicircle A B C, it will be seen, contains 180 degrees, and the quadrant A E B 90 degrees.

58. An angle is measured by the arc of a circle, which may be drawn between its sides, using the vertex of the angle as a center. Thus, in Fig. 35, the angle A C B is measured by the arc D E, which is struck from the vertex E as center.

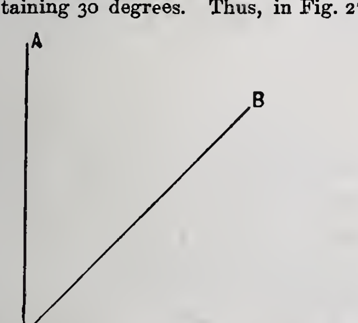
59. The radii drawn from the center of a circle to the extremities of a quadrant are always at right angles to each other. Thus E A and E B, Fig. 27, which touch the extremity of the quadrant A B, are at right angles.



Stair Building.—Fig. 27.—The Division of the Circle into Degrees.

60. If we bisect a right angle by a straight line, it divides the arc of the quadrant also into two equal parts, each being equal to an eighth of the whole circumference, or, in other words, to 45 degrees. In Fig. 27, F E bisects the right angle A E B, and the angles A E F and F E B each contain 45 degrees.

61. If a right angle is divided into three equal parts by straight lines, the arc also will be divided into three equal parts, each containing 30 degrees. Thus, in Fig. 27, G

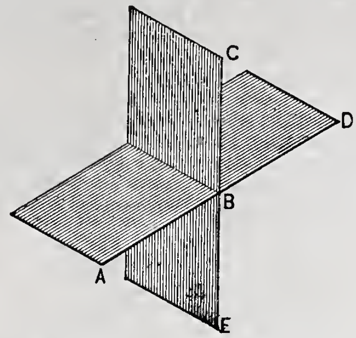


Stair Building.—Fig. 28.—A Straight Line Bisecting a Right Angle.

E and H E divide the right angle A E B into three equal parts, and therefore the angles A E G, G E H and H E B each contain 30 degrees.

62. Thus the degrees of the circle are used to measure angles, and when we speak of an angle by a number of degree, it is understood that if a circle with any length of radius be struck with one foot of the dividers in the angular point, the sides of the angle will intersect a portion of the circle equal to the number of degrees given.

63. Since a right angle is measured by an

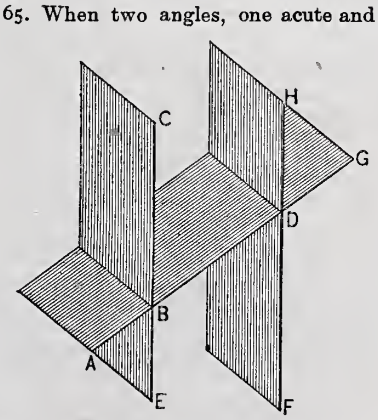


Stair Building.—Fig. 29.—Two Planes Intersecting.

arc of 90 degrees, it is frequently called an angle of 90 degrees.

64. A line which bisects a right angle is said to be drawn at an angle of 45 degrees, or, in common language, is called a square miter. Thus, in Fig. 28, the line D B divides the right angle A D C into two equal parts; therefore, the line D B is said to be drawn at an angle of 45 degrees, and is also sometimes called a square miter, or square miter line.

65. When two angles, one acute and the

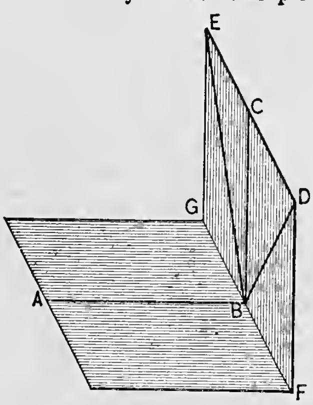


Stair Building.—Fig. 30.—Two Parallel Planes Intersected by a Third Plane.

other obtuse, are together equal to two right angles, then, as they both differ equally from a right angle—that is to say, one being as much greater than a right angle as the other is less—each may be called the inverse of the other. Thus, in Fig. 27, H E C is the inverse of the angle A E H, and by the same rule the angle A E H is the inverse of the angle H E C.

66. If two straight lines or planes intersect, the opposite angles are equal to each other. Thus, in Fig. 29, the angles A B C and D B E are equal, and the angles A B E and C B D are equal.

67. When two parallel lines or planes are intersected by another line or plane otherwise than at right angles, all the acute angles thus formed will be equal, and all the obtuse angles will be equal, and any acute angle will be the inverse of any obtuse angle. Thus, in Fig. 30, the acute angles A B E, C B D, H D G and F D B are equal, and the obtuse angles A B C, E B D, B D H and F D G are all equal, and by the above proposition any acute angle is the inverse of any obtuse angle, and also any obtuse angle is the inverse of any acute. The principles

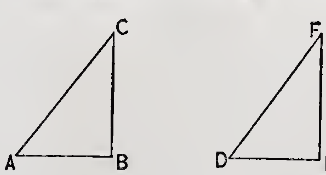


Stair Building.—Fig. 31.—The Lines in Two Planes Meeting at Right Angles.

involved in this proposition are quite important in the art of stair building, and the student will do well to investigate the relation of angles here explained in the most thorough manner.

68. If two planes meet each other at right angles, and a straight line be drawn upon one of them at right angles to the line of meeting, it will be at right angles to any straight line that may be drawn from it upon the other plane. Thus, in Fig. 31, the line A B drawn at right angles to the line of meeting between the two planes G F, is not only at right angles to the perpendicular B C, but is also at right angles to the lines B D and B E.

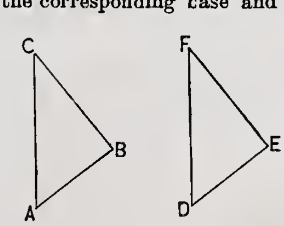
69. If the base and altitude of one right-



Stair Building.—Fig. 32.—Equal Right-Angled Triangles.

angled triangle are respectively equal to the base and altitude of another right-angled triangle, then the corresponding acute angles are equal. Thus, in Fig. 32, the right angled triangle A B C and D E F have their bases A B and D E equal, and also their altitudes B C and E F equal. Then the angle A is equal to the angle D, and the angle C is equal to the angle F.

70. If two right-angled triangles have the hypothenuse and one acute angle in each equal, the corresponding base and altitude



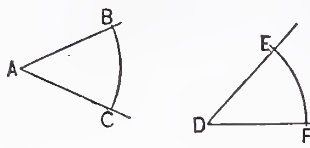
Stair Building.—Fig. 33.—Equal Right-Angled Triangles.

of each will be equal. Thus, in Fig. 33, the two right-angled triangles A B C and D E F of the two hypothenuses A C and D F are equal and the two acute angles C and F are equal. Then C B and F E will be equal and A B and D E will be equal.

71. To draw an angle equal to a given angle: In Fig. 34 let it be required on the

line D F to make an angle at D equal to the given angle A. With any convenient radius from A as center, describe the arc F E. With the compasses take the distance C B and set it off from F to E. Through E draw the line D E; then the angle at D will be equal to the angle at A.

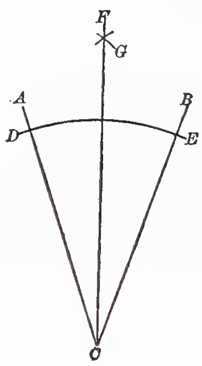
72. To divide an angle into two equal parts, let it be required to bisect the angle A



Stair Building.—Fig. 34.—To Draw an Angle Equal to a Given Angle.

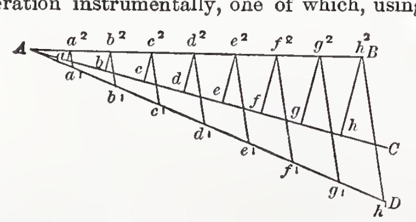
C B in Fig. 35. From C as center with any convenient radius, describe the arc D E. From the points D and E thus obtained as centers, with any radius longer than one-half of D E, describe intersecting arcs, as shown at G. Through the point of intersection thus obtained draw the line F C; then the line F C will bisect the angle A C B.

73. To divide a given straight line into any number of equal parts: In Fig. 36 let it be required to divide the line A B into eight equal parts. From one extremity of the line, as at A, draw a line, as either A C or A D, oblique to A B. Set the dividers to any convenient space and step off on the oblique line, as A C, eight divisions, as shown by the small letters *a b c d*, &c. From the last of these points, *h*, thus obtained draw a line to the end of the given line, as shown by $h\ h^2$. Parallel to this line draw other lines from



Stair Building.—Fig. 35.—To Divide a Given Angle into Two Equal Parts.

each of the points to the given line. The divisions thus obtained, indicated in the cut by $a^2\ b^2\ c^2$, &c., will be the desired spaces in the given line. By inspection it will be evident that it is immaterial, except as a matter of convenience, at what space the dividers are placed. The object of the second oblique line in the engraving is to illustrate this. Upon A C the dividers were set so as to produce spaces shorter than those required in the given line, while upon A D they are set to spaces longer than those required in the given line. By connecting the extremities, as shown by h^1 and h^2, and drawing lines from the other points parallel to this line, the same divisions are obtained in the given line A B as by the first operation. There are several methods of performing this operation instrumentally, one of which, using

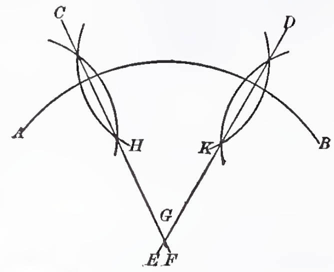


Stair Building.—Fig. 36.—To Divide a Straight Line into any Number of Equal Parts.

the square, was described by a correspondent on page 117 of the current volume, to which the reader is referred.

74. Given any arc of a circle, to find the center of the circle: In Fig. 37 let A B be the given arc, the center by which it is struck being required. With the dividers set successively at A and B, and with any convenient radius, strike arcs as shown. From points near the center of the curve, and with the same radius, strike corresponding arcs intersecting the first. Through the points of intersection thus established, draw the lines D E and C F, meeting in the point G; then G will be the center of the circle of which the arc A B is a part.

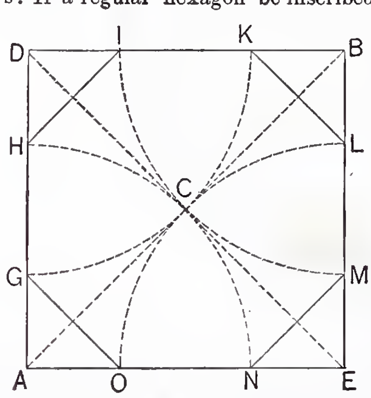
75. To draw an octagon in a given square: Let A D B E be the given square. Draw the diagonals D E and A B. With radius A C draw the arc H N, and in like manner, with equal radius, from the other three corners of the square describe arcs as shown.



Stair Building.—Fig. 37.—To Find the Center by which a Given Arc is Struck.

Join the points thus established, as shown in the engraving; the resulting figure will be the required octagon.

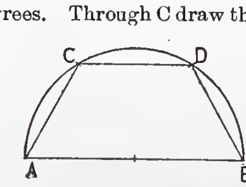
76. To draw a semi-hexagon within a semicircle: In Fig. 39 A C D B represents the given semicircle, A B being the diameter. From each end of A B set off upon the semicircle the length of the radius, as shown by the points C and D. Connect these points by straight lines, which will give the required figure. The principle upon which this problem is based may be stated as follows: If a regular hexagon be inscribed in



Stair Building.—Fig. 38.—To Draw an Octagon in a Given Square.

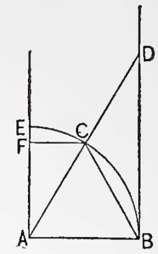
a circle, its sides will be equal to the radius of the circle; or, to state it in other words, if the radius of a circle be taken in the dividers and six spaces be stepped off around the circumference, the last point made by the dividers will coincide with the first. Since the circle is divided into 360 degrees, each of these spaces will measure one-sixth of 360 degrees, or 60 degrees.

77. To draw a right-angled triangle having its acute angles 30 degrees and 60 degrees respectively: In Fig. 40 lay off the right angle A B D, making the side A B of any desired length. From A as center, with A B as radius, describe the arc B E. From B set off B C equal to B A—that is, equal to the radius, which, by the last paragraph, we have shown to be one sixth of the circumference, or 60 degrees. Through C draw the line A D,



Stair Building.—Fig. 39.—Drawing a Semi-Hexagon in a Semicircle.

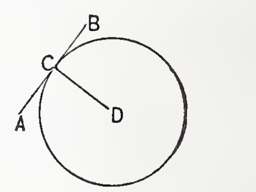
which will be the hypothenuse of the required triangle. The correctness of this rule is susceptible of easy demonstration. The angle at A must be an angle of 60 degrees, because it is measured by an arc of 60 degrees. Erect a perpendicular, A E, parallel with B D. The angle B A E is then an angle of 90 degrees. Subtract the angle B A C, which we have shown to be 60 degrees from the angle B A E, which is 90 de-



Stair Building.—Fig. 40.—Constructing a Right-Angled Triangle with Acute Angles of 30 and 60 Degrees, Respectively.

grees, and there remains 30 degrees for the angle C A E. Now, by a proposition which we have already explained, the angle B D A is equal to the angle D A E. Therefore, the angle B D A is an angle of 30 degrees.

78. To draw a line which shall be tangent to a circle at a given point: In Fig. 41 let C be the point in the circle at which a line is to be drawn tangent to the circle. From C draw the radius C D. At the extremity of the radius draw A B perpendicular to C D;

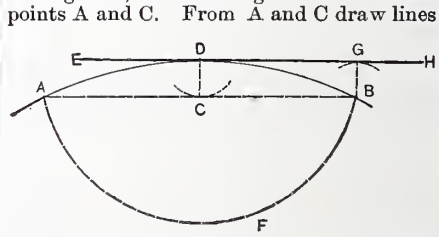


Stair Building.—Fig. 41.—Drawing a Tangent to a Circle at a Given Point.

then A B will be tangent to the circle in the point C.

79. To draw a tangent to a circle, or an arc of a circle, without having recourse to the center: In Fig. 42 let A D B be the arc of a circle to which a tangent is to be drawn. At the point D, with D as center, and with any convenient radius, describe the arc A F B, cutting the given arc in the points A and B. Join A and B as shown. From D draw a straight line perpendicular to A B, as shown by D C, and from B erect another perpendicular to A B, as shown by B G. Make B G equal to D C. Draw E H through the points D and G; then E H will be tangent to the arc in the point D.

80. Given two intersecting tangents to a circle, with the points where they touch the circle, to find the center from which may be drawn the included arc: In Fig. 43 let A B and B C be two tangents to a circle, intersecting at B, and touching the circles in the points A and C. From A and C draw lines



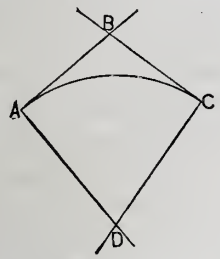
Stair Building.—Fig. 42.—Drawing a Tangent to an Arc at a Given Point without Recourse to the Center.

at right angles to the tangents and produce them until they meet in the points D; then D is the center by which the arc A C may be struck.

81. To draw a tangent to an ellipse at any given point: In Fig. 44, let A B be an ellipse, with its foci at E and F. Let C be the point in the circumference at which it is desired to draw a tangent to the ellipse. From C draw lines to the two foci, as shown by C E and C F; then bisect the angle E C F thus formed, as shown by the line C D. Through the point C draw a line at right angles to C D. The line thus drawn will be tangent to the ellipse in the point C.

82. To measure the length of an arc of a circle or to draw a straight line equal to a given arc: There are several approximate

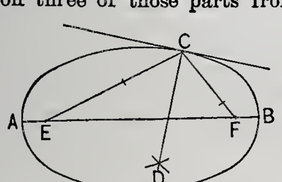
rules in common use for performing this operation, but none of them are mathematically correct. We shall call attention to only three, the employment of which is sometimes convenient, and which so closely approximate accuracy as to make them quite serviceable for ordinary purposes. In Fig. 45, let it be required to measure the length of the arc C D. Complete the semicircle A C D E B. Draw the tangent *a b* parallel with the diameter A B. With the diameter A B as radius, and from the points A and B as centers, describe the arcs A F and B F, intersecting in the point F. From F draw the lines F C and F D. Produce them until they touch the tangent line in the points



Stair Building.—Fig. 43.—Given Two Tangents and the Points at which they Touch a Circle, to Find the Center of the Circle.

c and *d*. Then, the distance *c* and *d* on the tangent line will be the length of the arc C D. In like manner, the semicircle from A to B is measured by the distance *a b*. A C is measured by *a c* and D E is measured by *d e*.

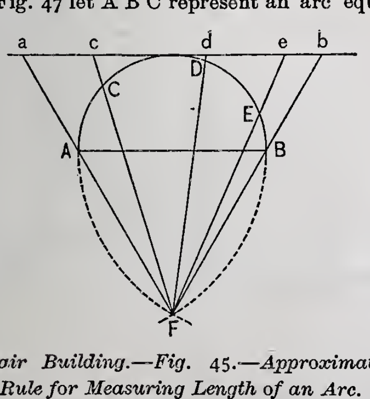
83. In Fig. 46, let A F B represent the given arc, equal to which it is desired to draw a straight line. Draw the chord A B, which bisect. From the middle point C, through the center of the circle of which the given arc is a part, draw the line J K indefinitely. Divide a radius of the circle—as, for example, D E—into four equal parts and set off three of those parts from E toward K, as indicated by the small figures in the diagram.



Stair Building.—Fig. 44.—Drawing a Tangent to an Ellipse at a Given Point.

ward K, as indicated by the small figures in the diagram. Draw the tangent G H to the arc at the point F, or where J K cuts the arc. From the point L, obtained as just explained, draw lines through the extremity of the arc, or, in other words, through the points A and B, cutting the tangent in the points G and H; then the line G H will measure the length of the arc A B. This rule, as well as all others of a similar nature, is restricted in its application to arcs which are less than a semicircle.

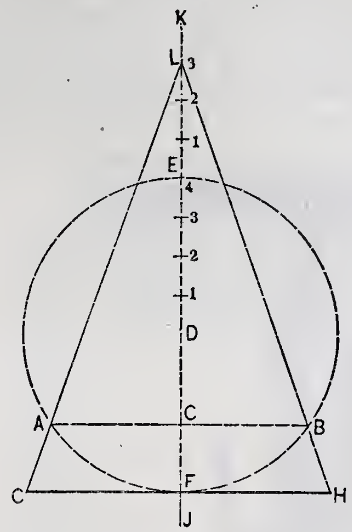
84. A third rule may be stated as follows: In Fig. 47 let A B C represent an arc equal



Stair Building.—Fig. 45.—Approximate Rule for Measuring Length of an Arc.

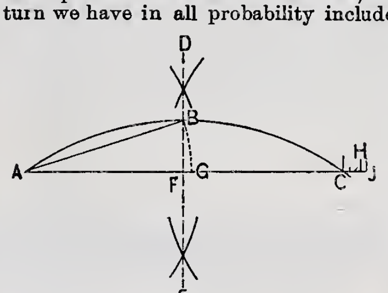
to which a straight line is to be drawn. Draw the chord A C, which bisect, as shown by D E. Draw A B, which is the chord of half the given arc. From A lay off the length A B twice on the chord A C, as indicated by A G, G H. The distance thus measured will exceed the length A C by a certain distance, shown by C H in the engraving. Divide this excess C H into three equal parts and increase the length just stepped off by the amount of one of these parts, as shown by H I; then A I will be a straight line, which in length is equal to the the arc A B C.

85. We might continue our chapter on the



Stair Building.—Fig. 46.—To Draw a Straight Line Approximately Equal to a Given Arc, Having Recourse to the Center.

elements of geometry with advantage, adding many other problems and stating many other principles which it is to the advantage of the stair builder to understand, but we have already presented enough, we think, to warrant commencing without further delay the consideration of some of the problems directly relating to the subject matter of our title. Undoubtedly we have omitted some problems which it would be very desirable to present, and which it may be necessary for us to introduce in explanation of some practical work at a later date, and in turn we have in all probability included



Stair Building.—Fig. 47.—Drawing a Straight Line Approximately Equal to a Given Arc without Having Recourse to the Center.

herewith some problems which in practical work are of exceptional occurrence, but which illustrate principles in a manner that has made it seem desirable to give them passing attention. Our next paper will commence with a description of stairs as commonly constructed.

Making Floors and Pavements.—Coal Tar Concrete.

Many of our readers are interested in the subject of making floors and pavements by the use of coal tar and sand or gravel. We have been asked on several occasions to give directions for doing this kind of work. The following paper upon the subject of making foot-walks of coal-tar concrete, &c., was read before an English association of engineers. While these walks are not as durable in this hot climate as they are in England, yet floors prepared in the same manner answer admirably, especially in cellars and other places, where they are protected from the sun. The author of the paper was Mr. E. Buckham, of Ipswich, England:

In Ipswich the mileage of footways in proportion to the population is very large, the population being 46,000, and the distance of streets and roads being about 75 miles. Of this about 22 miles are town streets, and double this distance would represent about the length of paths. Formerly, all the suburban paths, as well as the majority of those in third-rate streets, were made with gravel. These, however, were always in a defective state. To prevent mud accumulating in winter, shingle was put on the surface. This gravel in summer time was disintegrated, and laid on the surface as though it had been strewn with peas or beans. To avoid this, loamy gravel was put on. Then, again, in winter this worked up into mud, and again had to be covered with shingle, and so on alternately winter and summer. The defects gave rise to continuous complaints, and, having had experience of tar pavement in other towns, I was induced to recommend it as a substitute for gravel. My suggestion was approved by the authorities, and specimens of the pavement were laid, the first being done by contract at 1/3 (31 cents) per superficial yard and maintained in repair for five years. This was thought to be too much, and the sanitary authorities decided to make their own. I have prepared the material in different ways, sometimes using simply coal tar; at others, refined tar, and occasionally small portions of pitch, lias lime and Portland cement in the preparation of it. But in practice (although I use mainly refined tar) coal tar is all that is required, and will make as good a path as with refined tar or any other admixture. I have two ways of making tar pavements in this borough. One is with fine gravel and the other with slag, which is clinkers and refuse cinder dirt from factory furnaces. The process of making with fine gravel is simple, and is as follows: A fire is made on the ground and covered over with gravel; when this first covering is heated through, more is added from time to time, until there are about 10 or 15 tons.* For convenience in sifting over the stuff after it has been heated through, it is desirable that the fire should be of an oblong shape, presenting a form something like the mounds under which potatoes or mangolds are stored in a field. After the whole has been sufficiently heated to take out the natural moisture, it is sifted, the fine being placed in one heap and the coarse in another; when about one barrow load of each has been sifted, boiling tar is thrown upon each of them while in a hot state; the whole is then turned over with shovels and thoroughly mixed. The coarse forms the bottom layer of the path and the fine the top surface. After a path has been made about 10 days, it is dressed over the surface with boiling tar and sharp sand or ashes left from the heap of stone after burning. The sand combines with the tar and fills up the small interstices and produces a smooth surface. In making these pavements from slag it is not necessary either to heat the material or boil the tar. The material collected is turned over, so that all the large clinkers are broken into small pieces, after which the whole is sifted over to separate the large from the small, and is then mixed with cold tar (unless the weather is very cold, when it is warmed to make it mix more readily). The material made in this way is laid down in the same manner as described for gravel, but is not dressed on the surface with boiling tar and sand, being better without, but it is covered with a copious sprinkling of white Derbyshire spar, which is well rolled into the top layer to relieve the dull, somber appearance and give it a pleasing effect. In laying the paths care should be taken to roll the ground well, and bring it to a uniform surface before the bottom surface is laid on, to avoid uneven or soft places, which, if not provided against, would result in the path, after being laid down for a time, having a series of undulations on the surface. In laying, each layer should be well rolled with a roller of about 700 pounds weight. The bottom layer should be 1½ inches thick and the top one 1 inch. It is advisable to keep the prepared stuff a few weeks before

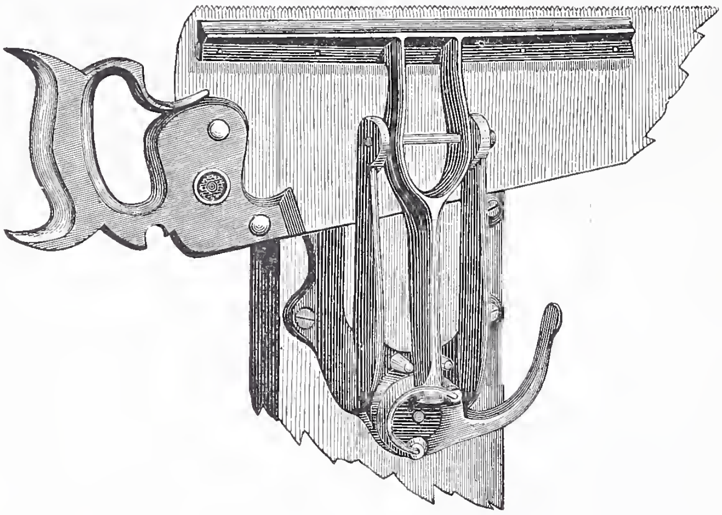
* In this country the customary way of heating the gravel is to use a light furnace made for the purpose. A large sheet-iron pan with a fire under it is sometimes employed. The pan is usually large enough to contain several barrow loads of gravel. The mixing of gravel and tar is often done in similar pans.

it is laid down, and although the work can be done in almost any season, spring and autumn are the most suitable, when it is dry and not too hot. Gravel-tar pavements require dressing over with boiling tar, and covering with sharp sand from time to time to preserve the surface, which, if not dealt with in this way, would become rough by reason of the softer material wearing from between the joints of the stones. The material does not always turn out equally well; sometimes a path will not consolidate, and at another time the surface will break up without any, so far as can be seen, apparent reason. The shingle-tar pavement costs 9d. (say, 18 cents) per superficial yard laid complete, and that made from slag 11½d. (23 cents). Preference is given here to those made of slag, but they are more costly in the first instance and less durable than those made with gravel, which can easily be understood when the nature of the material is considered; in the first instance we used gravel entirely, but from favorable reports of the Sheffield paths, from a personal examination, and from the easier mode of preparation, I was induced to adopt that plan. I believe the Sheffield paths are better than those in this town, and I have no doubt it arises from the fact that the material is of a more durable character than can be procured in Ipswich. The cost of these pavements varies according to local circumstances, being as low, in the case of Sheffield, as 7d. (14 cents) per yard, and as high in London as 2/3 (56 cents). From information obtained some time since, I found that the general price of this kind of pavements was about 1/ (25 cents) per yard, exclusive of the cost of preparing the foundation. The price I have given for Ipswich paths includes the foundations. Tar pavements are generally adopted as an improvement on gravel paths, and are not supposed to be regarded as a material to be taken in comparison with asphalte, although I think they bear favorable comparison with many of the more costly pavements, and are, in my opinion, much to be preferred to the common asphaltes prepared from pitch—to say nothing of the difference of cost—which expand and contract with variations of temperature. I have tried other materials for making cheap pavements for footways, such as bricks, earthenware tiles and Portland cement concrete, but the cost, which is about 4/6 ($1.12) per superficial yard, precludes their use for suburban paths, and their durability is not sufficient to allow them to be put in the place of York flagging for main streets. A path made from gravel and repaired in the way I have described would last, with the ordinary traffic of a provincial town, ten years. Paths laid under my direction as long since as this are still in fair condition. It is, however, difficult to say what the life of pavement would be without very careful observations, extending over a considerable period, as the duration of any paved footway is simply determinable by the amount of traffic. Having regard to the economy of first construction, reduction of dust and scavenging, and the cleanliness of the path after rain, it appears to the writer that there is no better material for suburban footways than tar pavement. It may be objected that the dull appearance and the difficulty of repairing them so as to bring the repaired part even with the old, and the disturbance of the paths caused by laying on gas and water, are against their adoption. The first objection can be avoided by using a good covering of Derbyshire spar, and the second applies more or less to any pavement, with the exception of York flagging. When I commenced to lay these paths ten years ago they were rather scarce, and had only been laid to a limited extent in a few towns, but during the past five years they have been very largely extended, and will in future occupy a permanent position among other paving materials for constructing footways in towns; this shows the suitability of the material for such footways as I have referred to in this paper. There are now about 15 miles of these paths in Ipswich, taking the place of paths which would, if they had not been superseded with this material, have still been muddy in the winter, and so rough on the surface in the summer as to make them always more or less unpleasant to walk upon, to say nothing of the indirect discomfort to the inhabitants by reason of additional dirt in winter and dust in summer. The cost of paving this length of footway with other material would have been so considerable as to have prevented the possibility of doing it, and I look upon it as a great boon to the inhabitants of any town to get such good pavements for suburban paths at such a small cost.

Note.—In this country fine, sharp sand takes the place of the Derbyshire spar. The great trouble in this country with tar pavements is that when once put down people seem to consider that they must last forever, and have no notion of repairing them. They would probably be both cheap and satisfactory if they were repaired as regularly as wooden walks are in some portions of the country.

Wentworth's Improved Saw Vise.

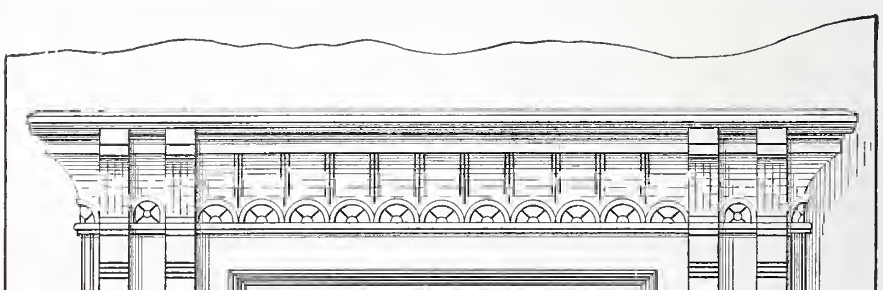
The accompanying engraving illustrates what is known to the trade as Wentworth's patent saw vise. It is constructed with a flexible rubber cushion or muffler between the jaws, which prevents any vibration during the process of filing, and, therefore, renders the operation noiseless. By its use that terrible screeching usually attendant upon saw filing is entirely overcome. The jaws of the vice are 10 inches long, and are made to open and close by simply turning a cam lever, which is shown in the engraving. This lever is so arranged that it will hold the jaws open at any position as well as fasten them shut. In use it is secured to a work bench by screws, or, instead of being attached to the bench, may be put up in any place desired. The manufacturers' agents are Messrs. C. N. Marcellus & Co., 91 Liberty street, New York.



Wentworth's Improved Saw Vise.

Designs for Interior Woodwork.

We present herewith a design for a mantel, Fig. 1, which is quite simple in its parts, very neat, and, withal, quite suitable for a great deal of work of a character which our readers are performing. The engravings so clearly represent the different parts that it is unnecessary for us to attempt a specific description. Fig. 2 represents the half frame of a pier glass, which, like the mantel just referred to, consists of simple parts, and yet in style is in keeping with the present prevailing fashions of interior finish. On account of the row of spindles at the top, we presume this would be termed by many Queen Anne style. There is very little in a name, however, and that with which our readers are most concerned is the thing itself. Fig. 3 represents an alternative design for the top of the same frame, in which the same general features are maintained, but which, after all, would give a materially different appearance to the frame, considered as a whole. For the drawings from which these engravings were made we are indebted to Messrs. Graham & Son, No. 305 and 307 East Forty-third street, New York.



Designs for Interior Woodwork.—Fig. 1.—Mantel.—Scale, ¾ Inch to the Foot.

Cary's Wardrobe Hook.

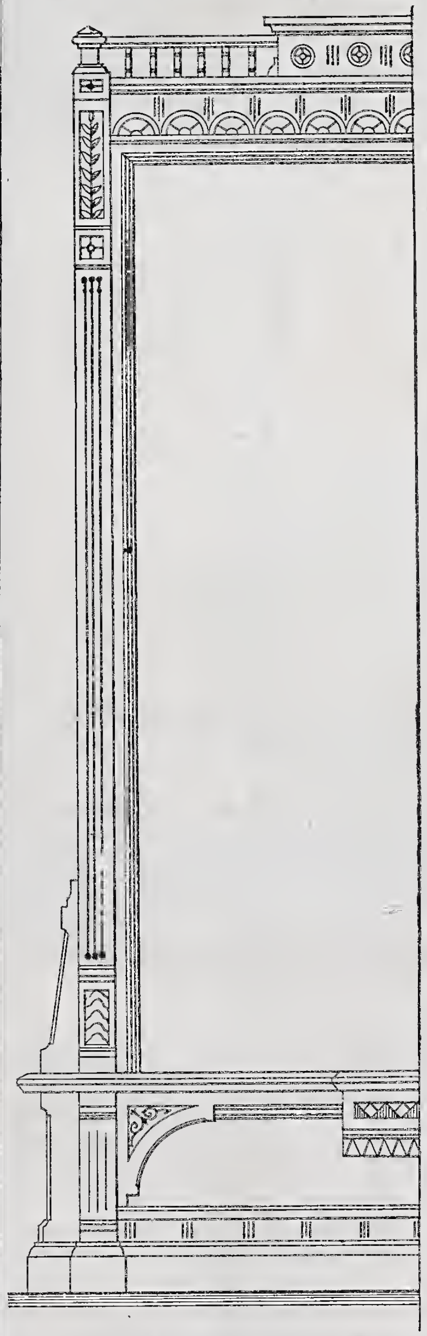
We have received a sample of an unique wardrobe hook, now being introduced by S. C. Cary, of 239 Mercer street, New York. Using familiar terms by way of description, we would say that this article consists of a spool through which a gimlet is run. The spool in shape is broad at the base, which bears against the wall or strip upon which it is placed, and tapers somewhat to the end, which comes directly under the handle of the gimlet. This end of the spool is provided with a ferrule, which is nickel-plated. The handle of the gimlet, so to speak, is of wood, and passes through a ring on the end of the shank. This wooden handle is encircled by a strip of crimped metal also plated, which gives the whole a bright and rather handsome appearance. It is evident, by the construction we have described, that this wardrobe hook may be screwed up in any place and easily removed when desired without the use of tools. It is quite as strong as any clothes hook with which we are familiar, and, as we have just said, in appearance is quite ornamental. The base of the spool presents a wide bearing, thus adapting the hook to receive more than an ordinary weight without being drawn out of shape. Various kinds of wood are used in their manufacture, thus adapting them to use in various places.

Model Tenement Houses.

The subject of tenement houses in this city has probably received more attention for the past two years than ever before, and many plans have been put forward for bettering the condition of houses of this class. A number of philanthropic men, either in their individual capacities or in the way of associations, have contributed more or less to the practical solution of the problems involved by erecting houses to some of the plans brought forward. Such efforts cannot fail to produce great good in the long run, although it may be many years before the condition of the poor—who are compelled to live in buildings of the tenement-house character—is brought up to anything like the standard of comfort and decency which is desirable. Among the co-operative efforts made in the way of erecting improved dwellings for the working classes, may be mentioned what is known as the Improved Dwelling Association. This association is about to erect a block of model tenement houses in the city, which are intended to be the most complete in their appointments of anything of the kind ever attempted. The association is composed of a number of well-known gentlemen who have grappled with this problem of furnishing cheap and comfortable houses for the working classes—more in a philanthropic spirit than in the interest of vested capital. The plans have been prepared by Messrs. Vaux & Radford, architects, of No. 71 Broadway. The contract calls for the completion of the work by the first of May next, and ground has already been broken.

The plans of the building practically comprise three blocks, whose rears overlook a large court yard which is to serve the many purposes of a spot for recreation and entrance to the dwellings—an opening through which the south winds may blow and from which an abundance of daylight may be obtained. The dwellings have been so carefully planned that there is not a single dark room in them. Every apartment will open either upon the court yard or one of the three streets upon which the block faces. The building will be six stories in hight, built of common brick, with trimmings in brick of a deep red and lustrous black. Each of the three blocks composing the building will have a frontage of about 200 feet. The depth of one will be 43 feet, and that of the other two 78 feet each. The entire area occupied will be a trifle less than one acre.

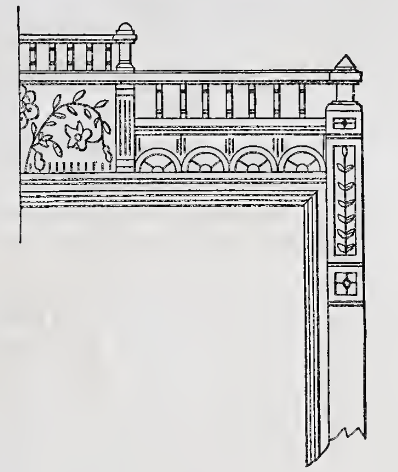
The ground floor of one of the blocks will be fitted up for 12 stores. Each of the remaining five floors will be divided into 12 tenements, giving 60 tenements for this portion of the building alone. Each tenement will comprise three living rooms, the two front rooms being 9 x 12½ feet and 6 x 15 feet respectively, and the rear room 9 x 12½ feet. A window in the rear room overlooks the court yard. In an extension back of this room are an ash chute leading to the cellar, a wash tub and sink and a water closet. A food closet and two ordinary closets are among the other accommodations. Every tenant is to be provided with a locked bin in the cellar, and, by means of a dumb waiter, can hoist his supplies to his own floor. Tenants in the upper part of the house will use the flat roof, which will be prepared for this purpose, for drying their clothes. Those occupying the lower half will use the yard for the same purpose. Water will be supplied to each tenement.



Designs for Interior Woodwork.—Fig. 2.—Pier Glass Frame.—Scale, ¾ Inch to the Foot.

Water for laundry purposes will be heated by steam. The janitor will remove the ashes from the cellar to the sidewalk, although tenants will be expected to attend themselves to the work of housing their coal and wood. The entrance to these tenements will be from the rear. The advantage derived from this arrangement is that the front rooms—the pleasantest ones of the suites—are neither broken up by the stairs nor made noisy by the continual tramping of tenants up and down.

The other two blocks are to be finished on the same general plan, but divided into tenements containing two, three and four rooms. One of these blocks is of three double houses, built on what is known as the "dumb-bell" plan. The front and rear correspond to the two spheres of a dumb bell and contain the tenements. That portion which corresponds to the handle of the dumb bell contains the fire-proof stair, the water closets, sinks, tubs, ash chutes and dumb waiters. Those portions of the house overlooking the streets will contain tenements of three and four rooms, while those parts overlooking the court yard will have only two rooms. The entrance to the court yard is to be under the control of the janitor, who will be required to exercise a close scrutiny over the exits



Designs for Interior Woodwork.—Fig. 3.—Alternative Design for Top of Pier Glass Frame.—Scale, ¾ Inch to the Foot.

and entrances to the house. He will also see that the several stairways and halls are kept clean and unobstructed by the tenants. Two reading rooms—which may, if opportunity requires, be used for meeting purposes—will be set apart in the basements.

Such is one of the solutions presented to the problem which is agitating a great many people in this city—how the laboring classes are to be provided with cheap, convenient, healthy and respectable dwellings. The practical working out of this experiment will be watched with great interest.

NEW PUBLICATIONS.

INSTRUCTIONS IN THE ART OF MODELING IN CLAY. By A. L. Vago. With an appendix on Modeling, Foliage, &c., by Benn Pitman, of Cincinnati School of Design. Cincinnati: Robert Clarke & Co. $1.

This little handbook of plastic art is one which will be welcomed by the many earnest students and amateurs who of late have been giving attention in this direction. It fills a want often expressed, and is likely to prove of great service to artisans as well as art students. Any one who has not given the matter thought will be surprised at the extent to which modeling is employed in our manufactures at the present day. Metal workers create their designs in clay or wax before commencing their patterns, and wood carvers quite generally make their studies in the way of models in clay before cutting upon the material in which the design is to be finally worked. Modeling possesses many advantages over drawing in the matter of studying designs and in originating forms.

The book gives excellent and practical ideas as to material and tools, and how an amateur should commence. The work does not pretend to instill genius, but it gives the beginner a fair start at his work and shows him in a concise form what it would take him a long time to find out for himself in the slow school of experience. Modeling in clay may even be regarded as a pastime. It is a natural art. To many it is much easier to model or carve than to draw.

Wood carving is an industry which is carried to considerable perfection among the Germans, and is fostered by the establishment of carving schools, particularly in districts where the wood used for the work—Spanish walnut, the best walnut the Germans have—is plentiful. There are now 80 such schools in Germany.

CORRESPONDENCE.

Hopper bevels and hip rafters still continue to receive attention from our correspondents. We have several other communications on these subjects, which we do not find room to print this month, but which will appear in due season. We congratulate our readers upon the fact that subjects of this general character are being discussed in our columns by practical men of more than ordinary experience and ability. *Carpentry and Building* presents from month to month, in the way of information direct from the workshop, what cannot be obtained from any book ever published. All that is printed in one number is carefully revised, and, when necessary, duly corrected in future numbers by a corps of the sharpest critics, who write, not from theoretical standpoints, but from actual experience in the matters referred to. In this way all rotten and shaky spots are removed, until there remains only sound timber with which to work.

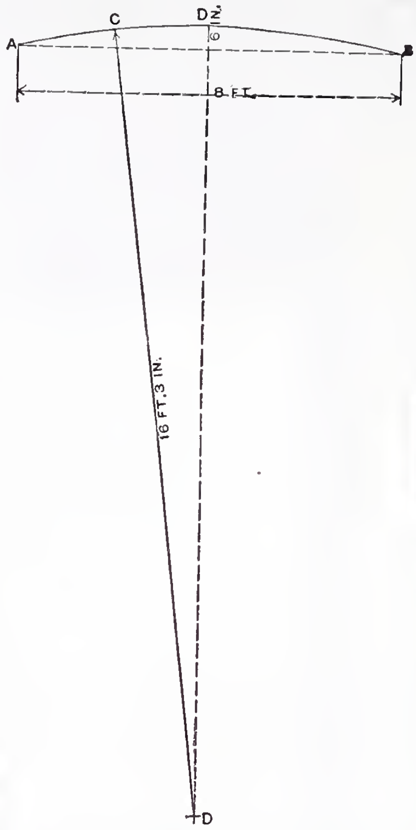
So far in the conduct of this journal we have refrained from putting any restrictions whatever upon our correspondents as to the style of their communications or the shape in which they should be prepared for our use. While we do not now intend to impose any useless conditions upon our friends, or make it needlessly difficult for those who would write us, we do desire to call attention to one or two little matters, attention to which will greatly facilitate our work, and lessen the labor of preparing the numbers for the press. It is the universal rule of printers to have copy written upon one side of the sheet only. Hence, if our correspondents, so far as possible, will send their letters to us written upon one side of the paper only they will, in many cases, save us the labor of copying their favors entire. Sketches illustrating letters should also be put upon separate pieces of paper. All drawings have to be sent to the engraver considerably in advance of the date of going to press, in order to be ready for use along with the text, but if they are in the body of the letter to which they belong, with writing on the opposite side of the sheet, it becomes necessary to copy them before they can be sent away, which frequently results in considerable delay. By care in little things of this character our friends will greatly lessen the monthly labor of preparing a number of *Carpentry and Building*.

Determining Radius of a Circle, Length of Chord and Rise Being Given.

From C. O., *Canton, Miss.*—I offer the following for the benefit of my fellow mechanics and readers of *Carpentry and Building*. It is a practical rule for finding the radius of any given arc of a circle, supposing it is necessary to cut a segment for a brick layer over which to turn an arch. He gives you the width of opening, say 8 feet, and spring of arch, 6 inches. It is not always convenient about a building in the first stages of erection to get a place for squaring and lining out the radius in the manner usually known, especially if the radius be very long. I figure it out in this way: Multiply half the width by itself ($\frac{1}{2}$ of $8 = 4 \times 4 = 16$); divide by the hight (6 inches), and it equals 32 feet; add the hight (6 inches), and we have 32 feet 6 inches, and this, divided by 2, gives 16 feet 3 inches, the hight of the radius sought. I am like your correspondent H. McG., who says he is short on algebra, but by actual experiment I know that this rule holds good. I have used it for over 20 years, and it has never failed. I have never met any one who was acquainted with it.

Note.—Our correspondent's rule is mathematically correct, as any one who understands arithmetic and the mere rudiments of algebra may see by the following demonstration (Fig. 2):

Let A B C be the given arc, A C the chord and B D the perpendicular hight from the center of the chord A C to the arc, commonly called the rise. Extend B D indefinitely, as indicated by the line D E. At some point on the extension of the line B D will be the center of the circle of which A B C is an arc. Let E represent that point. Then draw the line E C. According to the conditions stated, the triangle E D C is a right angled triangle, and E C, the hypothenuse, is equal to the line E B, for they are radii of the same circle. The chord A C being 8 feet in length, one-half of it must be 4 feet. If the length of the



Determining Radius, Length of Chord and Rise being Given.—Fig. 1.—*Rule Presented by C. O.*

line D E were given, by the application of the rule called square root the radius E C could be readily determined. Inasmuch as the length of the line E D is an unknown quantity, let x be its representative; then, as the square described on the hypothenuse of a right angled triangle is equivalent to the sum of the squares described on the two other sides, it follows that

$$x^2 + 4^2 = (\text{E C})^2.$$

Since the length of D B is 6 inches, it follows that $x + \frac{1}{2}$ foot represents the length of the line E B · but E B has already been shown to be equal to the line E C, each being a radius of the same circle; hence, if we substitute in the above equation the square of $x + \frac{1}{2}$ in place of $(\text{E C})^2$, its equivalent radius, we have

$$x^2 + 4^2 = x^2 + x + \tfrac{1}{4} \text{ foot.}$$

By cancelling x^2 from both sides of the equation and squaring 4, we obtain

$$16 = x + \tfrac{1}{4} \text{ foot.}$$

By transposition we find

$$x = 16 - \tfrac{1}{4} \text{ foot} = 15\tfrac{3}{4} \text{ feet.}$$

But, as x represents the length of the line D E, if we add $\frac{1}{2}$ foot to $15\frac{3}{4}$, we get $16\frac{1}{4}$, the length of the required radius E B.

Honor to Whom Honor is Due.

From J. E. W., *Royalton, Wis.*—I cannot understand what kind of a head a man must have not to see the point of W. B.'s diagrams illustrating the principles of hip roofs and rafters. Still, there are such men. Among them is S. F. D., of Newark Valley, who cannot see the point, and who pronounced the rules "decidedly incorrect." S. F. D. says he hardly ever backs hip rafters. That is all very well where the size of his building will admit of using 2-inch stuff for rafters.

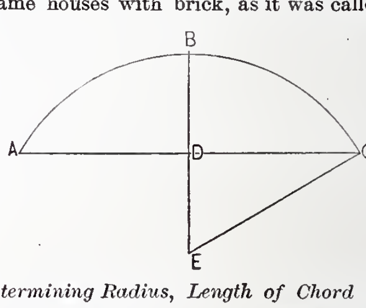
The "rough drawing" which he sends corresponds very nearly with the plan laid down in an old book I have by L. D. Gould. When correspondents copy from other authors, it seems to me that they should give them credit therefor. G. H. H., the great hip-rafter man, who called out W. B. and so many others on his way of backing rafters—which, although it possessed the merit of novelty, wouldn't work—comes in this month (August) with a very elaborate plan and description of a way to get the cuts and bevels of hip and jack rafters, copied almost exactly from "Bell's Carpentry Made Easy."

Reducing Noise.

From T. P., *New York City.*—I have seen an article going the rounds of the press credited to your paper, in which it was stated that the noise of pounding upon an anvil may be done away with by placing the anvil in sawdust. I write to ask whether a similar remedy will be effective in the following case: The partition between two houses is nothing more than two 1-inch boards nailed together. If I put up another partition, allowing a space of 1 inch between them, and pack the space with sawdust, will it effectually deaden the noise? As it now is, we can hear every word that is said in the other house, and, of course, we wish to remedy it, as it is very annoying. If the above is not a satisfactory remedy, can you recommend one that is?

Answer.—In the article to which our correspondent alludes we did not recommend sawdust, but sand, as a deadening material. An anvil mounted in a box or barrel filled with sand makes very much less noise than one set upon a block in the ordinary way. Yet there is a certain amount of noise occasioned by the stroke of the hammer upon the iron which cannot be destroyed by any amount of cushioning placed underneath the anvil. We imagine that the addition of another partition with a sawdust filling between them would not be sufficient to entirely cut off the noise between the two houses, although it would doubtless be a very great benefit. If the space could be filled with clean fine sand, the effect would probably be better still. Sand, however, is somewhat difficult to manage under such circumstances, as it is very likely, by the constant jar of the walls, to sift out through every opening. To keep it in it would be necessary to glue strips of cloth over all the cracks in the boards, or in some way to close them up tight. It will not answer to use paper, since the shrinkage of the paper when it is put on is so great that a very little shrinkage in the wood itself will cause the paper to crack along every joint.

Down East, sixty or eighty years ago, and even longer, it was quite fashionable to fill frame houses with brick, as it was called—

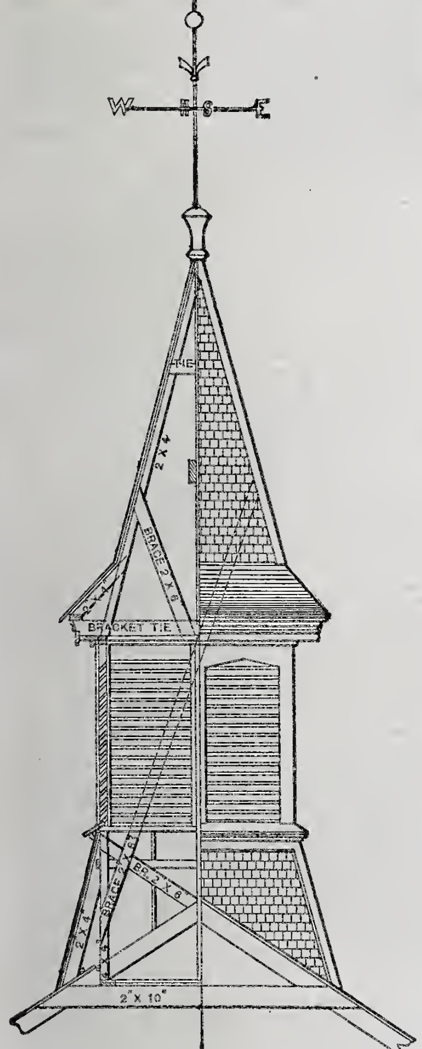


Determining Radius, Length of Chord and Rise being Given.—Fig. 2.—*Demonstration of the Correctness of the Rule.*

i. e., the space between the studding was filled up, before the lathing or boarding were put on, with brick laid in mortar and set edgewise. Our correspondent may perhaps find it cheaper to put up a wall of this sort and to plaster it, than to fill with sand or sawdust as he proposes. It must be admitted, however, that a single brick wall is a pretty fair conductor of sound, though it is not easy to hear every word that is spoken on the other side of such a wall.

A Very Simple Rule.

From D. H. J., *Danielsville, Conn.*—I have read the different articles on backing hip rafters with much pleasure, but I really think it unnecessary to make so many lines to perform the operation. I was talking with a mechanic the other day about the different methods shown in "our paper." He said: "When you write again, tell them it is the simplest thing in the world. The way we do it is this: When we have a rafter made off at the foot, we turn it over and take the square and put the corner exactly where the corner of the plate will be when the rafter is placed on the building. We then mark along the side of tongue and blade. Next, we square up from foot of rafter where the marks meet the side of rafter, and measure up on that line the same



Cupola Designs.—Fig. 1.—Sketch from H. C. L.—Scale, ⅛ Inch to the Foot.

distance that the rafter measures plumb over corner of plate. If that point is 1 inch from point of rafter, snap a line on the side of rafter 1 inch from edge, and another in the center of the top. Reduce the corners to these lines and it is done. It is unnecessary to set any bevel."

Cupola Designs.

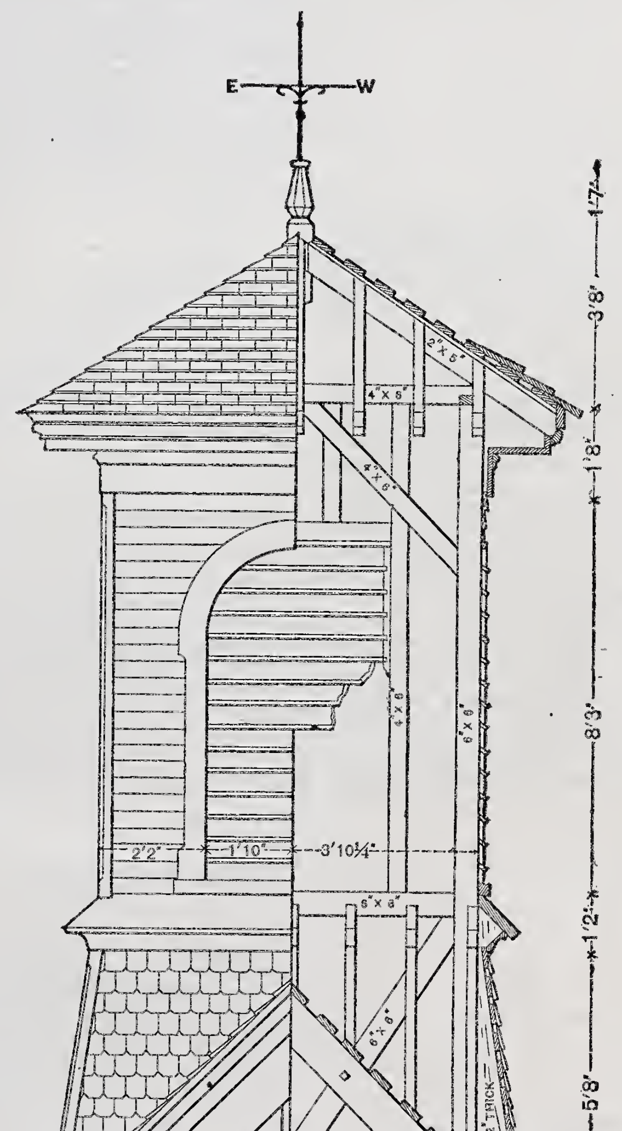
From H. C. L., *Fredonia, N. Y.*—I inclose a design for a ventilator suitable for a barn or stable, which I hope will be acceptable to your correspondents. I did not think it necessary to make any details, leaving the choice of moldings to the builder. It requires little explanation. The posts stand on sills laid on collar beams, well spiked to the rafters, and run full length to the top plate, the girt on which the cap of the lower cornice rests being cut in between the posts, of which there are eight, one at each corner and one between. The slats are ⅞ inch thick, set at an angle of 45 degrees, planed plumb on the outside, nailed between ⅞-inch jambs and set flush with the outside of the posts, the casings, which are 1⅜ inch thick, overlapping a half inch. The cap on which the first slat rests is set at an angle of 30 degrees, is 12 inches wide and 2 inches thick. The upper cornice has 8-inch plancier, 4 inch facier and 5-inch crown mold, surmounted by a 2-inch cap 6 inches wide, which also serves as a plate for the short rafters above. These are set at an angle of 45 degrees and spiked to the side of the main rafters. The lower part of the finial is of wood, and is worked around a piece of 4 x 4 scantling. This scantling extends down about 6 feet into the interior of the ventilator, and is secured at the lower end by ties spiked on each way to the rafters. Before putting it up, it should be bored for the rod of the iron finial, and have an iron band put around the top to prevent splitting when the finial is swayed by the wind. The four long braces inside extend from the rafters to near the bottom of the posts, and are spiked together where they cross each other, and also spiked to the cross ties above the plates; short braces should also be spiked on from the main rafters to the posts. The finial rod should be 1¾ inches, and have a washer shrunk on tight to set on top of wooden finish to prevent slipping down and prevent leakage. S. T. F. and C. P. B. may be somewhat alarmed at the dimensions of the cupola, but I do not think it is too large for the size of their buildings.

From A. M., *Baltimore, Md.*—In reply to your correspondents S. F. F. and C. P. R., I send inclosed a sketch of a cupola for a barn (Fig. 2). A detailed description of the design is, I think, quite unnecessary, as everything is plainly marked upon the drawing. The right half shows the construction, the outside covering being removed. The slat frame is made square at the head, the circular head being formed by outside casing.

Laying Out Blinds.

From E. H. F., *New Hampshire.*—I have had several years' experience in sash and blind construction, and previously served an apprenticeship of three years. At present I am in charge of a factory. We are in need of an apprentice, and if the writer of the letter asking questions on this subject in a recent number of the paper will come this way, I can assure him of the opportunity of learning the full trade. Before asking him to leave his country town, I will give him the information he asks, so far as it is possible to communicate it by means of the paper.

In laying out an 8 x 10 blind, square the bottom of the stile; then measure up 45½ inches. Measure up from the bottom end ⅞ of an inch for the leg, and then 2 inches for the bottom rail. Measure 2 inches down from the top end of the stile for the top rail;

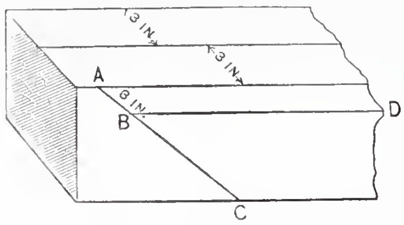


Cupola Designs.—Fig. 2.—Sketch Contributed by A. M.—Scale, ¼ Inch to the Foot.

next get the center between the two rails for the middle rail, which will be 3 inches wide. Space the distance between the rails into inch and half-inch spaces. One and one-half inches is the space that one slat will occupy. If by this division the spaces do not come out even, reduce or increase the width of rails as may be necessary. For rolling slats proceed in the same way, with one exception—measure ⅞ of an inch from each rail before dividing into 1½-inch spaces.

Backing Hip Rafters.

From GENE.—There has been a great deal written on the subject of backing hip rafters. Now, I think the simpler a rule is the better. Here is my plan: Let

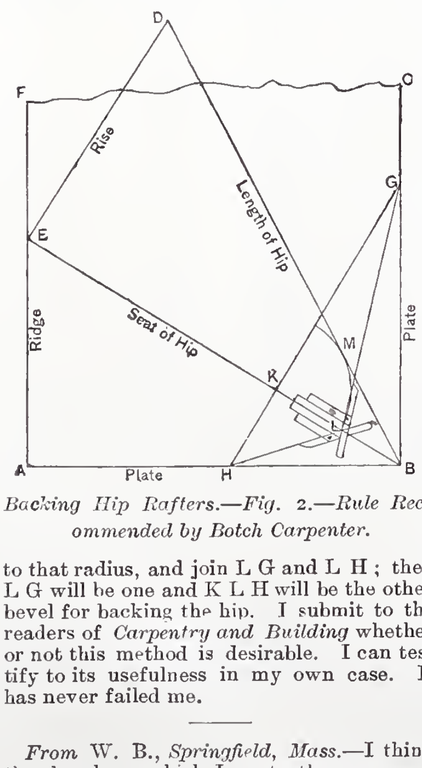


Backing Hip Rafters.—Fig. 1.—*Gene's Method.*

the inclosed sketch represent a stick 6 x 8, and the line A the foot of the rafter. Take half the face of the stick, which in this instance is 3 inches, and mark from toe of rafter 3 inches along the line A. By this you have the point from which to draw the line B. This rule is correct every time.

From BOTCH CARPENTER, *Philadelphia.*—I have carefully inspected each number of *Carpentry and Building* so far published, but up to date of writing have failed to see among all the different ways of backing hip rafters the rule I am in the habit of using; accordingly, I will send it along. The result is always correct on any angle to which it is applied, and it makes no difference whether the plates are at right angles, acute or obtuse angles.

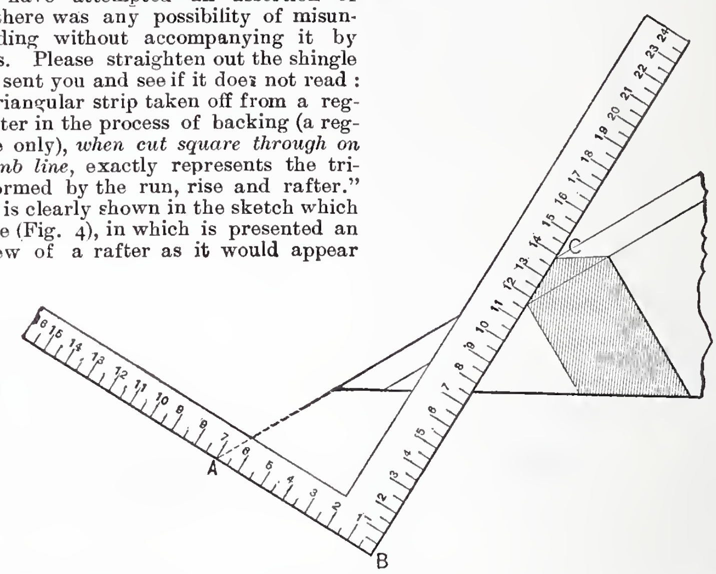
In the accompanying sketch let A B C represent the plates of a roof. Let A F represent the ridge of a roof. Let B E represent the seat of hip rafter, E D the rise of roof, and consequently D B the length of hip rafter. Draw G H at right angles to B E; then, with K as center, find the radius of a circle that will touch the line B D, as shown at M. Make K L equal



Backing Hip Rafters.—Fig. 2.—*Rule Recommended by Botch Carpenter.*

to that radius, and join L G and L H; then L G will be one and K L H will be the other bevel for backing the hip. I submit to the readers of *Carpentry and Building* whether or not this method is desirable. I can testify to its usefulness in my own case. It has never failed me.

From W. B., *Springfield, Mass.*—I think the shingle on which I wrote the communication published in the June number of *Carpentry and Building* must have got somewhat warped in transit; certainly the ideas as printed in the paper are warped, or at least fail to express what I intended to say. Some five or six lines of my letter, appearing near the top of the second column of page 118, seem to contradict everything I had previously asserted. I did not read the article when the paper first arrived, as I had found that it always reported me correctly heretofore, but one of the boys in the shop came to me to-day with paper in hand and asked me to explain to him what appeared to be a contradiction. His interpretation of the paragraph in question was that the angles of the strip taken off in backing and the angle of the run, rise and rafter were exactly the same, and that by returning the rise on the rafter the backing would be given. Of course, that could not have been my meaning, as may be plainly seen by the former part of the letter. I ought not to have attempted an assertion of which there was any possibility of misunderstanding without accompanying it by sketches. Please straighten out the shingle which I sent you and see if it does not read: "The triangular strip taken off from a regular rafter in the process of backing (a regular one only), *when cut square through on the plumb line*, exactly represents the triangle formed by the run, rise and rafter." All this is clearly shown in the sketch which I inclose (Fig. 4), in which is presented an end view of a rafter as it would appear when cut on a plumb line. The triangle E G F on the end of the rafter, it will be seen, is equal to the triangle A C B at the foot of the rafter. My design was to show that the backing could also be obtained by taking the triangle formed by the run, rise and rafter and properly placing it on the upper end of the rafter. Also, to show the manner of producing the same results by taking the length of the rafter and its rise on the square. This is accomplished as fully illustrated in the second sketch which I inclose (Fig. 3).

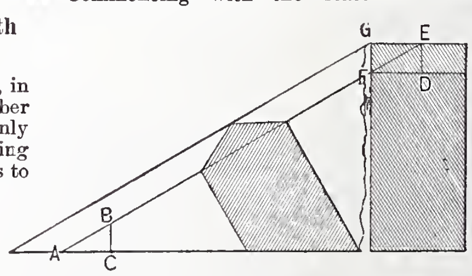


Backing Hip Rafters.—Fig. 3.—*W. B. Further Elucidates the Method of Placing the Square.*

Difference in the Bearing Strength of Woods.

From F. E. KIDDER.—Mr. G. M. Alves, in a communication in the September number of this paper, seems to advocate using only one constant for determining the bearing strength of wooden beams, and endeavors to show that the method advocated by the writer in a communication under the above head, in the July number, is not a practical one. He argues that as the difference in the strength of two pieces of wood of the same kind is so great, and as the values for the strength of the different woods given by the authorities vary so greatly, the only practical method of calculating the strength of a beam is to use some safe number that will apply for all woods. Now, it must be evident to all that if only one constant is used, we should have to take that for the weakest wood, for if we took an average value it would be too large for some woods; and hence, if we calculated all beams by the strength of the weakest woods, we should have more material than was needed in beams of the stronger woods. About what the difference in the strength of hemlock, white pine, yellow pine and spruce beams really is, was shown in the writer's communication in the July number. As to the reliability of the table given, the writer is well aware that there is a great difference in the values for the transverse strength of woods given by different authorities, but he has carefully examined every table given by any good authority that he could find, and from a large number of such tables he has compiled a table giving the average value for each wood; and this table—a part of which was given in the July number—he believes to be as correct as our present knowledge of the strength of woods will permit. Mr. Alves speaks of the great difference in the values given for the strength of yellow pine and hemlock. The value for hemlock is about the same as that given by Mr. Trautwine and the late Mr. R. G. Hatfield. The value given for yellow pine, the writer is well aware, seems very large, but he believes that, owing to lack of experiments on the strength of this wood, its bearing strength has been very greatly undervalued. The value given in the table was obtained from experiments made by the writer, and of which a report was given in *Van Nostrand's Engineering Magazine* for February, 1880. This value is about 3000 pounds less than one obtained by Prof. Thurston from experiments made at the Stevens Institute of Technology. It is also true that the strength of pieces of the same kind often varies greatly, but the writer believes with Prof. R. H. Thurston that the best and most accurate method is to obtain the strength of a perfect piece of each kind of material, and using this as a basis in our calculations, adopt such a factor of safety as shall make due allowance for the quality of the material used.

Commencing with the statement that



Backing Hip Rafters.—Fig. 4.—*W. B. shows that the Triangles E G F and A C B are Equal.*

"Mr. Kidder's method of finding the transverse strength from the ultimate or tensile strength is founded upon an erroneous statement," Mr. Alves proceeds at considerable length to show the falsity of a hypothesis which the writer never advocated, and which he would no sooner have advanced than he would the hypothesis that the sun revolves around the earth.

Mr. Alves has made a mistake in the meaning of the term "modulus of rupture," as used by the writer. This modulus is the one used by Prof. Rankine, and is the modulus of rupture by transverse strain, and has no more to do with the ultimate tensile strength than has the quantity denoting the transverse strength of one unit of the material. Mr. Alves' mistake seems rather odd, as the words "tensile" or "tension" are not contained in the writer's previous communication. Of the modulus of rupture spoken of, Prof. Rankine says, on page 252 of his treatise on "Civil Engineering," that it "does not always agree with the resistance of the same material to direct crushing or tearing, but has a special value which can be found by experiments on cross breaking only." On the same page he gives the formula $M_0 = n f b h^2$, where f represents the modulus of rupture. Substituting the values of M_0 and n for a rectangular-shaped beam loaded at the center, and solving for f, we have modulus of rupture $= \frac{18 W L}{b h^2}$, where W = load in pounds; L, span in feet; b, the breadth of beam; and h, the depth. Then from this formula we see that the modulus of rupture for a rectangular beam, supported at both ends and loaded at the middle, is 18 times the breaking weight of a beam 1 inch square, loaded at the center and having a span of 1 foot.

For wooden beams alone it would probably be better not to use the modulus of rupture, but to simply use the breaking weight of a unit of the material. But in treating of irregular-shaped iron beams, it is often more convenient to use the modulus of rupture.

In justice to Mr. Alves, I would say that some writers use not only a modulus of rupture by transverse strain, but also moduli of rupture by tension, compression and shearing, and this was probably what led him to make his mistake.

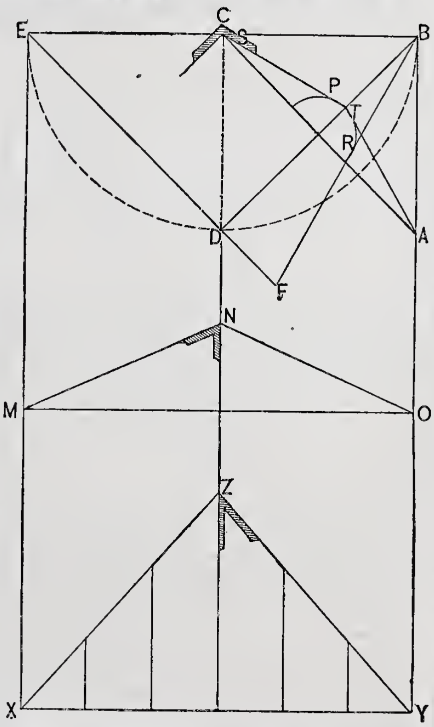
Experience of a Philadelphia Apprentice.

From T. L. S., *Bacam Castle, Va.*—A letter published in the August number of *Carpentry and Building* reminds me very much of my own case. Some five or six years ago I completed my time in Philadelphia. During my apprenticeship I had learned scarcely anything but how to do the woodwork of a brick house. By accident I settled in Virginia among pine timber and sawmills. Not being qualified for anything else, I naturally concluded to go to work at my trade, but I found many difficulties in my way. I was like the correspondent who describes himself away from the reach of planing mills, molding machinery, &c. In my case there were no planing mills nearer than Norfolk and Richmond. I was about half way between these two points and without direct communication with either. Consequently, I had all my timber to work by hand, and many of my sash and doors to make by hand. I worked on and learned what I could from the other men, but they told me nothing which they could avoid. I subscribed for such building journals as were within my reach and bought several works on architecture, but none of them proved of any great benefit. I soon learned to frame, however, and in time began to make progress. If I do say it myself, it is a fact that there is not a house of any importance now put up within 20 miles of this point of which I do not draw the plan or else build it outright. If I could have had the advantage of *Carpentry and Building* a few years ago it would have saved me many hours of hard study—time devoted to study as a necessity which should have been devoted to rest. In closing allow me to convey my regards to "Wood Butcher." I would like to take him by the hand and thank him for his efforts to make the paper useful. You will probably have to run this communication through the planing machine in order to smooth it. Writing and spelling are not my forte.

Oil Stones and Saw Filing.

From W. G. S., *Chattanooga, Tenn.*—I have now been reading our paper for some 18 months with both pleasure and profit. Some time since I sent a communication touching upon a variety of topics, all of which were duly noticed. Two things were spoken of in that communication which have not received the attention from correspondents, it seems to me, that their merit deserves. I refer to filing and setting saws and the use of different oils on oil stones. These topics, indeed, have received only passing notice. Experience and observation have taught me that a moderately thick oil stone, set in the box on edge, will give the best satisfaction, as it will wear truer and not get hollow in the center from edge to edge like those that are laid flat. I advise always to wipe the stone after using it. This plan will consume more oil, but it will pay, nevertheless. Never leave an oil stone dirty over night. The oil sets into the pores and forms a gum which destroys the coating qualities. The Washita or Arkansas stones are the best. Turkish oil stones, I am informed, are not at present imported on account of their inferiority in comparison with those of our own country.

I believe the best way to file saws is to file toward the handle. Henry Disston said that saws for different kinds of work require the teeth filed to different shapes; that generally there is not enough space for the dust between the teeth; that a saw, to cut fast, must have deep teeth. Experience has proved to me that a saw can be too coarse—that a fine saw cuts faster and cleaner, proportionately, than a coarse saw. I would never buy a cross-cut or rip saw with more than seven points or teeth to the inch, and a cross-cut is better with eight than seven. With regard to saw sets, I believe Henry Disston is the only man who has ever employed the correct principle in their construction, viz.: The use of a different punch or slot, as the case may be, for the different sizes of teeth. In other words, the gauge of the set should be made to conform to the gauge of the teeth. There is no mechanic who will not admit that a set suitable for a 14 point saw is not equally well adapted to a five-point saw, and *vice versa*. I believe that nine-tenths of the saw sets made are worthless for the purpose.



O. M.'s Method of Laying Out a Hip Roof.

Laying Out Hip Roofs.

From O. M., *Espyville, Pa.*—I will undertake to give you my rule for laying out hip rafters. Let B E X Y represent the ends of a regular roof, having a ridge, D Z, in the center. Make D C on the plan equal to half the width E B; then the angle B C D will be a right angle. Draw any line, as A C, at right angles to D B from D. Set off the hight of the roof, as D F, and draw F B, which will be the length of the hip rafter. Put one foot of the compasses in the center of the line A C, and with the other describe a semicircle, touching the line F B in the point R. In other words, the semicircle to be drawn is of such a radius as will make it tangent to the line F B in the point R. From the point T, at which the semicircle cuts the line D B, draw T A and T C, which will give the form of what is generally termed the backing of the hip rafter.

To find the length of the jack rafters and their bevels to fit the hip rafters, make the hip Q X and Z Y equal to the hip line B F, and square up the jack rafters, as seen in the plan, until they meet the hip, which operation will give the length of each jack rafter for the ends and also for the sides of the roof. It will be readily perceived that the bevel S is the side bevel of the jack rafters, and also the bevel to miter the upper ends of the truss. The bevel N, which is the down bevel of the common rafters, will also be the down bevel of the jack rafters at the hips. I trust this rule will be of interest to some of the readers of *Carpentry and Building*. If there are any easier rules for framing hip roofs I shall be glad to see them.

Leaning Chimneys.

From C. H. R., *Middletown, N. J.*—I desire to say a word upon the subject of leaning chimneys—not about the cause, but to describe what I notice in this neighborhood. On a blacksmith's shop near me there are two chimneys that have been built some 40 years. In size they are about 16 x 20 inches and are 7 feet high. They are upon a roof which faces the south, and lean about 6 inches to the east. On another building situated across the street from the first is a chimney 12 x 24 inches in size and 4 feet high, which leans, I should think, at least 3 inches to the east, and is bulged out on the west side. This chimney has been built only about four years. On a house which is nearly 150 years old there is a chimney 28 x 36 inches in size, projecting 10 feet above the roof, that leans both to the south and east. Whether the chimney is as old as the house or not I am not able to say. On other houses equally exposed the chimneys stand straight. I have often wondered what made the chimneys lean, but have never met any one who was able to explain.

From T. J. D., *Providence, R. I.*—The question with regard to leaning chimneys in New York, raised by your correspondent S. A., I think may be answered as follows: The heat of the sun on the south side all day causes the bricks so heated to expand, while the bricks on the north side, being comparatively cool, remain in their natural condition. By this means the chimney is drawn out of plumb. The bricks, when cooled, come back again to their original size, but the joints which have been loosened by the expansion do not again assume their proper condition. This process, repeated day after day, soon renders the chimneys so crooked that the bend becomes visible. This fact has long been noticed in our city on the tower of a large church, the material used in the construction of which is sandstone. When under the rays of a hot sun the tower leans to the north. Its inclination is so great that it was first noticed by workmen while making some repairs.

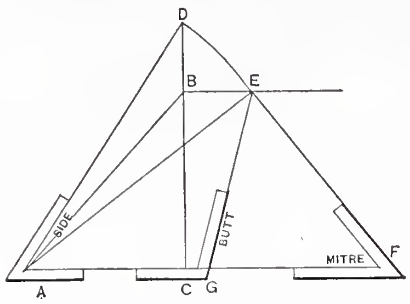
Dressing the Points of Drafting Pens.

From BOTCH CARPENTER, *Philadelphia.*—I would like to know if drafting pens can be sharpened after they are worn, in such a manner as to make them capable of drawing a very fine line.

Answer.—The ability to sharpen a drafting pen and put it in complete order depends, in some measure, upon the skill and experience of the draftsman and the previous condition of the pen. If the pen has been worn too much, it would be much better to throw it aside and procure a new one. If it has not been worn or rusted to any very considerable extent, it may be easily sharpened as follows: In the first place, screw the blades up into contact and pass along the surface of an oil stone, turning upon the point in a directly perpendicular plane until the two plates acquire an identical profile. Next, unscrew the blades and examine them, in order to ascertain the parts of unequal thickness around the nib; then the blades are to be laid separately upon their backs on the stone and rubbed down at the points until they are brought up to an edge of uniform fineness. At this stage it is advisable to screw them together again and pass them once or twice more over the stone, in order to bring up any fault. After this they may be also touched on the outer and inner si le to remove barbs or feather edge. Careful inspection of the instrument during this process, and the exercise of careful judgment, will enable any one to put a pair of drafting pens in good condition, provided, as we said above, they are not too badly rusted or worn out.

Hopper Bevels.

From W. H. C., *Orrillia, Ont.*—I submit to the readers of *Carpentry and Building* what I consider an excellent rule for hopper bevels. There have been published a great

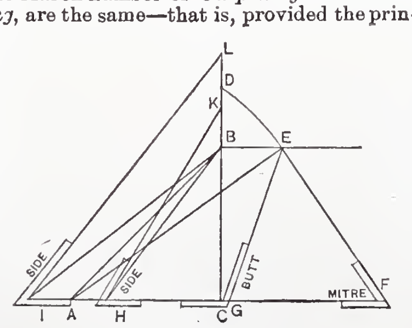


Hopper Bevels.—Fig. 1.—*W. H. C.'s Rule Applied to Hoppers all Sides of which Flare Equally.*

many rules for work of this kind, but none for hoppers having sides of different flares. Fig. 1 of the inclosed sketches shows the rule applied to a hopper, all sides of which flare equally. Let A B C be a right-angled triangle, A B being the intended flare of the hopper. Make C D equal to A B and draw B E square to C B. From A as center, with A D as radius, describe the arc D E, intersecting B E in the point E. Connect A E. Draw E F square to A E, and bisect A F in G. Connect E G; then the bevels at A G and F are respectively side, butt and miter bevels. The butt and miter bevels are applied with the stock of bevel square to raking cut of side bevel and in each edge of board. In Fig. 2, I B and H B are the angles of flares to sides. To get the side bevels, make C K equal to A B and C L equal to I B. Join K H and I L. For the side bevels bisect the angle between the two flares H B and I B by the line A B, and proceed to get the butt and miter bevels as in Fig. 1. A being a straight edge of a board, affords a ready means of se ting the bevels.

For proof of the correctness of these rules proceed with A B as a common rafter, and find jack-rafter miter, which should equal side bevel A; then get backing of hip rafter, which should equal butt bevel G. Bisect backing bevel, which should equal miter bevel F.

From A. M., *Baltimore.*—The readers of *Carpentry and Building* are called upon to apply the proper brand to T. S. V.'s rule for finding the bevels for a square hopper. I, to use the language of "Wood Butcher," brand it "sound," which assertion I think I can prove, by showing that the results obtained by T. S. V.'s method, and that laid down in the March number of *Carpentry and Building*, are the same—that is, provided the prin-

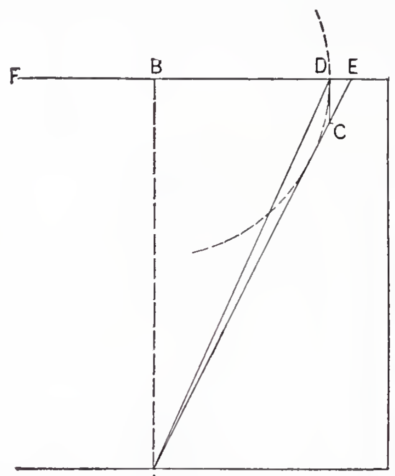


Hopper Bevels.—Fig. 2.—*W. H. C.'s Rule Applied to Hoppers in which the Ends and Sides Have Different Flares.*

ciples employed in the demonstration of that problem are carried out right—or, in other words, after the "shaky" places are cut out, for it certainly is "shaky." I allude to the method used for obtaining the bevels for the butt and miter joints.

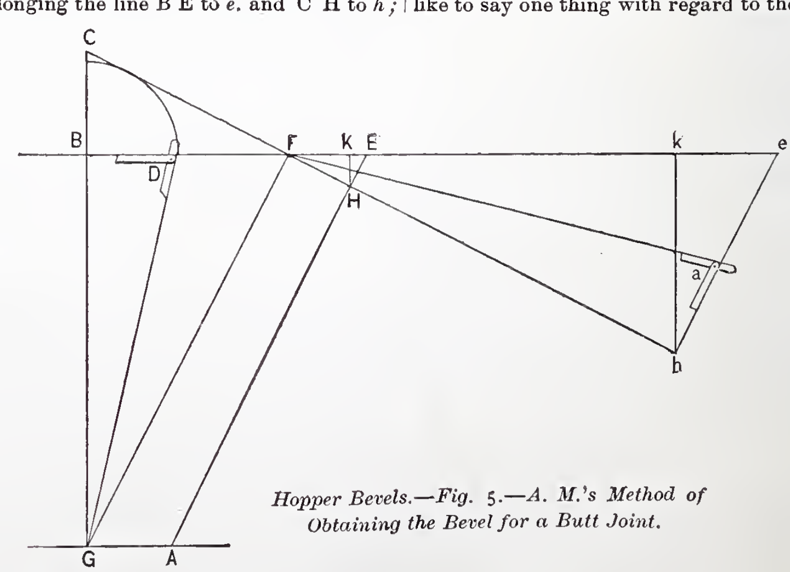
On examination of Fig. 4, page 57, it will be seen that the line A D, which corresponds to the line A D of Fig. 3, is used as a means for producing those bevels. Cut that line out, boys, and throw it aside for it is "shaky," and instead use the line A E. And now, having "sound" timber to work with, I will proceed to show that the bevels obtained by the two methods are the same at each step of the demonstration.

Having obtained the point D, Fig. 3, as explained by method in March number, the same point is found by T. S. V.'s method, by using B as a center, describing an arc touching the line A E and cutting the line F E in D. By connecting A and D we have the bevel of the face joint. The next step is to find the butt joint, which is as follows by the method in the March number—that is, using "sound" timber: Parallel to the line A E, Fig. 5, which corresponds to A E, Fig. 3, draw the line F G, making the distance between A E and F G, measured at right angles to A E, equal to the thickness of the stuff. From F, at right angles to F G, draw F H from the point H square up, thus obtaining the point K; then the distance K E shows how much the butt joint is from a square cut. Now, T. S. V.'s method of find-



Hopper Bevels.—Fig. 3.—*A. M.'s Amendment to the Rule for Obtaining the Bevels for Joints.*

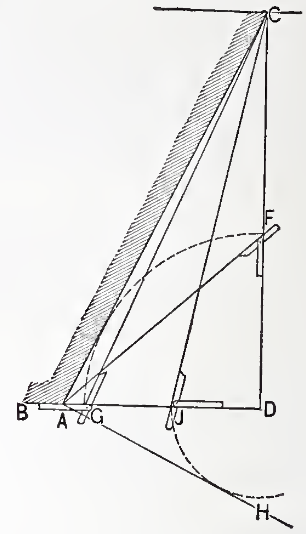
ing the butt joint is at right angles to F G. Draw F C, and with the point of the dividers in B, describe an arc touching the line C F and cutting B F at D. Connecting D and G gives the bevel of the butt joint. To prove that the results of the two operations are the same, and to make that proof clearer, construct a larger triangle similar to F H E, by prolonging the line B E to *e*. and C H to *h*;



Hopper Bevels.—Fig. 5.—*A. M.'s Method of Obtaining the Bevel for a Butt Joint.*

at right angles to *h* draw *h e*; then we have a triangle F *h e*. Similar to the triangle F H E draw *h k*, which corresponds to H K. Now, as K E represents how much the butt joint is from being a square cut, so will *k e* on the larger scale represent the same thing; therefore, taking F *h* as a square cut, and setting off *h a* equal to *k e*, and connecting

F *a*, we have the bevel of the butt joint at *a*, which is the same bevel as that at D. On examining closely and inverting the figure used by T. S. V. in his method, I found that it was the same principle as used by me for producing the bevels for a square hopper, except that I do not use so many lines for producing the same number of cuts as he does. My method is shown in Fig. 4. A C represents the plan of the hopper. Prolong A B to D; then with D as a center, describe an



Hopper Bevels.—Fig. 4.—*A. M.'s Rule for the Bevels in a Hopper.*

arc touching A C, and cutting D C in F and A D in G. Connect E G, and the bevel at G is the bevel of the face joint. Connect A and F, and the bevel at F is the bevel of the miter joint. To get the bevel for the cut of the butt joint proceed as follows: At right angles to A E draw A H; then from D as a center, describe an arc touching A H and cutting A D in J; connect E and J, and the bevel at J will be the bevel of the butt joint.

Time of Publication.

From E. A. C. D., *Hudson, N. Y.*—Will you please state in the next number of *Carpentry and Building* on what day of the week and what week of the month the paper is issued?

Answer.—*Carpentry and Building* is mailed to subscribers du ing the last week of the month preceding the month for which it is issued.

Proportions of Doors.

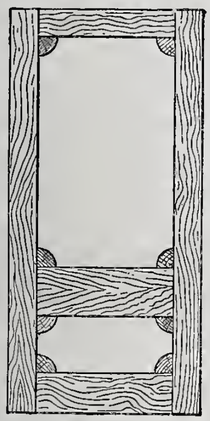
From G. W. B., *Chatham, N. J.*—I would like to say one thing with regard to the proportion of doors as given by G. W. C., of Yolo Yolo, Cal. He says that for front doors for 10 foot ceiling he uses 28 x 68 inches, or, in other words, 2 feet 4 inches by 5 feet 8 inches. Further, he says that for inside doors he employs 26 x 66, or, in other words, 2 feet 2 inches by 5 feet 6 inches. The only comment I have to make is that the inhabitants in his vicinity must be a race of dwarfs, or else they are fond of stooping when they go through the doors.

Obligations Acknowledged.

From C. P. B., *Claremont, N. H.*—I desire to return my thanks through the paper to H. N. F. and others for the designs of cupola sent in in answer to my request. Some very pretty designs have appeared, which are of easy construction and of moderate cost. I have already made selection of the one which I shall use upon my barn. I like *Carpentry and Building* more and more, it is so plain and practical.

Door and Window Screens.

From G. D. B., *Pittsford, Vt.*—I inclose a diagram showing the construction of wire door screens. The frames should be 1⅛ inches or 1¼ inches thick and of pine. I am in the habit of painting them green or staining them to imitate black walnut. I put the wire on the outside and cover the edge with a molding of the shape shown at B, in Fig. 2. The molding for the small brackets which occur in the corner of the screen



Door and Window Screens —Fig. 1.—G. D. B.'s Plan of Constructing Door Screens.

would have to be turned by hand. The lower panel of the door I generally make of wood, because it looks better and offers more resistance to dogs and cats. A molding of the style shown at A, in Fig. 2, looks very well around this panel.

From C. H. R., *Middletown, N. J.*—In answer to your correspondent H. H., who inquires for the best way of putting in wire screens, I inclose you sketches of my method of construction. For windows the slides are bradded to the stock bead and cut off the hight of the screen, thus allowing the screen to be moved up and taken out with ease. The wire can be put on the inside of the frame with the edges folded under, or a half round may be put over the wire where it is tacked on to the frame. Still another method of construction—to rabbet the frame—is shown by the dotted lines in

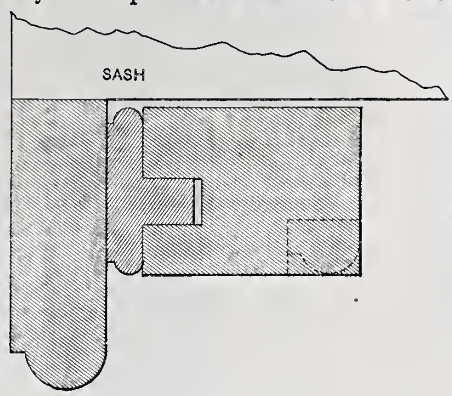
A B

Door and Window Screens.—Fig. 2.—Moldings for Finishing at Edge of Wire.

my full-sized sketch (Fig. 3). A bead being inserted over the wire to fill the rabbet, this makes the neatest job of the three. Constructed in this manner, the braces, which are shown in the corner of the frames, would have to be omitted.

From W. A. B., *Greenfield, Ill.*—I desire to say to H. H. that a good plan for constructing screens is to make them fit between the inside stops. Plow a groove in each side, say a quarter or three-eighths of an inch deep; get out a stop to fit the groove as long as the stile. Fasten to inside stop with three or four brads, and put a small knob at the bottom of the screen. Care must be taken to get the screen just close enough to the sash to let both work freely. When arranged in this manner the screen can be raised to close the blinds, or lifted clear out if desired. When taking the hight, raise the inside sash and make the top rail of screen come even with the bottom rail of sash.

From W. K. B., *Oaks Corners.*—Replying to H. H., who asks about screens, I would say that I plow the stiles of the screens

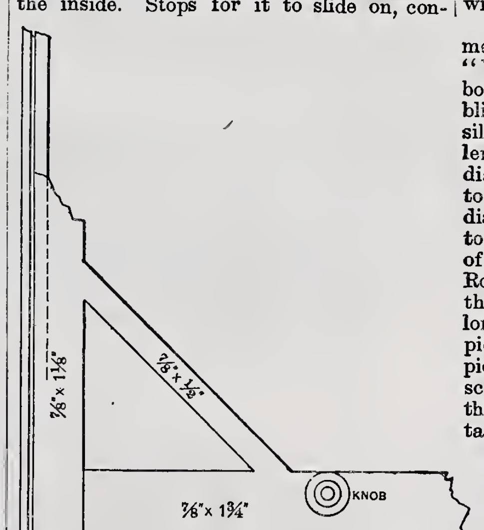


Door and Window Screens.—Fig. 3.—Method of Constructing Window Screens Employed by C. H. R.

with ¼-inch iron ⅜ inch deep, and nail a square strip on the inside stop of the window frame, which allows the screens to be raised the same as a window sash.

From A. S. C., *Burlington, Iowa.*—Your correspondent H. H., will get over all his difficulties if he will make his screens in the following way: Plow the bit-stops with a ¼-inch or ⅜-inch bit. Tongue the screens to match plow. Fasten so that when the wire is on the frame it will not rub the sash. Have the wire on the outside.

From J. V. A., *Canandaigua, N. Y.*—Make the frames same width and thickness as bottom sash and 4 inches shorter, which will admit of raising for the purpose of opening or closing the blinds. Take out the stops and put in the frame, letting the sash down on it, or make the frame the size of the sash. Plow the stiles and screw guides on the inside. Stops for it to slide on, con-



Door and Window Screens.—Fig. 4.—Manner of Bracing the Corners Employed by C. H. R.

structed in this way, may be used for either top or bottom of the window.

The best way to make frames for wire screens is to miter and nail the corners, instead of making a single miter joint.

From E. H. C., *East Rochester, N. H.*—In answer to H. H., I would say that I think that there is a better way to put screens into windows than to put them under the top sash, especially when there are outside blinds to the windows. If put under the top sash, it is necessary to take the screens out for opening or closing the blinds. If your correspondent will make his frames about 1 inch less in width than the space between the window beads, and about ½ inch less in length than the full opening; get out two strips ½ inch wide and of a thickness equal to the frames and as long as the frames; run both sides of the frame and each edge of the strips by a circular saw, sawing a groove about ¼ inch deep and wide enough to take strips of zinc ½ inch wide; insert these strips in the ½-inch pieces and make them fast with a few tacks; brad them to the windows close to the sash, thus forming a run for the frame to slide on, he will have something that will please the ladies very much. By this construction the frames can be raised in order to close the blinds, and may be taken entirely out without any trouble at all. I might inclose a sketch, but I don't think it will be necessary if your correspondent follows my directions.

We have also had communications concerning door and window screens from a number of other correspondents. Some of those which inclosed sketches of construction did not reach us until after the engravings above presented had been commenced; therefore those who feel disappointed at not seeing their sketches used must be more prompt next time.

W. G. G., of Lenox, Iowa, sends us a sketch of his construction of door screens which, in all essential features, is the same as the above illustrations.

E. D. S., of Painesville, Ohio, sends us a sketch of a door screen, which we find is of a character not generally adapted to the needs of our correspondents.

W. A. S., of Canyon City, Oregon, sends us a description of his method of constructing screens, in which he describes them put either inside or outside of the sash, dependent only upon the construction of the shutters.

C. W. F., of Morrisville, Vt., incloses us a circular describing Porter's metallic corners, used for the construction of wire screens. The metallic corners take the place of the ordinary miter joint at the corner of the frames. These patent corners, we take it, are intended more for amateur use than for carpenters. The circular is headed "Every one his own screen maker."

R. K. H., Philadelphia, sends a sketch illustrating the same method of constructing window screens as is described above.

L. C. L., of Mansfield, Ohio, describes his method of constructing screens as follows: "Where they are to be placed so as to have both sashes move, fit the screen between the blind stops. Leave space enough above the sill to work the blinds. Make a piece same length as width of main screen, and to run diagonal to the sill and bottom sash, and hang to main screen. Close ends of the piece with a diagonal piece by which means it can be raised to get at the blinds. Put the covering on inside of frame, so as not to interfere with the blind. Rods, if preferred, or pieces, can be put against the parting stop by being made a half-inch longer than the main screen with a rabbeted piece at each end to hold it in place; also a piece to run from main screen to sliding screen to stop opening, and then by raising the sliding piece above main screen it can be taken out."

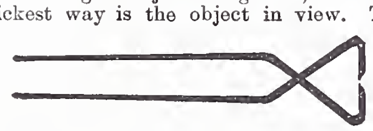
W. H., of Cincinnati, sends us a description of his method of construction, which, in several essential particulars, differs from what we have illustrated. He describes it as follows: "I make my frames of black walnut. I plow a groove 1 inch back from inside edge of screen with a ¼ or ⅜-inch bit, and about the same depth. I then rip strips to fill the grooves, less the thickness of the wire. I bend the wire into the groove and then drive in the strips and brad them. By this construction I have just seven-eighths the thickness of the outside casing. I then take my seven-eighth match plane and work a tongue on the edge of a piece of seven-eighth black walnut the length of the whole frame. I then rip the tongue off, leaving a quarter of the square wood standing. Next, I joint my piece again and stick another piece and rip off again. I then have a piece for each side of my screen. I brad these strips to the outside casing on the edge, so that it does not interfere with the outside shutters. I plow the two edges of my screens with a bit one-sixth larger than the tongue, so as to work easily on the guides. I bore a hole through the stile and put in what I call a spring catch, or what others sometimes call spring-catch locks, and cut notches on the guide for the spring bolt to play in, by which construction I can have my screens either at the top or bottom of the window. By providing notches opposite the spring in the guide when the screw is down on the subsill, it will prevent any one from raising it from the outside."

Thanks Returned.

From A. K. H., *Philadelphia.*—I take this opportunity of thanking several correspondents who sent in answers to my question with reference to the inclined bottom of a grain bin. I am under many obligations to them for the very able manner in which they handled the problem. What was published not only afforded me great pleasure, but it became a source of important information. I am very much interested in *Carpentry and Building.*

Ceiling Tongs.

From J. D. H., *Alabama.*—I inclose you a sketch of ceiling tongs, a tool which is in common use in this part of the country, though I find it is not generally known in other sections; accordingly, this may be of some interest to readers of *Carpentry and Building.* This place is in a mountain country, some 20 miles from railroad or river. We have no planing mills, and, as you can see, are too far away to have ready-prepared material shipped to us. We, therefore, have to dress, tongue and groove all our stuff by hand, although all carpenters know it is impossible to work out ceiling and flooring to fit as well as machine-worked material. Of necessity we are bound to devise some means of straining the joints together, and the quickest way is the object in view. The



Ceiling Tongs.—Sketch Accompanying Letter from J. D. H.

tongs illustrated in the inclosed sketch we find to be the greatest time-saving device for closing the joints in flooring and ceiling that we ever discovered. The tool is made about 30 inches long and is about 4 inches from the points to the rivet. It is made strong enough to bear the weight of any man who may use it. The tool is employed as follows: The nails are set ready for driving, when the tongs are applied. By setting a small block between the tongs and work to prevent bruising, one end operates the tongs while the other drives the nails. If any reader has a better plan for closing the joints in ceiling and flooring, he will confer a favor by sending it on for publication.

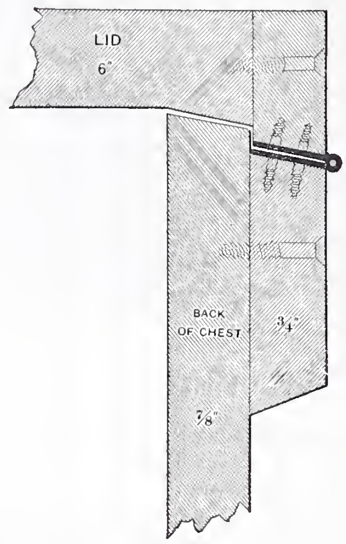
Construction of Lids to Tool Chests.

From W. G. S.—Herewith I present an improvement in the manner of making the joint between the cover and body of tool chests. I think the plan here represented is very much better than the common square joint. It has the advantage of being entirely water-tight, so long as it remains in proper position, which is not the case with the square joint. I run the binding all around the chest, and place the butts in the same. I have shown more bevel in the joint than I consider really necessary. In common work I make it from an ⅛ to 3-16ths of an inch, which I find to be entirely sufficient.

Method of Drawing Polygons.

From J. P. F., *South Acton, Mass.*—I inclose you herewith my way of striking any regular polygon. In constructing the figure always use very sharp dividers and mark very accurately, as small variations make bad work with a rule of this general character.

To draw a polygon in any given circle, draw the diameter A B of Figs. 1 and 2, as shown. From E, the center of the circle, erect the perpendicular E C, cutting the circle at F. Divide the space E F into four equal parts, and set off above F a space equal to three of these parts, as shown from F to C. Divide the diameter A B into as many equal parts as the polygon is required to have sides—in Fig. 1, five, and in Fig. 2, seven. From C, through the second divis-



W. G. S.'s Construction of Lids to Tool Chests.

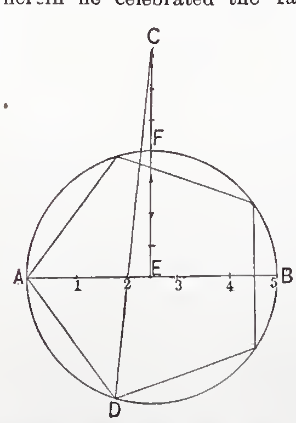
ion in the diameter, draw C D. Join A D, which will be one side of the required polygon.

Note.—This rule our readers, no doubt, will find very convenient for use. We shall be shall be pleased to see a demonstration of the principles upon which it is based, either from the correspondent who sends it or from any one else who may be disposed to furnish the same. We believe such a demonstration has never been published.

Originality.

From H. McG., *Journeyman Carpenter, Paterson, N. J.*—When your correspondent H. D. C. smashed that shingle over the metaphorical head of P. S. B. for prigging what was not his'n, it served him right. Some others of your correspondents require ditto, ditto. They seem to think that all they write is swallowed by the readers as "original taffy." The hip backing given by A. S. L., which he is man enough to say is old, was given by some one in the August number in a shape that left the inference that it was original, but the editor sat upon that by declaring that it was old.

Now, I was not there, but I am willing to bet six cents that Noah had that identical way of backing a hip committed to a palm leaf in good Hebrew geometrical drawings before his head was clear from that big drunk of his, wherein he celebrated the fact that

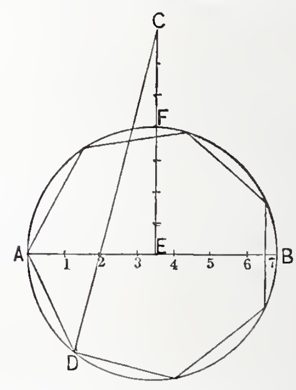


Method of Drawing Polygons.—Fig. 1.—Rule Applied to a Pentagon.

original chaps in his day didn't know enough to go in out of the moisture, and were, in fact, killed by originality.

Now, as to authorities, Nicholson says that Richards in 1676 ascribed it to Pope, and that Price gives it in 1735. Price says that it is the "most exact and easiest method ever delivered for that purpose." Langley, in his "Builders' Assistant," 1736, and in his "Workman's Treasury of Design," 1739, gives it in almost exactly the same form as presented by A. S. L., except that he did not draw the bevel with a stock.

W. B.'s rule, Fig. 1, June number, is exactly the same as that given by William Pain in 1766, and which is branded as shaky and unscientific by Nicholson. How much older these methods of doing that great bore—backing a hip—really are, depouent sayeth not, because he does not know. Now, Mr. Editor, can't this thing be stopped? Can't some way be invented by which, when some correspondent steals an original idea, a moral persuasive will be administered which will make him acknowledge where he stole it, so that when the rest of us who are not smart want to do the same thing, we shall be able to do it from good authority? If the drawing is original, make it so that the direction of every line, with every number and every figure, is exactly like some other. The present way of doing it is apt to cast suspicion on the originality of the last fellow. Every one knows that all great minds, in thinking about great subjects, always work exactly alike. Accordingly, when we see their thoughts on paper we involuntarily exclaim, "That's Nicholson!" "That's Benjamin!" "That's Hatfield!" and so on. The readers of *Carpentry and Building* are not all putty heads. Some of them have seen this thing before and are able to distinguish a "jackass from a hand saw." They are able to do their own stealing, and, it may be, their own lying also. Many problems in constructive carpentry are appropriated from authors who—alas! unknown, unsung—are defunct. It is even probable that some of the problems were demonstrated by Adam



Method of Drawing Polygons.—Fig. 2.—Rule Applied to a Heptagon.

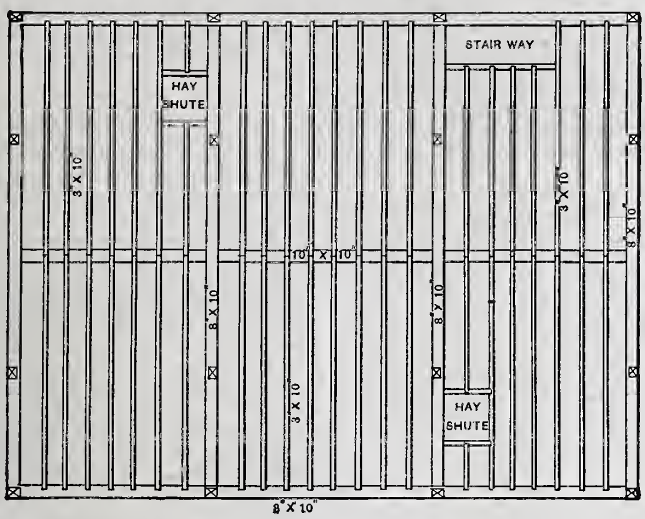
when he assisted Eve in establishing the first fashion plate and in describing the shape of that first suit of hers (that was wood, fig tree). Therefore, I say, quote your author. If original, brand it so. Then, perhaps, the old chap who writeth on a shingle will take your scalp quicker than the lower regions can toast a slice of Limberger or roast a Coney Island clam. Geometry was born before the present generation. Some old chaps might have had a smattering of it, even in the time of Pythagoras. This man, if history is correct, tramped through all the carpenter shops in the world, raising a rumpus and exciting the bosses' ire, simply because he found how to get the length of a regular hip, and, if memory does not fail me, he slaughtered about 100 of the original chaps and raised such a disturbance generally by yelling "Eureka! Eureka!" that, to prevent all the people and the bosses from going clean crazy, they were forced to stop his grub and give him a dose of rock and rye, flavored with hemlock. All this occurred because he discovered how to back a regular hip and did not know enough to keep his mouth shut about the thing.

Note.—While reading our correspondent's letter, we thought he was going to refer to the fact that the roof of Noah's ark had two pitches, since the account says it was pitched within and pitched without. However, we see that is not the direction in which he is working. Our correspondent's citations of authorities are too many for us. Our library, extensive as it is, does not contain all the books to which he refers. Some of them, as may be seen by the titles, are exceedingly rare and hard to obtain.

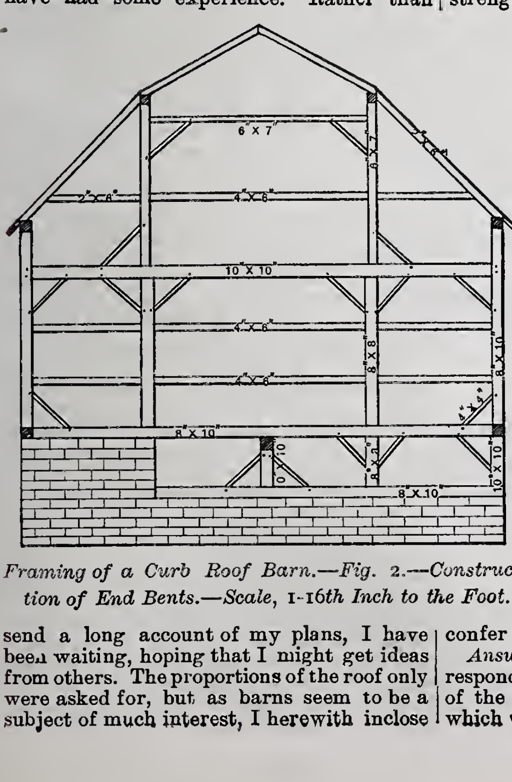
We do not believe that our readers generally, when they see a paragraph in the paper entitled "Jno. Smith's rule for backing a hip rafter," take it as a claim upon the part of John Smith that he invented that particular rule. We think rather that they take it that John Smith, in the course of his experience, has never found any other rule for the purpose which he likes better, and that therefore he has recommended this one for the use of his brother carpenters. Some one said a great many years ago that there was nothing new under the sun, and we believe this assertion to be just as true in the science and practice of carpentry as in anything else. New combinations and new applications can be made, but the principles upon which the art is founded are ever the same. Accordingly, there is little else to be done by the present generation than to adapt things to modern requirements.

Framing of a Curb Roof Barn.

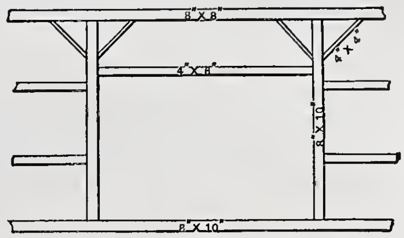
From A. S., *Dallas, Pa.*—I have been reading *Carpentry and Building* for some time and with great interest. I have received valuable information from its columns. In consideration of the general interest that has been manifested in this journal and the contributions from its generous correspondents, I feel that I must contribute my share and respond to its invitation. I have noticed two inquiries concerning curb roofs. In the construction of roofs of this kind I have had some experience. Rather than send a long account of my plans, I have been waiting, hoping that I might get ideas from others. The proportions of the roof only were asked for, but as barns seem to be a subject of much interest, I herewith inclose plans of a curb roof, applied to a bank barn, showing not only the proportions of the roof, but also the size of the material which is most commonly employed. Fig. 1 exhibits the floor plan; Fig. 2 the end elevation; Figs. 3 and 4 the sides, and Fig. 5 the middle bent, so framed as to make access to the hay loft convenient. This construction is very much approved by some. The timbers in the middle bents vary a trifle from those in the ends. I have not given any plan for underground stabling, for the reason that there are hardly any two in this part of the country who desire their barns arranged exactly alike in this particular. In Fig. 2 it will be noticed that the beam is proportioned larger than the other timbers, the object of which is to give it sufficient strength to keep it from springing outward when filled with hay, which is apt to be the case when carelessly mowed with a hay fork. The threshing floors, which used to be made 12 or 14 feet in width, I find are a great deal more convenient when made 16 or 18 feet, on account of using tread-power threshing machines.



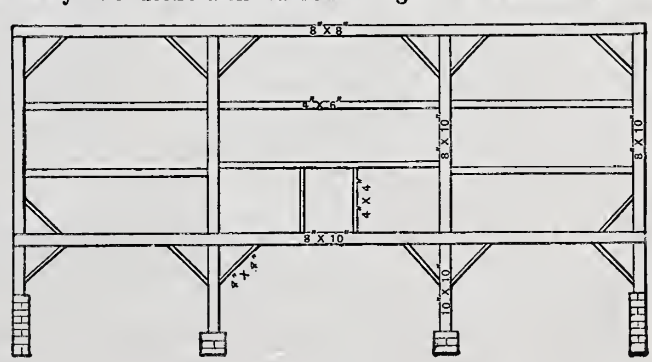
Framing of a Curb Roof Barn.—Fig. 1.—*Plan of Floor Beams.—Scale,* 1-16*th Inch to the Foot.*



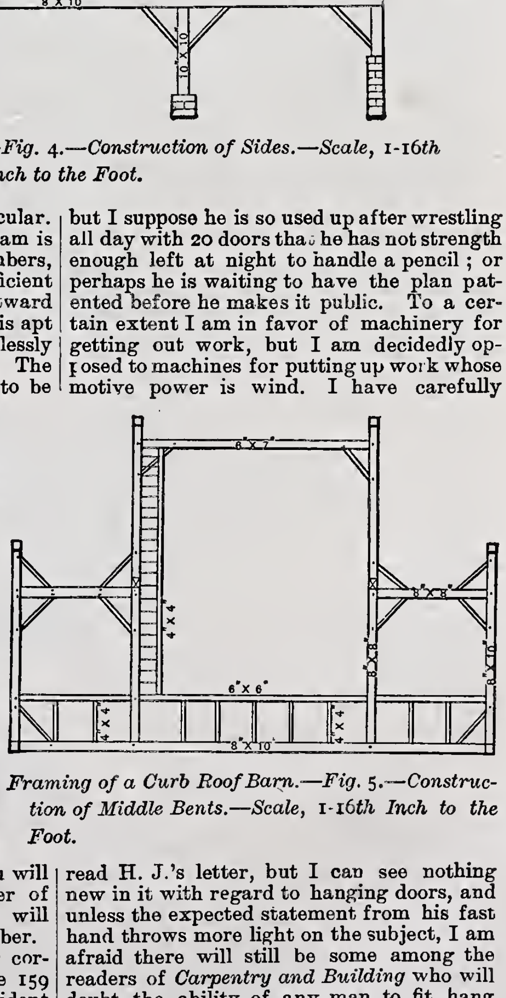
Framing of a Curb Roof Barn.—Fig. 2.—*Construction of End Bents.—Scale,* 1-16*th Inch to the Foot.*



Framing of a Curb Roof Barn.—Fig. 3.—*Construction of Sides.—Scale,* 1-16*th Inch to the Foot.*



Framing of a Curb Roof Barn.—Fig. 4.—*Construction of Sides.—Scale,* 1-16*th Inch to the Foot.*



Framing of a Curb Roof Barn.—Fig. 5.—*Construction of Middle Bents.—Scale,* 1-16*th Inch to the Foot.*

A Missing Reference Letter Supplied.

From E. W. H., *Humboldt, Kan.*—In S. F. D.'s diagram for getting the length of hips for square roofs and for obtaining the backing, all of which appears quite practical, there is something omitted. In his demonstration he says: "Set up E F for rise of roof." I fail to find "E." This, most likely, is a misprint. If you will explain in the next number of *Carpentry and Building*, you will confer a special favor on a new subscriber.

Answer.—The diagram to which our correspondent refers was printed on page 159 of the August number. By some accident which we are unable to explain at the present time, the letter E, which occurred at the intersection of the diagonal lines in the center of the figure, was destroyed in the plate, and therefore does not appear in the print. If our correspondent will insert the letter in the place we have described, we think he will have no further difficulty with the demonstration.

Fast Door Hanging.

From A. M., *Baltimore.*—I have been waiting very patiently for that statement from H. J.'s man about hanging doors. I think he is doing wrong in withholding such valuable information. What a revolution in building that statement will cause. To be able to fit, hang and trim 20 doors per day, provided we don't stop to discuss politics, is something worth while. Talk about machinery; it's nowhere compared with such skill. It seems to me that the statement is a long time in making its appearance, coming as it does from such a fast hand; but I suppose he is so used up after wrestling all day with 20 doors that he has not strength enough left at night to handle a pencil; or perhaps he is waiting to have the plan patented before he makes it public. To a certain extent I am in favor of machinery for getting out work, but I am decidedly opposed to machines for putting up work whose motive power is wind. I have carefully read H. J.'s letter, but I can see nothing new in it with regard to hanging doors, and unless the expected statement from his fast hand throws more light on the subject, I am afraid there will still be some among the readers of *Carpentry and Building* who will doubt the ability of any man to fit, hang and trim 20 doors in a day's time.

REFERRED TO OUR READERS.

Carrying Timbers.

From J. L. F., *Milan, Ohio.*—I have a problem which I desire to propose to the readers of *Carpentry and Building.* If three men carry a stick of timber, one supporting the back end of the piece in his hands, and the other two carrying the front by means of a stick, what proportion of its length must project in front of the carrying stick—or, in other words, how far back from the front end must the two men be—so that each one of the men shall carry one-third of the total weight of the timber?

Concrete Walks.

From C. S. P., *New Bedford, Mass.*—Can you or some of the many readers of *Carpentry and Building*, give me information concerning the mixing of concrete for walks and drives. Any information upon this subject will be thankfully received.

Paraffine Oil for Oil Stones.

From W. S. G., *Chattanooga, Tenn.*—I have had far better success with paraffine oil on oil stones than with any other kind; have been experimenting with it for the past five months. I have found the best quality, sometimes called sewing-machine oil, entirely satisfactory. I am now trying the next grade lower, commonly called light engine oil. I bought some of the gum, but could not make it stay in an oily condition when melted. Can some reader of the paper tell me how to do it? Paraffine oil is the best thing I have ever used on tools to prevent rust.

Certificates of Apprenticeship.

From A. O. L., *Oak Run, W. Va.*—I would like to have an expression of opinion in regard to mechanics having papers or certificates of some kind to show that they are regular mechanics, and to show that they have gone through a regular course. I think something of the kind would be a benefit to the trade—especially to those who have spent three or four years in learing their business. I hope the day is not far distant when every carpenter will be compelled to stand an examination, and to have his papers before he can follow the business. If such were the case, I think that a great many who now call themselves carpenters would be compelled to drop out of line.

Home-Made Scroll Saw.

From W. E. B., *Vail, Iowa.*—Will some reader of the paper furnish for publication drawings of a scroll saw suitable for sawing 2-inch stuff? I wish to make one for myself, and, accordingly, would like the drawings accompanied by a full description.

Note.—If any of our readers see fit to comply with the above request, we will take pleasure in publishing what they send in. We will remark, however, that it is doubtful economy for any one to attempt to build a scroll saw in this day of ready-made machinery. We think it would be far cheaper to buy one. It is almost certain that a better article could be obtained through any dealer in machinery than by the results of amateur effort. We made these same remarks in connection with wood-turning lathes, the designs of which we published in *Carpentry and Building* a few months since. We should be pleased to publish any descriptions sent in for the benefit of any who may be interested.

Discoloration of Pine.

From S. D., *Coopersville, Mich.*—Will some one tell me what to do to keep pine from being darkened or discolored when oil is used? I have the inside finish of a drug store to execute in pine and cherry. I want the pine to appear as light as possible and the cherry to be dark. The woodwork is to be finished in oil only. Some fellow reader who can give me information how to proceed in this case will confer a material favor. May the shadow of the man who so successfully engineers *Carpentry and Building* never grow less.

Barn Framing.

From W. A. H., *Rootstown, Ohio.*—Will some one furnish to *Carpentry and Building*, for my benefit, illustrations and description of the framework for a barn 26 x 36 feet? I am a subscriber to *Carpentry and Building* and I think it a very good paper. If it continues to be as good for the future as it is for the present, I shall take it as long as I am able to read. I am nothing but a boy yet. I have just begun to learn the trade, and I feel sure I shall want the paper as long as I live.

Cove Siding.

From O. M., *Espyville, Pa.*—I inclose a sketch of what is called cove siding, and desire to ask the question if it was ever patented. If so, in what year?

Note.—We publish an engraving herewith made from the sketch inclosed by our correspondent. Our impression is that the siding concerning which he asks was patented upward of 15 years ago, but we have no means of giving the exact information for which he inquires; accordingly, we refer the question to our readers.

Cove Siding.—Referred to in Inquiry from O. M.

To Prevent Chipping in Hard Finish.

From J. T. B., *Canada.*—Will some one of the numerous and intelligent readers of the paper inform me of some article to prevent chipping cracks in hard finish when one man is working alone. I want something which will not be injurious to the wall or to the color of the wall. I have a brick wall to paint red without oil. If some one will inform me what is best to use that will not wash off, I shall be greatly obliged.

Bake Oven.

From READER, *Easton, Pa.*—Will some one furnish plans and description of the construction of a bake oven? This is something which carpenters are very often required to superintend in connection with housework.

Borders and Dados.

From G. D. B., *Pittsford, Vt.*—Will some of your readers furnish designs of borders, dados, &c., for kalsomining?

Cement for Joining Wood.

From READER, *Easton, Pa.*—I desire a recipe for cement that will hold end wood together. I desire to make a strong joint in a piece that is ⅛ of an inch thick by 1 inch wide.

Cement Houses.

From READER, *Easton, Pa.*—Will some subscriber of the paper, who understands the building of cement houses as practiced in England—or, for that matter, any other part of the world—furnish for publication in *Carpentry and Building* a description of the manner in which these houses are erected? Information upon this point will greatly oblige.

Gothic Window Frames.

From GOTHIC, *Maysville, Ky.*—Will some of the readers of *Carpentry and Building* please give me a method for obtaining the cut on the end of slats in the head of Gothic window frames, such as is shown in C. H. M.'s design of steeple, page 111, June number?

Window Caps.

From C. W. S., *Alfred Center, N. Y.*—Will some of the readers of *Carpentry and Building* furnish some designs for window caps?

Note.—Our correspondent does not say of what material he desires to construct his window caps. We will supplement his request by saying that designs for stone, galvanized iron and wood window caps will be acceptable for publication in this department of *Carpentry and Building.* We except cast iron and terra cotta, because designs in these two materials are ordinarily controlled by the parties by whom they are made, and the designer has less chance to embody his own ideas than in the other materials specified.

ACKNOWLEDGMENTS.

From J. B. G., *Louisville, Ky.*, we are in receipt of a design for a bookcase and secretary combined, which we regret we have not room to publish at the present time. In the design our correspondent has given evidence of more than usual care and a considerable degree of taste. We shall be pleased to hear from him often.

From E. A. C. D., *Hudson, N. Y.*, we have what seems to be an original rule for constructing an ellipse by means of centers, or, rather, producing an approximate ellipse by the use of centers, which we have not room to publish at present. This correspondent proposes several questions the discussion of which will hardly be of interest to our readers at the present time. One question, however, that he names we will refer to briefly at this time. His query is: Given the minor axis of an ellipse, to find the length of the major axis, and *vice versa.* It is evident that our correspondent has little conception of the properties of the ellipse, or he would not have propounded this question. Suppose, for example, that several different oblique sections be made of a cylinder—say, 3 inches in diameter—the resulting ellipses will all have minor axes of 3 inches, while their major axes will differ according to the angle of the oblique cut which formed them. Thus it may be seen that an infinite number of ellipses could be produced, all varying in their major axis. The ellipse, as defined in our second article on "Practical Stair Building," is either an oblique section through a cylinder or an oblique section of a cone through its opposite sides. Now, it is evident that any oblique cut through either of these two solids will produce an ellipse. Accordingly it is possible to have ellipses of varying proportions; from which it follows that there is no fixed relationship existing between the major and minor axes. Hence it would be impossible to determine either of these, the other being given.

C. E. R., *of South Acton, Mass.*, sends floor plans and elevations of a farm house, which have some desirable features, but which we do not find room for publishing at present. We shall be pleased to hear from this correspondent again whenever he has anything which he may think will be of interest to our readers.

We are in receipt from F. M. S., Hickory, Miss., of an arithmetical solution to the problem of equal areas, which, although correct, does not comply with the original conditions laid down by the correspondent who asked the question, and which, therefore, we do not publish. We are much obliged to our correspondent, and shall be glad to hear from him again whenever he has anything to communicate.

CARPENTRY AND BUILDING

A MONTHLY JOURNAL.

VOLUME II. NEW YORK = NOVEMBER, 1880. NUMBER 11.

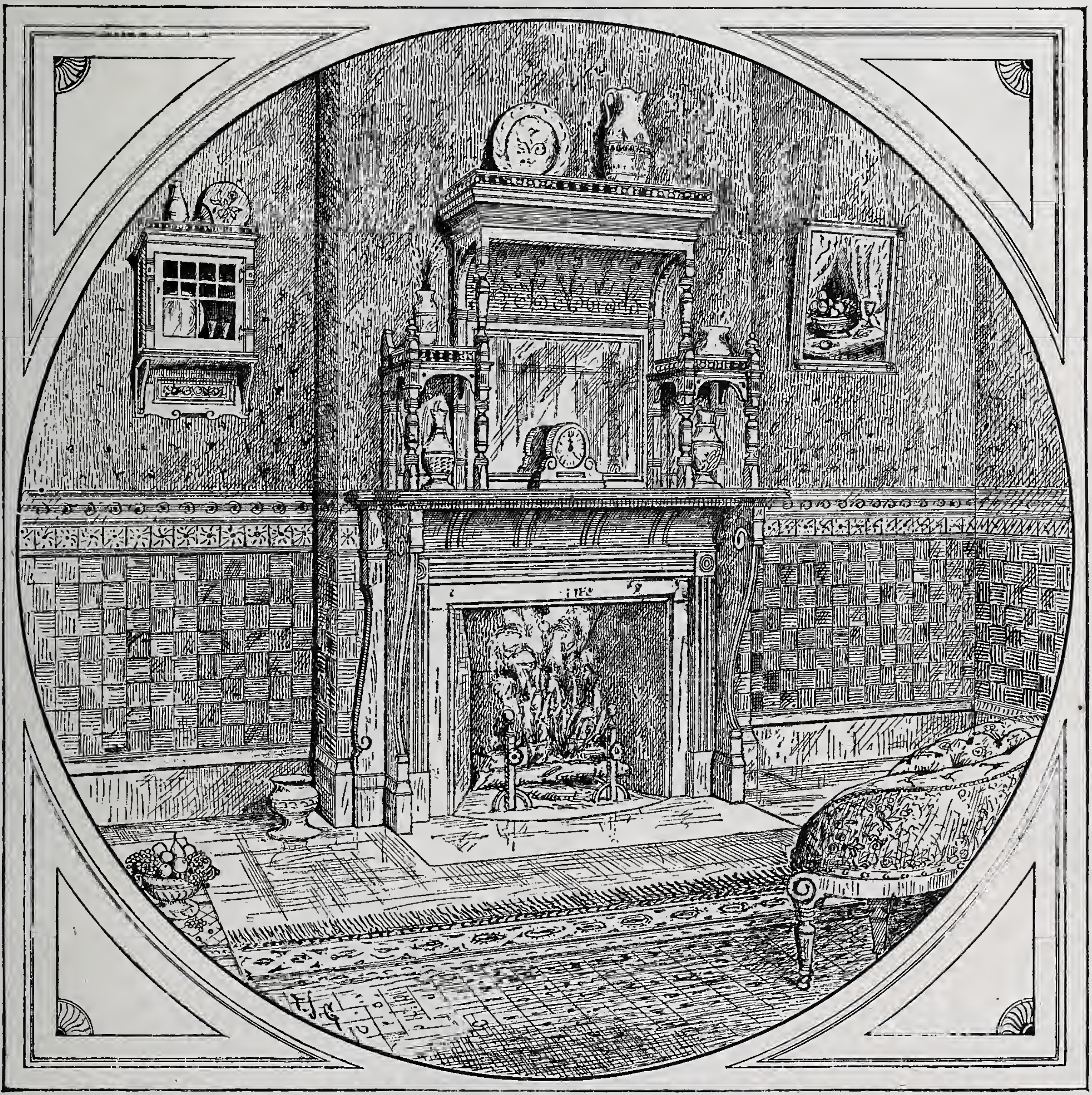
Dining Room Mantel and Mirror.

Herewith is presented a perspective view, together with details, of a mantel and mirror in a dining room. The mantel alone is quite simple in form and the moldings not numerous, and would be suitable to place in any room; but taken in connection with the mirror and shelves, it makes a handsome piece of dining-room furniture. It would figure in gold. A heavily embossed paper-hanging might be substituted for the leather with good effect.

Although this subject has been prepared with especial reference to its effect as a piece of furniture, it is, perhaps, not out of character to pay some attention to the detail of chimney and fire-place, without which the whole affair would be of little service. The scale drawings will fully explain the

The fire-place here described commonly costs from $20 to $30; the mantel alone is estimated at $35, while the mirror and shelves would add an expense of about $60. The whole is so designed as to be easily separated and made simpler, if the taste or means of the maker shall so decree.

The design, taken as a whole, is a very attractive one and worth careful study. The floor is of hard wood, and the center of the



Dining Room Mantel and Mirror.—Designed and Drawn by Thos. J. Gould, Providence, R. I.

look well executed in any hard wood, but best perhaps in mahogany, cherry or black walnut.

The scale drawings that accompany this design fully explain the form of the moldings and method of construction. The bold cove over mirror is indicated in the perspective as being engraved, but may be left plain or veneered with another kind of wood. The popular method is to cover this cove with leather, in color to match the woodwork, and thereon stamp a handsome

general outline of construction—in fact, the mason, carpenter and cabinet maker have each sufficient drawings to go on with his work.

The hearth is supported in the ordinary manner, by a brick arch turned from the chimney breast in the cellar to a trimmer in the floor, the intervening space between the arch and hearth being filled in with plaster-of-Paris. The inner hearth, as well as the sides and back lining of fire-place, is of soap-stone, and the outer hearth of black marble.

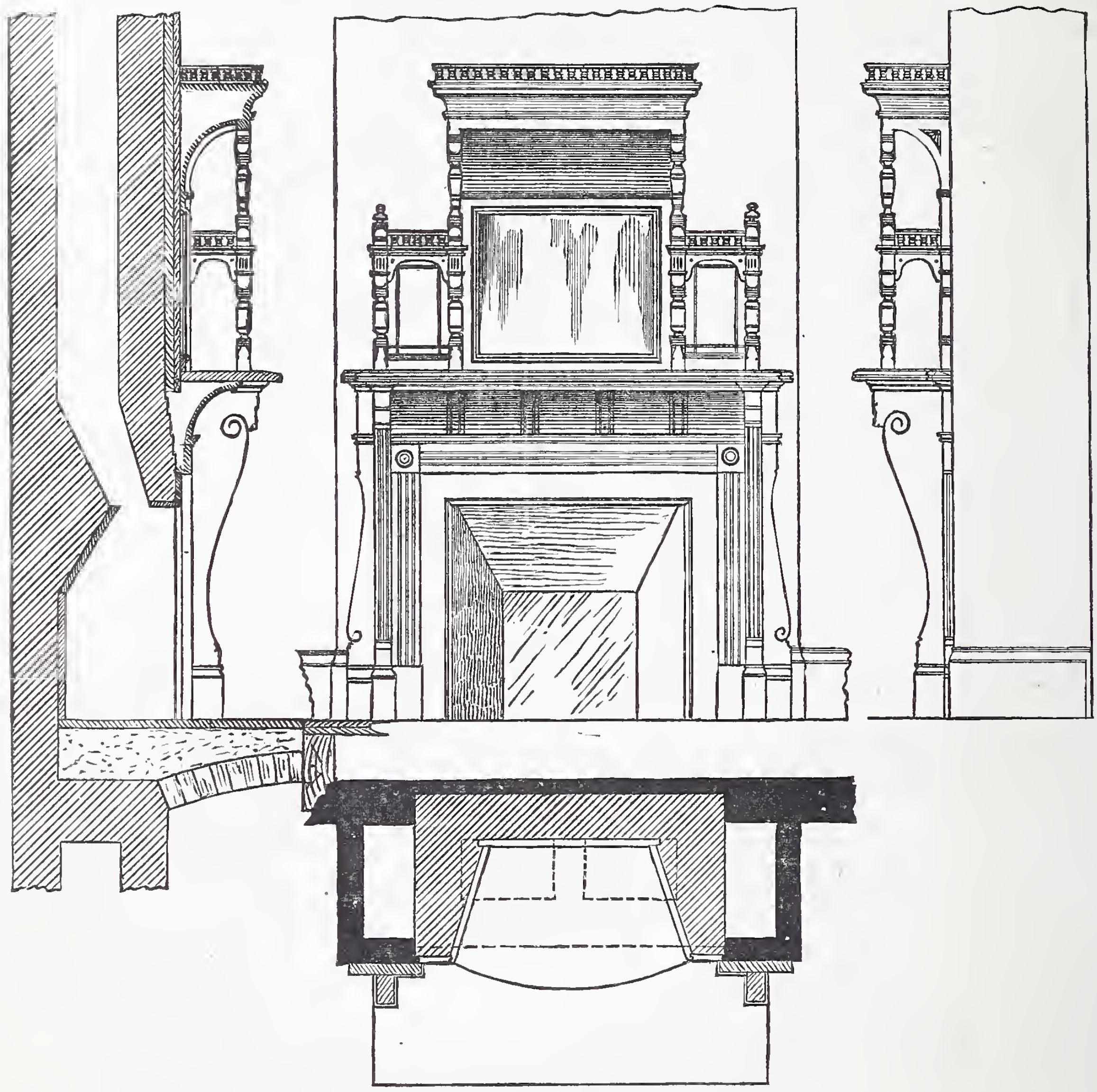
room is covered with a large mat or a carpet, to the border of which a fringe is attached. The wall paper has a wide dado, which starts at the level of the mantel, and thus seems to connect the mantel with the room and its furnishings. The disposition of the cabinet and picture add greatly to the sense of cosy comfort. Here we may say that wall space for pictures, as well as spaces for furniture, should be taken into account by architects, as well as the locations of doors and windows. Many rooms and houses have an indefinite feeling of unrest hanging about them because there are no places for pictures, no places for beds, sofas nor chairs, and, in fact, no places for any of the things that make a house a home. When, on the other hand, one discovers a corner that seems "made for" a cabinet or a picture, there is a pleased, undefinable feeling that adds a double charm to the possession of both the room and its furnishings. In the design here presented the author has been very succ ssful in his treatment of the simplest parts, and has produced something unusually attractive.

How Spools are Made.

The town of Drummondville, Canada, on the St. Francis River, had the good fortune some years ago to be selected as the site of several factories for the manufacture of spools, the principal reason for the selection being the abundance of white birch wood in its immediate vicinity. This wood, though inferior for many purposes, is just the thing for spools; and, in consequence, quite a thriving industry in this line has grown up. The following account of the process of manufacturing these useful articles may be of interest:

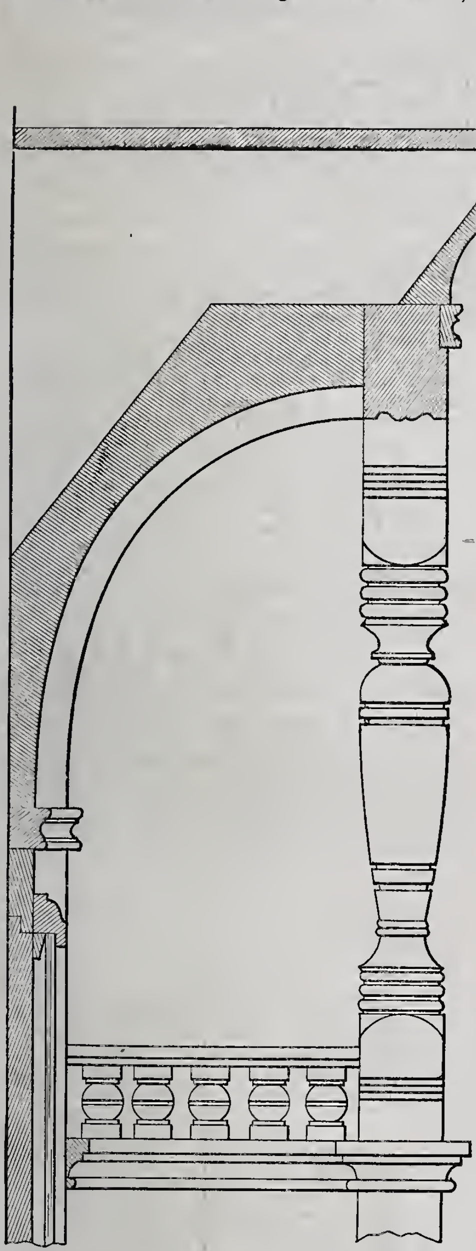
The wood, after being delivered to the factories, is first sawed into pieces about 4 feet long and from 1 to 1½ inches square, according to the size of the spool it is desired to make. These pieces are put into a dry house and there thoroughly dried, whence they are taken into the factory and given to the rougher, who, in an incredibly short space of time, bores a hole in the center a couple of inches deep, turns about the same space round, and then cuts off the length required for a spool. The machines used for this purpose are revolving planers, in the center of which is a revolving gimlet or bit, and immediately to the right a small circular saw, with a gauge set to the proper size for the spools. The roughers receive 1½ cents per gross for their work, and experienced men can turn out from 100 to 130 gross per day. The round blocks pass from them to the finishers, who place them in machines which give them the shape of spools and make them quite smooth. The spools are thrown loosely into a large cylinder, which revolves slowly, so that the spools are polished by the constant rubbing upon each other for some time. On being taken out of the cylinder they are placed in a hopper with an opening at the bottom, through which they pass down a slide for inspection. Here the inspector sits and watches closely to see that no imperfect spools are allowed to pass, and a very small knot or scratch is sufficient to condemn them. They are packed in large boxes, made the proper size, and no additional packing is needed. The packers receive one-quarter of a cent per gross for packing, and a smart boy who is accustomed to the work can pack about 200 gross per day. One proprietor ships over 2,000,000 spools per month to England, and another firm ship over 1,000,000 spools to Glasgow, Scotland.

Lads and Ambition.—There is hardly a man, however moderate his abilities and energies, who might not look forward to a fair share of human happiness if he were early taught to conform carefully his conception of life to his powers, and seek nothing beyond what those powers entitle him to look for. And the same is true of women. Weariness of life in the young arises—in so far as it arises from causes that are purely moral—chiefly from a great disproportion between the kind of career the young have been taught to expect and the kind of career for which they find themselves fitted. There is too much of the idea that it is good for all lads to be spurred into a sort of ambition for which they are by no means suited. A life of carefully limited desires—a life more or less approximating, in its reticence and moderateness of aim, to that which the old most usually live, if they are to live happily at all—need be by no means an unhappy life for a very large number of the young people of our generation, if only they were not so early taught to look upon such a life with contempt, as if it were no life at all. In reality, it might be a much more dignified and noble life than the life of fretful competition, and of unsuccessful or half successful ambition.



Dining Room Mantel and Mirror.—Fig. 2.—Section, Front Elevation, Side Elevation and Plan.—Scale, ½ Inch to the Foot.

Mahogany Trees.—Full grown, the mahogany tree is one of the monarchs of tropical America. Its vast trunk and massive arms, rising to a lofty hight and spreading with graceful sweep over immense spaces, covered with beautiful foliage, bright, glossy, light and airy, clinging so long to the spray as to make it almost the evergreen—present a rare combination of loveliness and grandeur. The leaves are very small, delicate and polished like those of the laurel. The flowers are small and white, or greenish yellow. The mahogany lumbermen, having selected a tree, surround it with a platform. Some 12 or 15 feet of the largest part of the trunk are thus lost; yet a single log not unfrequently weighs from 6 or 7 to 15 tons, and sometimes measures as much as 17 feet in length and 4½ to 5½ feet in diameter, one tree furnishing two, three or four such logs. Some trees have yielded 12,000 superficial feet, and at average prices have sold for $15,000.



Dining Room Mantel and Mirror.—Fig. 3.—Section through Cornice over Mirror.—Scale, 3 Inches to the Foot.

The Commercial Importance of Yellow Pine.

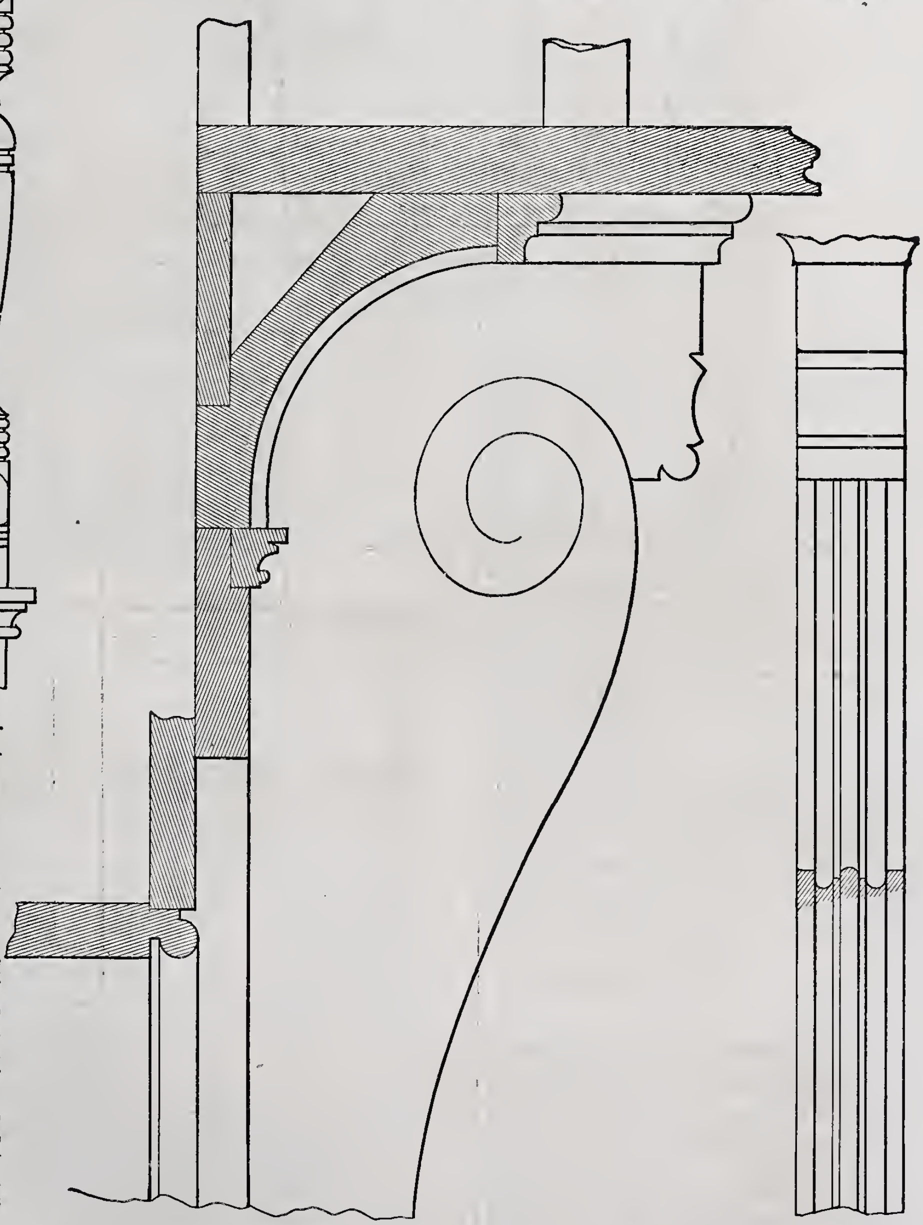
Few have any idea of the magnitude of the receipts of yellow pine at the port of New York. Even the large and active dealers themselves can give no accurate idea of its magnitude, and only know in a general way that the business has increased during the past few years. The trade, however, has long existed, and dates back before the war, but has received its chief impetus since that time. It is carried on exclusively by means of small sailing vessels, of which there are a large number in the busines. As many as a dozen have been known to arrive in New York in a day with lumber. The yellow pine district begins in Virginia, which e ports a large amount from Norfolk and other sea towns, and continues around to the Gulf States. The forests around Wilmington are largely tapped for tar, pitch, &c., so most of the good lumber comes from south or north of that locality. Not only has the dome tic trade increased rapidly of late, but there is an immense foreign demand. Darien, Ga., ships a large quantity across the Atlantic. From January 1 to July 1, 1880, the foreign shipments from that port amounted to 41,752,211 feet; the domestic shipments were 14,040,327 feet; total, 55,792,538 feet. New York received 1,608,819 feet of this, and Philadelphia 5,749,200 feet. New York, however, is an immense receiver of this wood. Mobile, from January 1 to September 1, 1880, shipped here 1,898,000 feet, against 688,000 the corresponding period last year. Savannah, which exports about 60,000,000 feet a year, sent to New York, for the 12 months ending September, 19,220,000 feet. Pensacola shipped, during the year ending September, 150,340,000 feet to foreign ports, and 31,845,000 feet coastwise, a total of 82,150,000, against 59,751,000 feet the previous year.

Statistics of the trade show, with respect to New York, that the total receipt of yellow pine from all sources, Virginia alone excepted, in 1877 were 32,848,620 feet; in 1878, 71,678,602 feet; in 1870, 100,320,005 feet, and for nine months of 1880, 108,122,200 feet.

From this it will be seen how rapidly the trade has grown, the receipts in 1878 being double those of 1877, those of 1879 being 29,000,000 greater than those of 1878, while the receipts this year, with three months to spare, exceed those of 1879. The first rapid increase appears early in 1878, when there was a great demand for the lumber for ties and other railroad purposes. There has been also a growing use of yellow pine in the construction of buildings, grain elevators, hotels, docks, &c. The elevated roads also consumed an immense quantity of this timber for ties, depots, &c. Nevertheless, it is believed that the increase of receipts this year must have largely exceeded the demand, and that considerable stock is on hand. Large quantities of the timber was used in the Coney Island and Rockaway hotels, but this was not all entered at this port. A schooner in the regular trade makes about eight round trips during the year, carrying Northern products South and returning with timber. It is impossible to estimate the value of the pine received here. The market rates range from $23 per thousand to $27, but there are private contracts at higher prices.

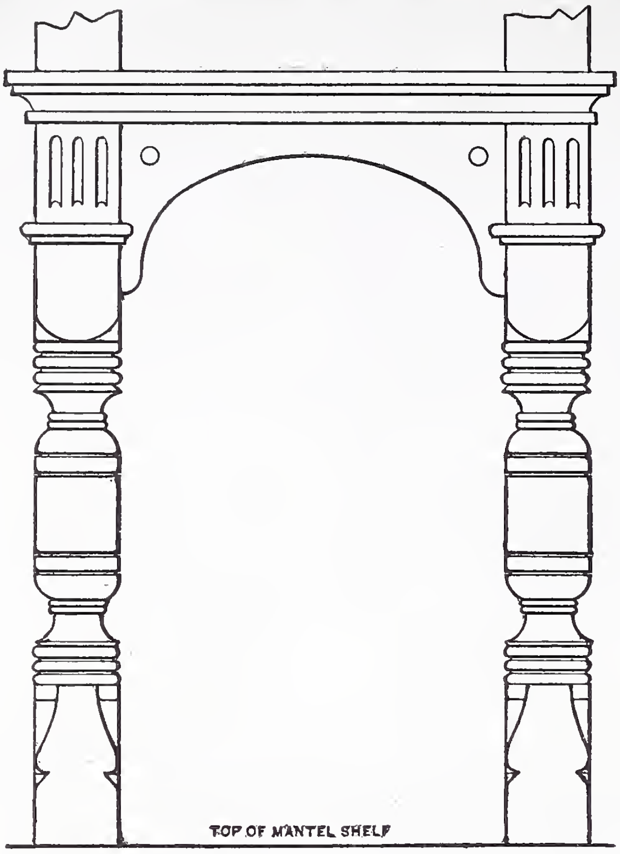
The Future Supply of Black Walnut Lumber.

The future supply of black-walnut lumber is a question of the greatest importance to all those who are engaged in the manufacture of sewing machines, as this is the kind of material that has been found the best adapted for all kinds of sewing-machine cabinet ware. The fact that the supply of this lumber would run short at no distant day was foreseen some years ago by several of those who were using large quantities of black walnut, and many efforts were



Dining Room Mantel and Mirror.—Fig. 4.—Section through Mantel Shelf, and Face of Pilaster.—Scale, 3 Inches to the Foot.

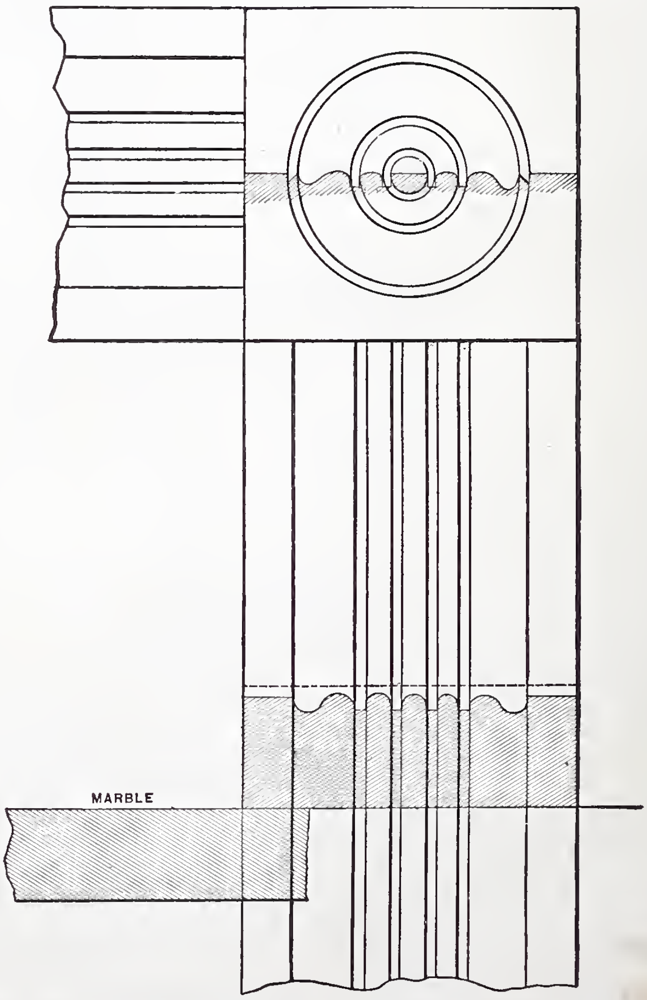
made by them to substitute some other kind of wood in its place. These efforts, however, were not successful, and the consumption has continued to increase to such an extent that at the present time the greater part of the land upon which this timber is growing has been placed under control by capitalists, both at home and abroad. The region from which the great supply of black walnut has been heretofore obtained is that known as the "Walnut Levels" of Indiana, but as the supply in these parts is about exhausted, other localities have been prospected for this kind of wood, the greatest attention having been turned to some parts of Tennessee. Here black walnut is found in great abundance, but it is inferior to that which grows in Indiana. It is eagerly sought after, however, in the absence of any other. The fact that Indiana has been the great black walnut region, has induced many to put up large factories there for the manufacture of the various different articles that are made of this kind of wood. That the approaching scarcity of black walnut in Indiana will necessitate the removal of many of these manfacturing concerns there can be no doubt. As an evidence of this, it is reported that one very large establishment now located in Indiana has the question of removal already under advisement.



Dining Room Mantel and Mirror.—Fig. 5.—Details of Shelf and Supports.—Scale, 3 Inches to the Foot.

Competition in Stove Designs.

In the September number of *Carpentry and Building* we directed the attention of our readers to a competition in stove designs, which was announced to be closed on the 1st of October. Owing to the fact that the time proved too short for many designers who desired to compete to get their drawings ready, the committee who have this scheme in charge have decided to postpone the date of closing the competition to December 31. Accordingly, many who have regretted their inability to take part in this competition are now afforded, we believe, sufficient length of time to perfect their designs. In response to the first announcement a considerable number of designs were sent in, the character of which is eminently satisfactory to the committee, and this extension of time is made only in deference to the wishes of many who would otherwise be unable to compete. The subjects of the competition are well worth the attention of all designers and artists. The field is one which is scarcely occupied as yet, and promises good returns to those who shall devote attention to it. A circular containing full particulars of the competition can be obtained by addressing James C. Bayles, Editor of *The Metal Worker*, 83 Reade street, New York.



Dining Room Mantel and Mirror.—Fig. 6.—Details of Architrave Around Fire-place.—Scale, 3 Inches to the Foot.

NEW PUBLICATIONS.

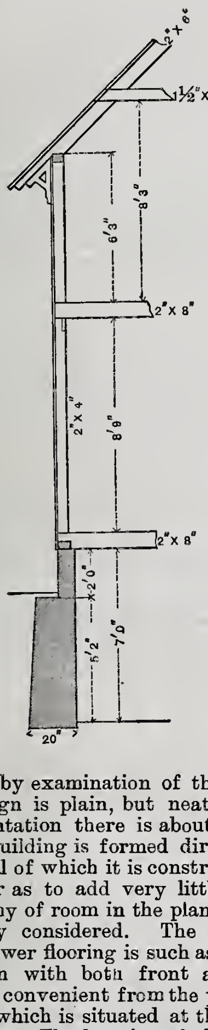
THE ELEMENTS OF HAND-RAILING SIMPLIFIED AND EXPLAINED IN CONCISE PROBLEMS THAT ARE EASILY UNDERSTOOD. The whole illustrated with 38 accurate and original plates, founded on geometrical principles, and showing how to make rail without center joints, making better rail of the same material with half the labor and showing how to lay out stairs of all kinds. By R. J. Sherratt. Boston: James R. Osgood & Co.

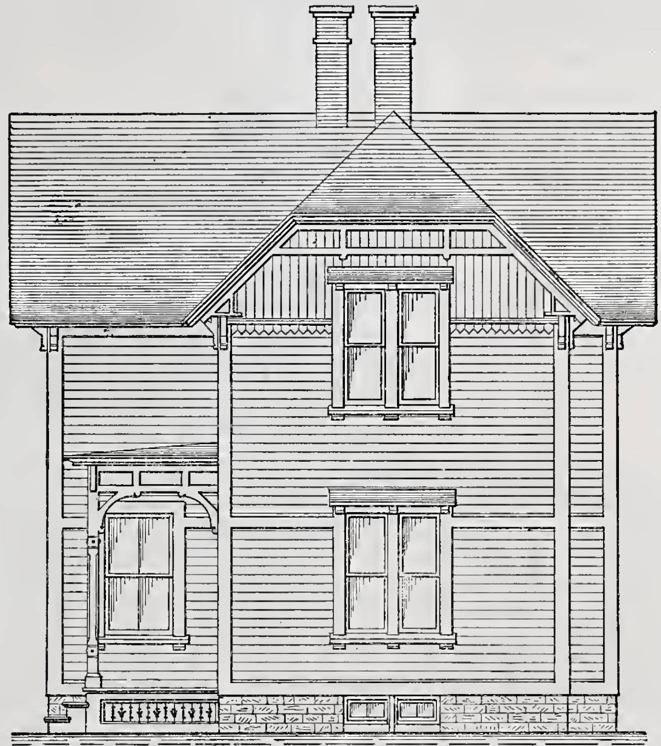
This work is the production of a man who has written for the benefit of his fellow workmen. He has set out, according to his own declarations, to bring the science of hand-railing down to the level of the shop, so that it may be comprehended by common mechanics. With respect to books upon this subject which have preceded the present work, the author says: "They might have been understood by a professor of some college, but not by a common mechanic." How well Mr. Sherratt has succeeded in his effort we shall not attempt to estimate. It would appear, however, from the absence of elementary problems and the lack of definitions of terms, that more knowledge and experience are demanded from the reader, in order to understand the work, than is likely to be met with in the ordinary house carpenter. The first problem in the book is entitled "Tangents and the Use of Face Mold." While the demonstrations and explanations are for the most part couched in language which the mechanic will understand so far as the words employed are concerned, they are quite brief, and in many cases little things are left unsaid the saying of which would, in our estimation, have made the book far more useful. Withal there are many really good features about the work, and few will regret buying it who are at all interested in the general subject discussed.

Design for Cheap Frame House.

We take pleasure in presenting our readers this month with another addition to our already large gallery of inexpensive frame buildings, adapted to the general requirements of builders. The elevations, plans and details here presented are engraved from drawings prepared by Mr. Walter B. Nourse, architect, of Worcester, Mass. As may be seen by examination of the elevations, the design is plain, but neat. What little ornamentation there is about the exterior of the building is formed directly out of the material of which it is constructed, in such a manner as to add very little to the cost. Economy of room in the planning has been carefully considered. The arrangement on the lower flooring is such as to make communication with both front and rear portions quite convenient from the principal outside door, which is situated at the end of the front piazza. The location of the stairs, which are placed immediately opposite this door, is such as to make the three chambers on the second floor easily accessible by the way of a small central hall. Communication with the cellar is had from the kitchen by means of a stairs placed below the principal stairway. The dining room is provided with a china closet, and the pantry opens out from the kitchen. An unfinished room in the rear affords a convenient place for coal and wood or storage of other material. Each of the three chambers is provided with a closet, and each may be heated by a stove in case it is desired.

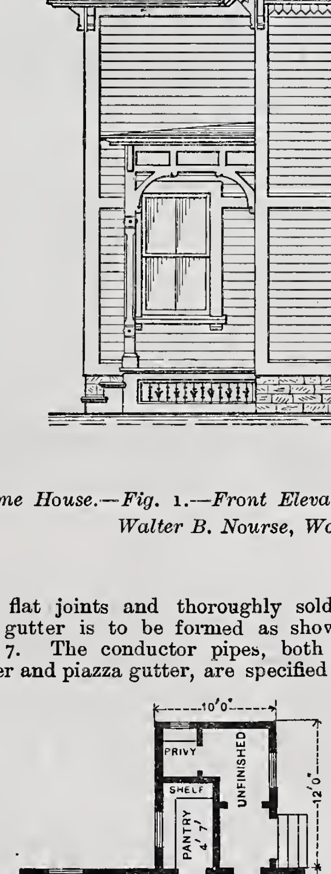
The architect's specification provides for a cellar under the front of the building only. Trenches for foundations are to be dug 5 feet in depth for the rear part of the house. The foundation walls are specified to be 20 inches thick, of quarry stone laid dry in the best manner. The cellar walls are to be pointed with cement mortar. The chimneys are to be built of a good quality hard-burned common brick, laid in a substantial manner in cement mortar. Each chimney is to be provided with suitable sheet-iron thimbles and caps, one to each room. The chimneys are to be properly flashed at the juncture of roof with sheet lead in the best manner. The flues are specified to be 8 x 12 inches in the clear, and to be smoothly plastered, inside and outside, to the line of roof. The walls and ceilings, except the unfinished back room, are to be plastered one coat brown mortar. The lath used to be of the best quality of spruce, well laid, breaking joints in the usual manner. The ceilings are to be whitewashed at completion.





Cheap Frame House.—Fig. 1.—Front Elevation and Section.—Scale, ⅛ Inch to the Foot.—Walter B. Nourse, Worcester, Mass., Architect.

Under the head of metal work the main gutter is specified to be of tin, and of the form shown by the detail, Fig. 8. The piazza roof is to be tinned, a good quality of roofing tin being employed for the purpose, laid with flat joints and thoroughly soldered. The gutter is to be formed as shown by Fig. 7. The conductor pipes, both main gutter and piazza gutter, are specified to be



Cheap Frame House.—Fig. 2.—First Floor Plan.—Scale, 1-16th Inch to the Foot.

of galvanized iron, to extend to the ground and to be provided with suitable shoes securely fastened to the building.

The frame of this building is specified to be of good quality of spruce, of the following dimensions: Sill, 4 x 6 inches, laid flat; corner posts, 4 x 6 inches; first and second floor joists, 2 x 8 inches; rafters, 2 x 6 inches; collar beams, 1½ x 6 inches; wall studs, 2 x 4 inches; partition studs, 2 x 3 inches; plate, 2 x 4 inches, double, and the girder in cellar under partition, 6 x 8 inches.

The framing is to be done in the style usually known as balloon framing. The wall studs are to be framed into the sill and plate, and the rafters are to be notched on to the sill, having a bearing, also, of 2 inches on brick underpinning. The second floor joists are to rest on ledger ⅞ x 6 inches, and to be notched into studs and thoroughly spiked to their sides. Both floor joists and studs are to be placed 16 inches between centers and rafters 20 inches between centers. The floor joists are to be bridged in the center with 1 x 2½ inch spruce, bridging well nailed at each end.

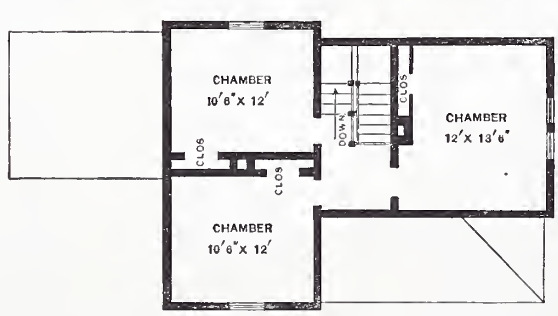
The roof and side walls are to be sheeted with good quality of hemlock boards ⅞-inch thich, square edged and jointed and well nailed. The roof to main house and L is to be covered with good quality of sawed pine shingles, laid with the usual overlap and well nailed, breaking joints in the best manner. The sides, with the exception of gables, are to be clapboarded with a good quality of spruce clapboards, laid 4½ inches to the weather and nailed to every bearing. The gables, as shown in Figs. 5 and 10, are to be finished over the sheeting with ⅝-inch matched and beaded stuff, terminating at the bottom in pointed ends. The buckets on corner boards are to be made of 3-inch plank and the verge in gable of 2-inch plank. The entire exterior finish is to be executed in No. 2 Michigan pine; the piazza window frames, belts and corner boards are to be ⅞-inch thick, as shown by the several details; the under side of piazza roof to be sheeted with second quality matched and beaded stuff; the floor to be of pine ⅝-inch thick; also the steps, both front and rear. The finish under piazza is to be as shown by detail, Fig. 9.

The window frames are to have 1¾-inch plank sills, with casings inside, as shown by Fig. 13; the sash to be 1⅜ inches thick, hung with weights and evenly balanced; the frames to have pockets for removing the weights. Detail of this construction as shown in Fig. 12. Four cellar windows having 1¾-inch plank frames, with 1⅜-inch sash, hung at the top with hinges, are to be provided; the same to be fitted with iron buttons at the bottom; the weighted windows to have common japanned axle pulleys fitted with good quality hemp sash cord, with stops at sides properly screwed up with round-headed screws. Outside blinds 1⅛ inches thick are to be provided. All glass throughout the building to be of first quality American single thickness, of size as figured.

The floor linings to be of hemlock, of the same quality as used for the outside sheeting. The floors to be laid with number 2 pine flooring cut inside of base, all as shown by the detail Fig. 14. Grounds are to be put on in the usual manner around doors, windows and base, against which to plaster. Windows in front part of house are to be panneled below stool cap, as shown in Fig. 14. The front door is to be 2 feet 3 inches (double) by 7 feet 6 inches and 1¾ inches thick. The rear door to be 3 feet by 7 feet 6 inches and 1¾ inches thick. The interior doors are to be 2 feet 10 inches by 6 feet 10 inches and 1½ inches thick, made of good quality, well-seasoned pine and hung in 1⅛-inch plank jambs. The doors are to be hung with the usual quality of butts and knobs. The two outside doors are to be provided with good mortised locks in addition. The pantry to be fitted up with shelves in the usual manner. Sink in the kitchen is to be sheeted underneath, and provided with a door to form a cupboard. The closet in the dining room is to be provided with suitable shelves, and the closet in the chambers are to be furnished with double rows of wardrobe hooks. The stairs are to be constructed as shown on the plan, and furnished with a 6-inch square black walnut newel post with base and beveled top. They are also to be provided with angle posts, 4 inches square, with beveled top and bottom; also to be provided with suitable hand-rail, and 1¾-inch balusters square at top and bottom.

The roofs are to be painted with common quality of roof paint. All outside woodwork is to be painted two coats, good lead and oil, the belts and cornice to be somewhat darker than the body of the house, in order to form an agreeable contrast. The inside wood-work is to be painted two coats, except the unfinished room. The pantry and kitchen floors and floors to all closets, also risers and treads of stairs, are to be painted. This is an important provision, but one which is very generally neglected. All material throughout the house is to be of fair quality, and all workmanship to be done in a thoroughly substantial manner.

Cheap Frame House.—Fig. 3.—Side Elevation.—Scale, ⅛ Inch to the Foot.



Cheap Frame House.—Fig. 4.—Second Floor Plan.—Scale, 1-16th Inch to the Foot.

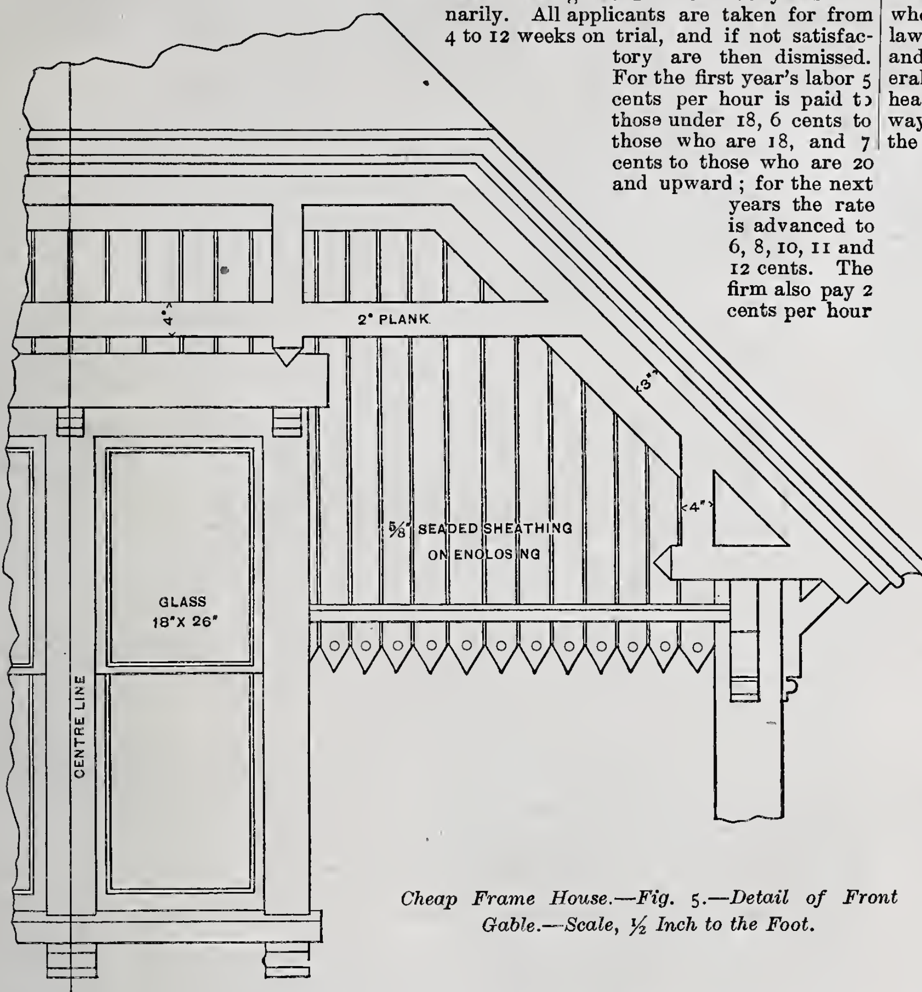
The Rights of the Public in the Matter of Street Architecture.

On Chestnut street, Philadelphia, extending from Eleventh street to Twelfth street, there is a block owned by the Girard estate which is known as the Girard Row. During the past summer some improvements have been made in this block which in character have manifested anything but enterprise and far-sightedness upon the part of the trustees in whose hands is the management of the estate. The Philadelphia *Times*, in commenting upon this circumstance, says: "A man who builds a lodge in some vast wilderness may build it in whatever form will best please himself; as no one else is expected to see it, no one can reasonably criticise. But a man who builds a house in town, and especially upon a main thoroughfare, is under some obligations to the public as well as to himself. Legally, no doubt, he has a right to make his house as ugly as he pleases; but morally he has no such right. There are thousands of people who see the outside of his house much more frequently than he sees it himself, and to whom the sight may give pleasure or positive pain. He has no right to annoy them by needless ugliness."

After citing other arguments of a similar character, the writer proceeds with the subject matter of his criticism as follows:

"If ever such criticism was called for, it is by the so-called improvement in the Girard Row on Chestnut street, which has caused so much surprise and disappointment to every one coming back to town after the summer holidays. There was an opportunity here for a great architectural work. Such an opportunity, indeed, can seldom occur, for the entire block, from Chestnut to Market and from Eleventh to Twelfth streets, is owned by the Girard estate, and is so situated that it might be made an example both of architectural effect and of business enterprise. By opening an avenue through the center of the block so as to bring Girard street into direct communication with the two great thoroughfares, and reconstructing the whole block in accordance with the demands of modern trade and of modern taste, the trustees would soon get their money back in the increased rentals, and would give the city a monument worthy of the name of its great merchant. Something of this sort would be worth doing. Short of this there was really no necessity for doing anything, for the block, though not handsome, was at least unobtrusive. It was a fair example of the way they built houses 50 years ago, and age had made its homeliness respectable. Still, there was a chance for knowledge and good taste to do a great deal with it, and a capable architect could ask no better field for the display of his skill than in remodeling this old front. It was simply a plain, flat wall, pierced with rows of plain windows, and his first thought would naturally be to break this monotonous expanse. If he could not shut up any of the windows, he could work them into some architectural relations, and he would try to give some appearance of solidity to the wall spaces. This could be done by a slight projection of portions of the wall, or by broad pilasters of brick at suitable intervals, with real arches above the windows, and with paneling of molded brick, which would impart something of the character of a genuine building instead of a mere flat wall, and would give the play of light and shade, on which so much of architectural effect depends.

"Instead of this, the architect of the Girard estate has simply removed the old brick facing and put on a new one of fresh bricks, a 4-inch 'skin,' without projections or other break in the surface, leaving the windows as they were, only with badly shaped groups of colored bricks above them, and with the flatness of the wall emphasized rather than relieved by the use of enameled bricks, which have about as much artistic value as so many patches of varnished oil cloth. As for the poverty of invention displayed in the effort to break the dead level of the sky line, words are scarcely adequate to describe it. The architect has, indeed, contrived a rudimentary brick cornice here and there, but he has surmounted it with vulgar excrescences of sheet iron, which would tumble down if they were as heavy as they pretend to be, and for which the only good that can be said is that they fitly crown a work that is a model of tawdry humbug. When we consider the infinite capabilities of Philadelphia brick in competent hands, this whole performance excites indignation. An unobtrusive block of dingy old houses, whose faults were only negative, has been transformed into an offensive piece of modern clap-trap, without beauty or dignity or repose, a positive eyesore in the center of our principal thoroughfare. And this has been done by a most respectable body of men, who are intrusted with the administration of a wealthy estate and to whom the community had a right to look for an example to be followed in substantial public improvements. Instead of this, they have given us only a frightful warning of what is to be shunned. Such a failure is disheartening."

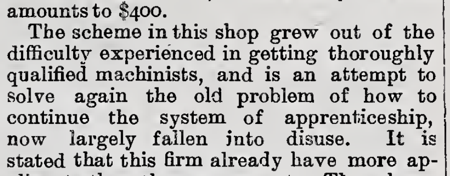


Cheap Frame House.—Fig. 5.—Detail of Front Gable.—Scale, ½ Inch to the Foot.

A New System of Apprenticeship.

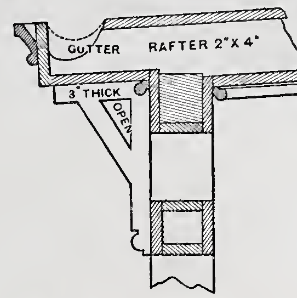
A system of apprenticeship, in some respects new, has been adopted by Messrs. Richards & Dole, machinists, of Springfield, Mass. It is intended to combine the thoroughly practical education of the shop with the theoretical education of the school; or, in other words, it is an industrial school in which the most time will be given to practice instead of to theory. They propose to require of the apprentice 58 hours a week of work in the shop and 9 hours a week of study. The term of apprenticeship for those beginning to learn a trade who are under 20 years of age is to be six years, in which time, under this system, it is believed that an apprentice will be qualified to rank with the best journeymen and to earn the same wages. Those who are over 20 years of age are allowed to finish their apprenticeship in five years, and those who have worked in a shop are advanced according to proficiency. The beginner is first put to drawing from sketches, then takes up projection and diagrams, and advances regularly according to his ability. It is believed that in this way one year will qualify him as well to work from drawings as four or five years ordinarily. All applicants are taken for from 4 to 12 weeks on trial, and if not satisfactory are then dismissed. For the first year's labor 5 cents per hour is paid to those under 18, 6 cents to those who are 18, and 7 cents to those who are 20 and upward; for the next years the rate is advanced to 6, 8, 10, 11 and 12 cents. The firm also pay 2 cents per hour additional into a reserve fund, which is paid to those apprentices who finish their full term of service; for the six years this amounts to $400.

The scheme in this shop grew out of the difficulty experienced in getting thoroughly qualified machinists, and is an attempt to solve again the old problem of how to continue the system of apprenticeship, now largely fallen into disuse. It is stated that this firm already have more applicants than they can accept. The scheme certainly seems worthy of a trial. We have but little sympathy in many cases with the lament over the decadence of the apprentice system. The introduction of machinery and the consequent subdivision of labor have made it unnecessary in many trades. In some trades, however, there cannot be such a subdivision nor such machinery as will do away with the necessity for a large proportion of skilled, thoroughly educated mechanics, and the machinist's trade is one of these. The scheme we have described above certainly seems well calculated to produce workmen not only competent for the ordinary routine of shop-work, but competent to design and oversee the execution of work.



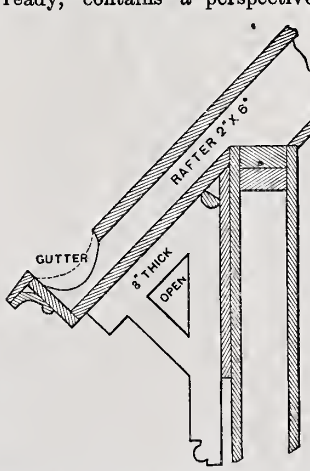
Cheap Frame House.—Fig. 6.—Section through Door.—Scale, 1½ Inches to the Foot.

The Glory of the Architect.—Robert Burdette, of the Burlington *Hawkeye*, says: I have often wondered why the architects of court-houses were not always hanged at the dedication of the building. If the court-house is a very cheap, shabby, old-fashioned sort of affair, worth about $950, the chances are that a man speaking from the bench can be heard half way to the door. But if it is a handsome affair, and costs the county anywhere from $150,000 to $500,000, then the lawyer, climbing into the laps of the jurors and bellowing his eloquence into their several respective ears, can make himself heard. The reason why the judge always writes out his charge to the jury, and the foreman always brings in his verdict in writing, is because, in most court-houses, the jury would never know anything about the charge, and the court would never know whether the prisoner had been hanged or awaredd a premium of $200, if the human voice alone were the medium of communication.



Cheap Frame House.—Fig. 7.—Section through Piazza Cornice.—Scale, ¾ Inch to the Foot.

Announcement.—Messrs. Bicknell & Comstock, of 194 Broadway, N. Y., announce a new and important architectural work. It is entitled "Modern Architectural Designs and Details." It is to contain in all 80 lithographed plates, of large quarto size, representing new and original designs of moderate cost in Queen Anne, Eastlake, Elizabethan and other modernized styles. Unlike other publications of this house, the present work is to be issued in parts, to be brought out monthly. The first number, which is now ready, contains a perspective view and plans of a Queen Anne cottage; four elevations of the same, drawn to ⅛-inch scale; framing plans, exterior and interior details, and designs for four piazzas, with details. The complete work is put at $10.00, including portfolio cover. Single numbers are $1.00 each.



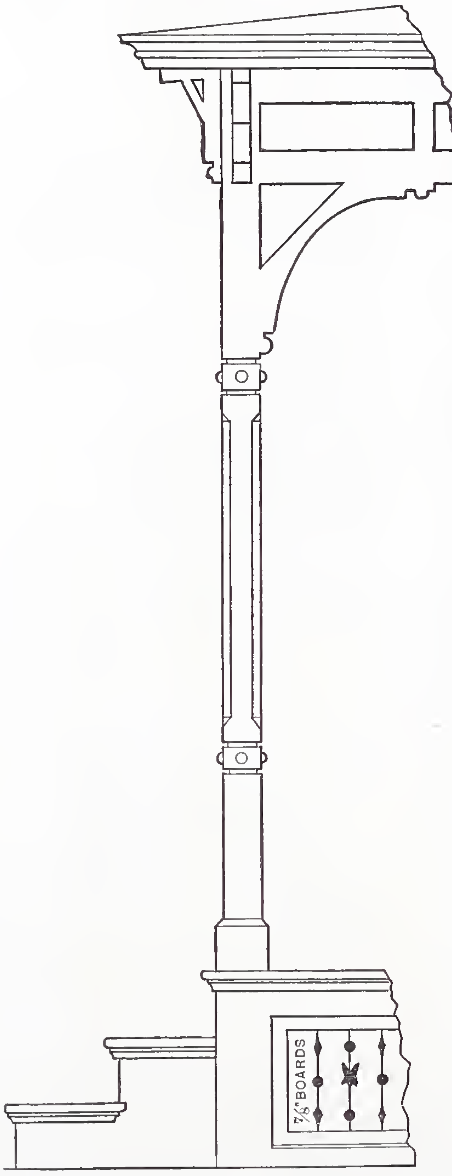
Cheap Frame House.—Fig. 8.—Section of Main Cornice.—Scale, ¾ Inch to the Foot.

India Rubber Solvents.—Caoutchouc dissolves more or less perfectly, according to its condition, in various liquids, among which may be mentioned the various fixed and hydrocarbon oils, chloroform, either and carbon disulphide. Unless, however, the caoutchouc has been masticated or otherwise degenerated, it is doubtful whether a true solu ion is obtained. When a clear limpid solution is required, one of the best solvents is that proposed by Payen, namely, carbon disulphide, mixed with 5 per cent. of absolute alcohol. If one part of masticated caoutchouc is dissolved in thirty parts of the above solvent, a solution is obtained which can be filtered through paper, and may be employed in covering the most delicate mold with successive layers of caoutchouc.

Practical Stair Building.—IV.

DESCRIPTION OF STAIRS.

That commodious arrangement of steps in a building by which access to the different stories is attained is called the stairs. Very much of the comfort and elegance of the house in which they are placed is dependent upon the finish, form and position of the stairs. They should be located so as to facilitate communication with various rooms and passages into which the building is divided. For this purpose they are required to be near the middle of the building, but they should also be well lighted, for which purpose they ought to be near the side of the building. A skylight in the roof, however,

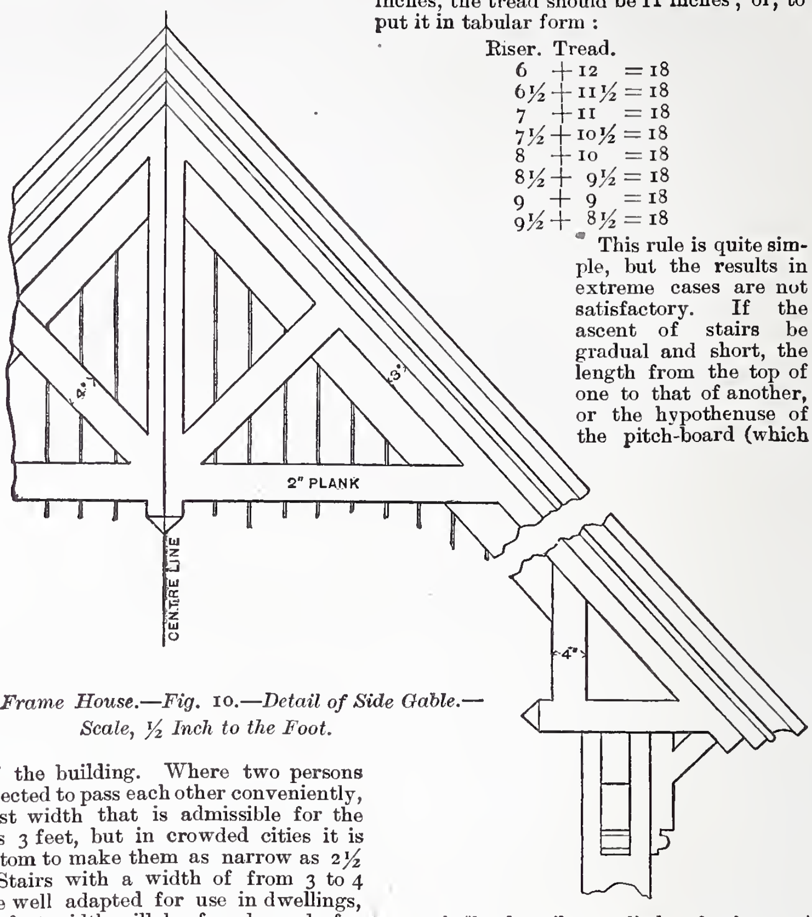


Cheap Frame House.—Fig. 9.—Detail of Piazza Column.—Scale, ½ Inch to the Foot.

can be made to furnish light to the stairs wherever they may be placed, and therefore their location becomes simply a matter of planning, which should be carefully considered in the original design of the building.

Winding stairs are those in which the direction is gradually changed by means of winders or steps which taper in width. Stairs of this character are very interesting to the builder, because of the greater skill required in their construction; but they are objectionable, because of the liability to accidents from their use. Accordingly, winding stairs are tolerated only where there is not enough space for stairs with flyers or steps of parallel width, nor are stairs in one long continuous flight desirable. Platforms or landings should be introduced at intervals, so that any one flight may not contain more than about 12 or 15 steps.

The width of the stairs should be in accordance with the character and import-



Cheap Frame House.—Fig. 10.—Detail of Side Gable.—Scale, ½ Inch to the Foot.

ance of the building. Where two persons are expected to pass each other conveniently, the least width that is admissible for the stairs is 3 feet, but in crowded cities it is the custom to make them as narrow as 2½ feet. Stairs with a width of from 3 to 4 feet are well adapted for use in dwellings, while 5 feet width will be found ample for stairs in buildings occupied by many people. From 8 to 12 feet width is sufficient for stairs in halls of assembly.

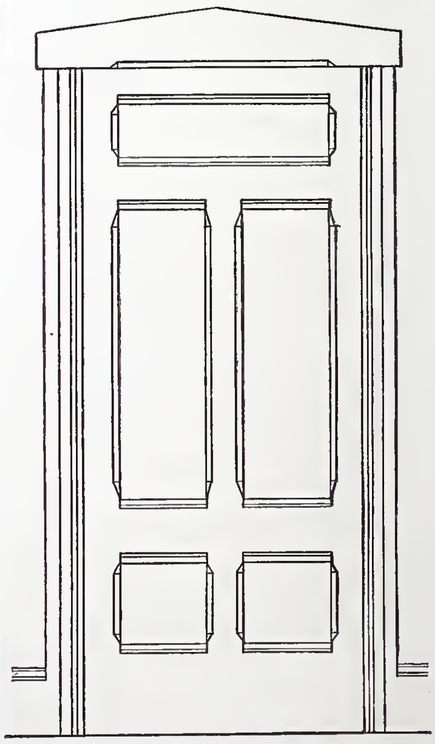
To avoid tripping or stumbling, care should be taken in the planning of stairs to secure an even grade. To this end the nosing or outer edge of each step should be exactly in line with all the other nosings. In stairs composed of both flyers and winders, precaution in this regard is especially necessary. In such stairs the steps, flyers and winders alike, should be of one width on the line along which a person would naturally walk when having his hand upon the rail. The tread line, consequently, would be parallel to the hand-rail. It is usually taken at a distance of 18 to 20 inches from the center of it. In the planning of stairs the tread line should be drawn and divided into equal parts, each part being the tread or width of the flyer from the face of one riser to the face of the next.

The extra exertion required in ascending a staircase over that from walking on level ground is due to the weight which a person at each step is required to lift—that is, the weight of his body. Hence, the difficulty of ascent will be in proportion to the hight of each step, or to the rise. To facilitate the operation of going up stairs, therefore, the risers should be low. The grade of a stairs or its angle of ascent depends not only upon the hight of the riser, but also upon the width of the step, and this has a certain relation to the riser, for the width of a step should be in proportion to the smallness of the angle of ascent. The distance from the top of one riser to the top of the next is the distance traveled at each step taken, and this distance should vary as the grade of the stairs. A person who, in climbing a ladder or nearly vertical stairs, can travel only 12 inches or less at a step, will be able with equal or greater facility to travel at least twice this distance on level ground; therefore, the dimensions of riser and step should be reciprocal. A low rise should have a wide step, and a high rise a narrow step.

Among the various rules for determining the relation of the rise to the tread or the net width of step, one is to make the sum of the two equal to 18 inches. The following example of this rule is taken from Hatfield's "American House Carpenter," to which we are indebted for other portions of this article. For a rise of 6 inches, the tread should be 12 inches; for a rise of 7 inches, the tread should be 11 inches; or, to put it in tabular form:

Riser.		Tread.	
6	+	12	= 18
6½	+	11½	= 18
7	+	11	= 18
7½	+	10½	= 18
8	+	10	= 18
8½	+	9½	= 18
9	+	9	= 18
9½	+	8½	= 18

This rule is quite simple, but the results in extreme cases are not satisfactory. If the ascent of stairs be gradual and short, the length from the top of one to that of another, or the hypothenuse of the pitch-board (which we shall describe a little further on) may be proportionately longer; but if the stairs be steep the length must be shorter. Those of our readers who care to investigate this particular part of the subject further will find other rules described in *Carpentry and Building* in the issue for February, 1879, page 23. The rules there given relate more especially to English custom. What we shall now present is restricted to what is deemed good practice among American stair builders.



Cheap Frame House.—Fig. 11.—Detail of Interior Doors.—Scale, ½ Inch to the Foot.

Besides the considerations already named which determine the angle of ascent, the strength and hight of the class of people who are to use the stairs must be taken into consideration. Tall and strong persons will take longer steps than short and feeble people. The hypothenuse of the pitch-board should be made in proportion to the distance taken in a step on level ground by the persons who are to use the stairs. If the people are divided into two classes, one composed of robust workmen, the other of delicate women and infirm men, then there may be two scales formed for the pitch-boards of stairs. One would be suitable for use in shops and factories, and the other for dwellings. The distance on level ground traveled per step by men varies from about 26 to 32 inches, or, on an average, 28 inches. The hight to which men are accustomed to rise on ladders is 12 to 16 inches, or, on an average, 14 inches. With these dimensions, therefore, of 14 and 28 inches, a scale may be formed for pitch-boards for stairs in buildings to be used exclusively by robust workmen; and with 12 and 24 inches—which dimensions are determined in an analogous manner—another scale may be formed for pitch-boards for stairs in buildings to be used by women and feeble people. Based upon these two sets of dimensions, the following tables, which appear in the "American House Carpenter," have been computed :

STAIRS FOR SHOPS.

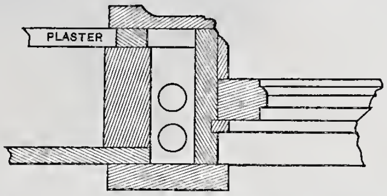
Rise.	Tread.	Ratio of Rise to Tread.
2.	24.	1 to 12.
3.	22.	1 to 7.33
3.50	21.	1 to 6.
4.	20.	1 to 5.
4.50	19.	1 to 4.22
.	18.	1 to 3.60
5.4	17.20	1 to 3.19
5.7	16.60	1 to 2.91
6.	16.	1 to 2.67
6 25	15.50	1 to 2.48
6.50	15.	1 to 2.31
6.70	14.60	1 to 2.18
6.90	14.20	1 to 2.06
7.	14.	1 to 2.
7.20	13.60	1 to 1.89
7.40	13.20	1 to 1.78
7.60	12.80	1 to 1.68
7.80	12.40	1 to 1.59
8.	12.	1 to 1.50
8.20	11.6	1 to 1.41
8.50	11.	1 to 1.29
8.80	10.40	1 to 1.18
9.	10.	1 to 1.11
9.30	9.40	1 to 1.01
9.60	8.80	1 to 0.92
10.	8.	1 to 0.80
10.50	7.	1 to 0.67
11.	6.	1 to 0.55
11 50	4.95	1 to 0.43
12.	3.58	1 to 0.30

STAIRS FOR DWELLINGS.

Rise.	Tread.	Ratio of Rise to Tread.
2.	20.	1 to 10.
3.	18.	1 to 6.
3.50	17.	1 to 4.86
4.	16.	1 to 4.
4.50	15.	1 to 3.33
5.	14.	1 to 2.80
5.40	13.20	1 to 2.44
5.70	12.60	1 to 2.21
6.	12.	1 to 2.
6.25	11.50	1 to 1.84
6.50	11.	1 to 1.69
6.75	10.50	1 to 1.56
7.	10.	1 to 1.43
7.10	9.80	1 to 1.38
7.20	9.60	1 to 1.33
7.30	9.40	1 to 1.29
7.40	9.20	1 to 1.24
7.50	9.	1 to 1.20
7.60	8.80	1 to 1.16
7.70	8.60	1 to 1.12
7.80	8.40	1 to 1.08
7.90	8.20	1 to 1.04
8.	8.	1 to 1.
8.10	7.80	1 to 0.96
8.30	7.40	1 to 0.89
8.50	7.	1 to 0.82
8.75	6.50	1 to 0.74
9.	6.	1 to 0.67
9.30	5.40	1 to 0.58
9.60	4.80	1 to 0.50
10.	3.90	1 to 0.39
10.50	2.20	1 to 0.21

These tables are useful in determining questions involving the proportion between rise and tread of a pitch-board. For stairs in which the run is limited, to determine the number of risers which would give an easy ascent, divide the run by the hight, and find in the proper table above the ratio nearest to the quotient, and in a line with this ratio in the second column to the left will be found the corresponding riser. With this divide the rise in inches, the quotient, or the nearest whole number thereto, will be the required number of risers in the stairs.

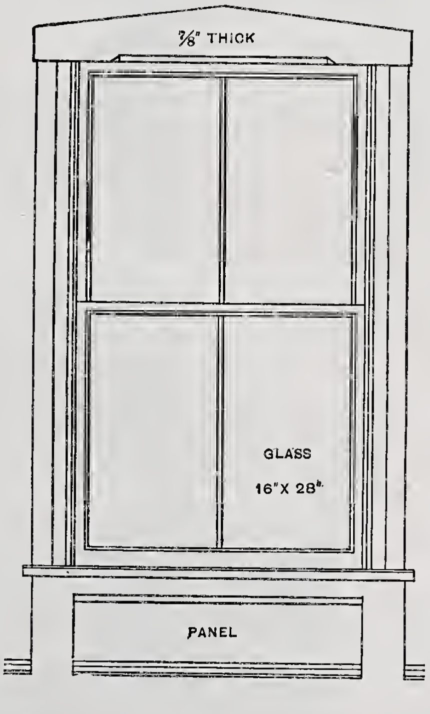
For example, take the stairs in a building in which the rise is 12 feet and 8 inches, or 152 inches, and in which the run between the extreme risers is 17 feet 2 inches. To this latter sum, for the purpose of obtaining a correct angle of ascent, by having an equal number of risers and treads, add for one more tread—say, 10 inches, its probable



Cheap Frame House.—Fig. 12.—Horizontal Section through Windows.—Scale, 1½ Inches to the Foot.

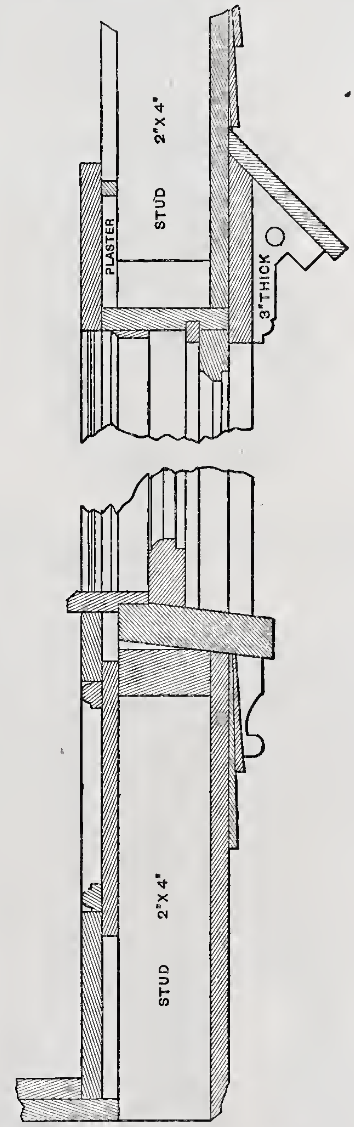
width—thus making the total run 18 feet, or 216 inches. Thus, we have for the run 216 and for the rise 152. Dividing the former by the latter gives us 1.42, nearly. In the table of stairs for dwellings the ratio nearest to this is 1.43, and in the line to the left in the second column is 7, the approximate size of riser appropriate to this case. Dividing the rise 152 inches by this 7, we have 21 5-7 as the quotient. This is nearer to 22 than to 21 ; therefore, the number of risers required is 22. When the number of risers is thus determined, the rise divided by this number will give the hight of each riser. Thus, in the case just cited the riser is 152 inches ; this divided by 22 gives 6.999 inches for the hight of the riser.

When the hight of the riser is known, if the run is unlimited the tread will be found in the proper table above. For example, if the rise is 7 inches or nearly that, then in the table of stairs for dwellings in the next column to the right and opposite 7 in the column of risers is found 10, the approximate width of tread. When the run is limited and the number of risers is known, then the width of tread is obtained by dividing the run by the number of treads. There are always one less of treads than risers in each flight.



Cheap Frame House.—Fig. 13.—Interior Finish of Windows.—Scale, ½ Inch to the Foot.

In the above description of stairs we have made use of several terms which it may be well to define before we proceed further. In this connection we shall also introduce definitions of some terms which it will be necessary to employ in describing the construction of stairs. Those parts of stairs upon which we step in passing over them are called steps or treads. Technically the word tread means the horizontal distance gained at each step. The upright pieces which support the front edge of the steps are called risers. The hight gained by each riser is called the rise. The horizontal distance occupied by the entire flight of steps or stairs is called the run. Winders are steps which taper in width, and which accordingly are employed in what are known as winding stairs. Flyers are steps of parallel width, and are of the kind employed in common forms of stairs. The nosing is the outer edge of the step. The tread line is the line along which a person would natur-



Cheap Frame House.—Fig. 14.—Vertical Section through Windows.—Scale 1½ Inches to the Foot.

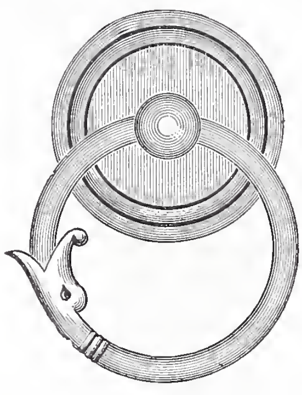
ally walk when having his hand upon the rail. The pieces which sustain the stairs and to which the step and risers are fastened are called string pieces, also stringers and sometimes strings. The pitch-board is a right-angled triangle, which shows the pitch of the stairs, the base representing the width of the tread, while the altitude represents the hight of the rise. It is usually made of a dry piece of thin stuff, with the grain of the wood parallel to the hypothenuse. The well hole, or, as it is sometimes called, the well, is the open space in the middle of a staircase beyond the ends of the stairs. The same term is also applied to the open space in the middle of a winding staircase and to the opening in the middle of a staircase built around a hollow newel. When in passing up an open stairway the right hand is next the rail, the stairway is called a right-hand stairway. On the contrary, when the rail is at the left hand it is called a left-hand stairs.

With reference to the construction of

stairs, it may be stated that in some instances all the stringers are notched cut and the steps and risers are nailed over them. In other cases one or both of the outside stringers are left straight on the top edge and are mortised about half way through to receive the steps and risers. When this is done the mortises are usually made so as to admit of wedges being driven back of the steps and risers. This insures a tight fit on the face side. The wedges are glued in, and therefore hold the steps and risers fast to the string-pieces.

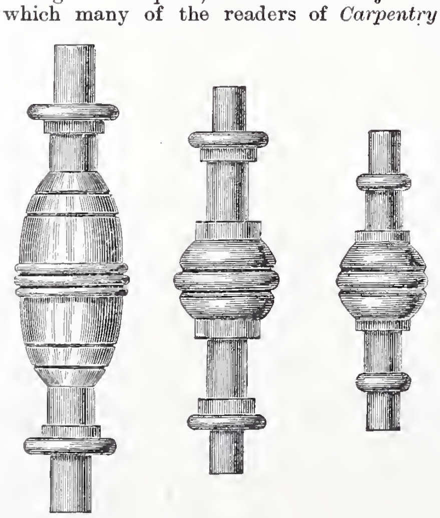
Cabinet Hardware.

Boule, the famous French cabinet maker, the inventor, or, at least, the first great designer in what is now erroneously called "Bulwork" (it should be Boule work), made conspicuous use of metal in the decoration of furniture, and he employed it in all cases with great advantage. Decorated metal



Cabinet Hardware. — Fig. 1. — Antique Drawer or Cabinet Ring-Handle (Full Size).

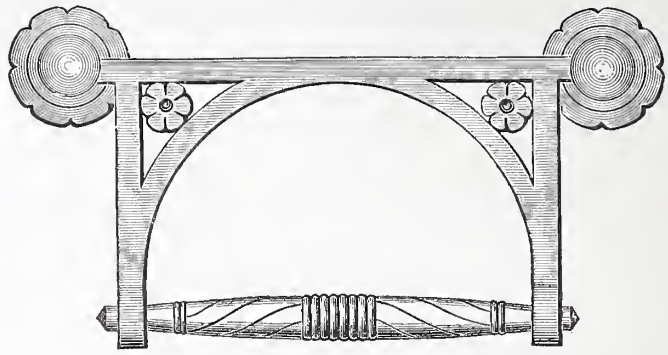
panels, gilt rails and gilt rods, and a variety of other forms of metal, were freely employed by him, and always with the best results from an artistic standpoint. At the present time metal trimmings and metal ornaments are very freely used in various connections. Metal forms a conspicuous feature of cabinets and of all the finer specimens of fancy wood-work which are employed in decorating and embellishing modern houses. Since cabinet hardware is in such general request, it becomes a subject in which many of the readers of *Carpentry*



Cabinet Hardware.—Fig. 2.—Furniture Spindles (Full Size).

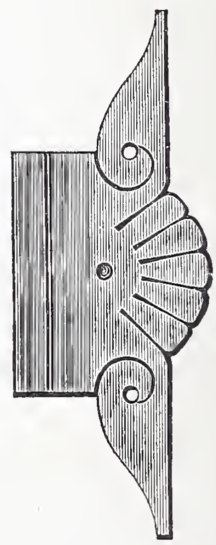
and Building are especially interested. To cabiuet makers it appeals directly, and yet, as a class, they among all our readers are likely to be better informed upon those points concerning which we shall write, than the carpenters and amateurs who occasionally get up odd fancy articles for their own use or for presents to their friends. This latter class, no doubt, will particularly appreciate information as to what the market affords and where the goods may be obtained, while all, we believe, will be interested in considering some points with reference to the use of work of this kind, and the principles which govern taste with respect to it.

Comparatively speaking, it is but a very short time since our hardware manufacturers commenced making what we have termed cabinet hardware, or, indeed, since there has been any demand for goods of this character. At the Centennial Exposition there were many samples of fine hardware upon carved boxes and cabinets. In the Women's Pavilion there were some notable samples, designed by the ladies who carved the furniture. These were cast from original wax or wooden models, and to many who saw them were a revelation in the way of making hardware decorate the articles on which it was used. Specimens of work of this kind also attracted attention upon the samples of English and Continental cabinet work brought into this country during the past few years, both by private individuals and enterprising dealers. When imitations came to be made here, or, rather, when cabinet work of this general character came to be manufactured by our home establishments, the first supply of trimmings was from the English manufacturers, but prices were so high that anything but the most sparing use of the goods made the work too dear to sell. As soon as it became evident, however, that there was a real demand for goods of this character, American enterprise was equal to the task, and in a short time manufacturers on this side of the water were offering to the trade better designs and better workmanship than it had been possible to obtain in a foreign market.



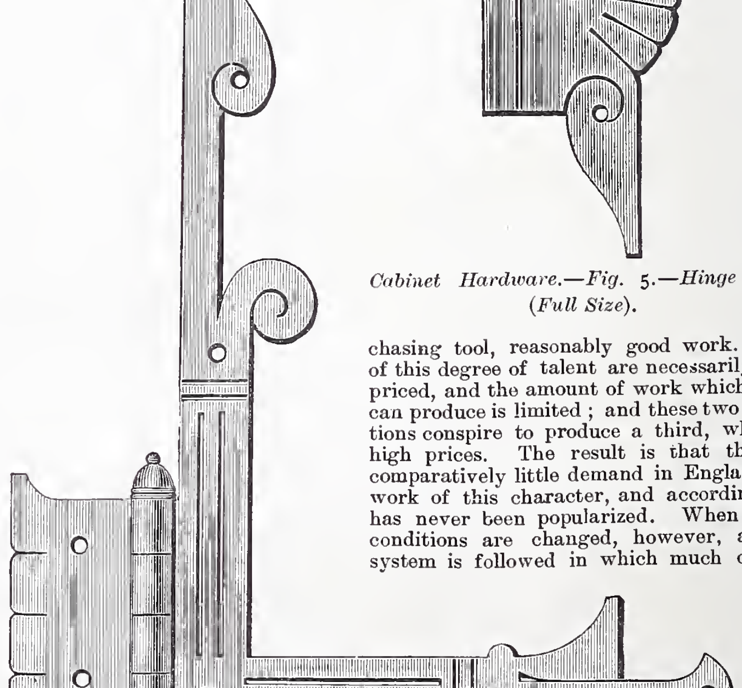
Cabinet Hardware.—Fig. 3.—Drawer or Cabinet Handle (Full Size).

The cost of English hardware of this general description is almost too great for belief. The simplest articles are priced altogether out of proportion to their value, whether considered from the standpoint of the work expended upon them or from that of their artistic excellence. There are a variety of reasons for this condition of affairs, and a mention of them will show the superior advantages enjoyed by American makers over the system of manufacture employed in England. There it is necessary for the workmen to have a considerable amount of artistic skill in order that he may produce in a free-hand way, by means of the file and



Cabinet Hardware.—Fig. 5.—Hinge Plate (Full Size).

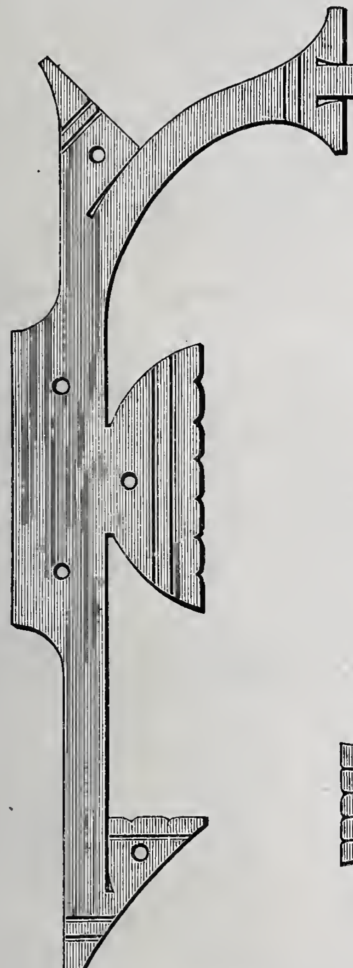
chasing tool, reasonably good work. Men of this degree of talent are necessarily high priced, and the amount of work which they can produce is limited ; and these two conditions conspire to produce a third, which is high prices. The result is that there is comparatively little demand in England for work of this character, and accordingly it has never been popularized. When these conditions are changed, however, and a system is followed in which much of the labor is performed by machinery, lower prices are the result and greatly increased sales follow. The artist, under this system, has merely to look after his designs, and, therefore, works with the same freedom in wood or metal as on paper. Hence it follows that the mechanical quality of work produced in this country in which the conditions are as we have last described, is



Cabinet Hardware.—Fig. 4.—Corner Hinge Plate, with Hinge Attached (Half Size).

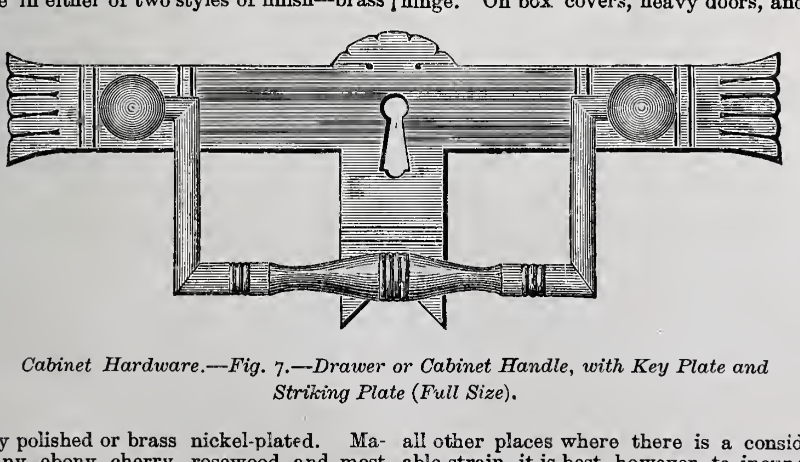
greatly improved, while prices are reduced to surprisingly low figures. And, further, this system is calculated to give results much better than can be expected from the old methods, because it enables men of much higher ability to take up the actual production of fine work.

Such, then, are some of the circumstances under which American hardware manufacturers have commenced to produce art metal



Cabinet Hardware.—Fig. 6.—Antique Corner Hinge-Plate (Half Size).

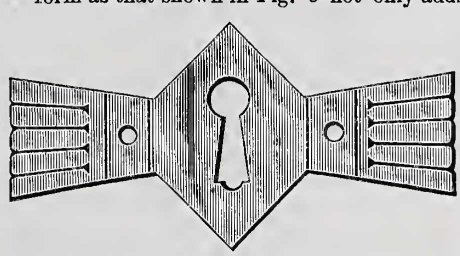
work for furniture decoration. The accompanying engravings, for which we are indebted to Messrs. J. B. Shannon & Sons, Philadelphia, are fair illustrations of goods of this character as they are being made at the present time. As noted under the several cuts, the designs presented are either full size or half size, from which our readers can judge of the effect and of their suitable ness for placing in certain positions. All the designs here shown are furnished to the trade in either of two styles of finish—brass



Cabinet Hardware.—Fig. 7.—Drawer or Cabinet Handle, with Key Plate and Striking Plate (Full Size).

finely polished or brass nickel-plated. Mahogany, ebony, cherry, rosewood, and most of the dark and rich woods in use harmonize well with polished brass or gilt metal. White holly and maple will also bear gilt decoration. Silver, on many kinds of wood, has a far better appearance than brass or gold, and nickel-plate is, from an artistic standpoint, almost identical with silver. From this our readers can judge of the wide range of application to which these designs are adapted.

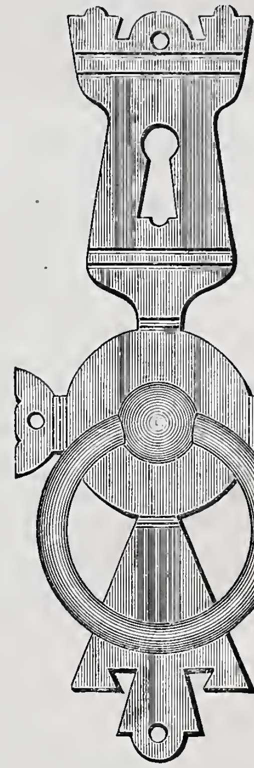
One of the most conspicuous articles of cabinet hardware in use is known as the hinge plate. Hinge plates are of two general kinds—those which are attached to the hinges, an example of which is shown in Fig. 4, and those which are put on simply for ornament, examples of which are shown by Figs. 5 and 6. The first are more expensive than the others, as the cost of making a hinge with a large plate attached is greater than that of making an ordinary butt. Hence it is that in general use designs of the kind shown in Figs. 5 and 6, which are to be used in connection with the ordinary brass butts to be bought at any hardware store, are more popular than those of the kind shown in Fig. 4, which commonly are applied only to the more elaborate and expensive articles of cabinet work. In spite of the quarrel which the artistic people have with all sorts of shams, among which are included hinge plates of the kind we have just described as being in general use, we believe these plates have a good and sufficient excuse for being employed. Such a form as that shown in Fig. 6 not only adds



Cabinet Hardware.—Fig. 8.—Antique Escutcheon (Full Size).

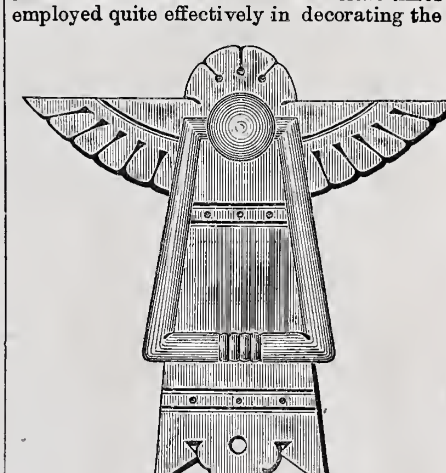
to the beauty of any door to which it is attached, but it also increases the strength of the door by bracing the rail and stile. Indeed, the primary object of the old metal workers in arranging hinge plates, and in some instances almost covering doors with them, was to secure the woodwork most effectually. Hence a plate of this character serves a useful purpose, and is not to be considered as a decorative feature alone. We hold, therefore, that when a plate is applied separately which both strengthens and decorates a door, it is not in bad taste, even though it has no solid connection with the hinge. On box covers, heavy doors, and in all other places where there is a considerable strain, it is best, however, to incur the extra expense and employ plates to which hinges are attached, after the manner shown in Fig. 4.

A keyhole is usually considered well finished when it is provided with a flat metal escutcheon with a proper opening for the key. Much more than this, however, is really required, as the ancient hardware makers knew. There should be either a boss or a large depression, in order that in the dark the key may be readily guided into the lock. In the next place, if the boss is used there must be a depression in the cen-



Cabinet Hardware.—Fig. 9.—Ring Handle for Cabinet or Drawer, with Key Plate and Striking Plate (Full Size).

ter by which the key shall be guided into the keyhole without delay or difficulty. A keyhole with a slight rim is very annoying. The key encounters the rim at the last moment and slips too far or catches. If a deep depression is used around the key, the key very readily finds its way into the hole. Both of these methods were in ancient times employed quite effectively in decorating the



Cabinet Hardware.—Fig. 10.—Drawer or Cabinet Handle, with Striking Plate (Full Size).

fronts of boxes, doors, gates, &c. Many of the modern wood escutcheons to be seen on furniture are models in respect to the ease with which the key is directed into the lock without danger of marring the surrounding surfaces. Ornamental keyhole plates of the general character illustrated by Fig. 8 have a far different use. Such plates are intended for use upon locks which are never opened except when there is an abundance of light. Their use, therefore, is a double one—they defend the keyhole from wear, and they decorate the surface upon which they are placed. When they are finished in gilt they form beautiful contrasts with all kinds of dark wood. Figs. 7 and 8 illustrate keyhole escutcheons, in combination with very convenient drawer pulls. In both of these instances are illustrations of a small matter, attention to which renders the trimmings much more satisfactory for use than they would be otherwise. The rings or pulls have striking plates which prevent them from injuring the varnish or polish of the wood upon which they may be mounted. On this account the pull shown in Fig. 1 would not, in many situations, be as desirable as those to which we have just referred.

Fig. 3 illustrates a style of handle which is quite new in design, and is becoming exceedingly popular for more substantial reasons than ordinarily attach to the preferences for certain goods. The handle is provided with a stop, which prevents it passing inside a vertical line. It is unusually convenient in shape, while its general appearance is such as to recommend it for use. The drawer pull shown in Fig. 10 is a very handsome design, whether finished in silver, nickel or gilt. It is convenient in shape, and has also a striking plate for the pull, the advantages of which we have just recited. It is secured to the drawer or door upon which it may be used by a bolt and nut at the top and a screw at the bottom. In this connection it may be remarked that the convenience with which all these trimmings may be removed from the furniture on which they are placed, greatly facilitates the process of cleaning and polishing which all such goods require at stated intervals, and also removes all danger to the wood incident to the act of cleaning.

Fig. 2 represents some turned brass spindles, the use of which forms a most effective relief in a great variety of situations. By their construction they are very easy of application, and a number of uses to which they may be applied will readily suggest themselves to our readers.

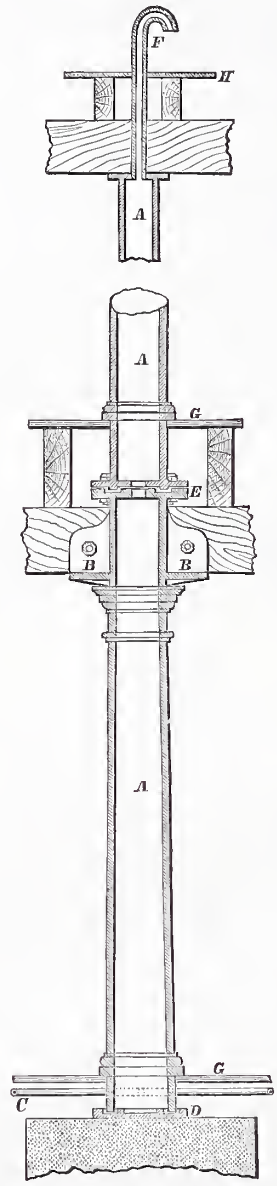
In using metal cabinet trimmings, it is to be kept in mind that wood is subject to shrinkage and that metal is not. When wood and metal, therefore, are combined in the same article, the metal should be fastened in such a way that shrinkage will not in any way loosen the metal or draw the wood away from it, so as to present unsightly gaps. To do this, it is only necessary to exercise a little care in devising the method by which the metal is to be attached. We have seen brass-trimmed work-boxes in which the greater portion of the brass was secured by glue or cement. The least shrinkage would, of course, instantly sever the connection between the two, and once separated there was no chance of bringing them together again. On the other hand, when metal-work is secured by screws and the trimmings are laid on the surface, the shrinkage does not cause any defect and the metal remains secure to the end.

Fire-Proof Iron Columns.

In this day of great conflagrations and inadequate protection from the ravages of the fire-fiend, much attention is being given by engineers and inventors to the subject of rendering existing methods of construction measurably fire proof. Among the plans which have been suggested for protecting iron columns, which, as is well known, soon give way under great heat, is that of filling them with water. A plan for accomplishing this end is illustrated by the accompanying engraving, which represents what is known to the trade as Mettam's system of fire-proofing iron columns.

The advantages of filling columns with water may be briefly stated. In case of fire, columns so filled cannot be injured by heat, and, therefore, their sustaining ability is assured. In illustration of this, take a common iron pot in which water is being boiled; the under side of the pot in which the water is boiling may be pressed with the hand without fear of burning. Now, when heat and flame reach and surround a column filled with water, the water inside commences to heat, and as it heats it commences to circulate, so that, like the pot, the column can scarcely be made so hot that the hand could not touch it. As the water inside the column becomes heated it gives off steam, and, in order that this confined steam may not cause an explosion in the columns, a vent pipe is carried from the top of the upper column out through the roof, as shown by F, in the engraving. This pipe also serves another purpose, that in case the water level rises above the extreme hight of the columns, it can find an outlet through the pipe, and flow away on the roof without doing damage.

This system of protection to iron columns does not in any way alter the outside appearance of the columns to the eye. Whatever diameter of column and whatever thickness of metal would be required upon other considerations, is still adhered to where this system is adopted. There is but little change in construction necessary. In a modern store or warehouse, in each story a central line of columns supports the girders and floor beams. The columns stand one on



Mettam's Fire-Proof Iron Columns.

top of the other, an iron plate intervening. The only modification of construction required is clearly shown in the engraving. At the bottom of each of the lower columns a hole is drilled and tapped, and into this is screwed a short piece of pipe. Connecting these branches a supply pipe is run, so that when the water enters this pipe it will simultaneously pass into the columns. The water rises from the inside of the basement column to the first-story column, and so on upward. The shapes of the plates and the mode of connecting the columns together, as well as supplying the water to the columns and in passing the water from one column to another, can be accomplished in many ways. Such variation of details will occur to any architect, engineer or steam fitter, by which he will be enabled to adapt the construction according to requirements.

Referring to the engraving: A A are iron columns, B B are brackets cast on the columns to support the usual wooden or iron girders and floor beams, C is a water-pipe, D is the bottom plate of the column, E the connection between the columns, F is the vent-pipe at the roof, G G the floors.

This system of fire-proofing columns can be applied to existing buildings having solid intervening plates between the columns in different stories, by making the connection between the columns through an outside pipe passing around the plate. This invention is controlled by the Etna Iron Company, 104 Goerck street, New York, although we understand that licenses are being granted to iron-founders, thus making it possible to obtain columns of this construction in almost any part of the country without exorbitant charges in the way of transportation.

HEATING AND VENTILATION.

Expedients for Use in Buildings Already Constructed.

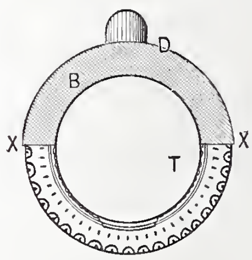
BY REV. DANIEL C. JACOKES, D. D.

To secure the greatest convenience, health and economy in heating and ventilating our private homes, and our churches, schools and other public buildings already constructed, is the object of this paper. To accomplish this purpose two things are to be done:

1. The warming of buildings with efficiency and economy.

2. The ventilation of buildings so as to secure pure air for the use of the occupants.

The supply of pure air for breathing purposes is of more importance to secure health



Heating and Ventilation.—Fig. 1.—Application of a Jacket to an Ordinary Stove. D, Jacket Fitting against Sides of Stove at X X. B, Open Space at Top. Corresponding Space at Bottom is Closed. T, Section through Stove.

than the amount of warmth, as breathing impure air is certainly known to be the cause of a large majority of diseases which afflict communities. It prepares the system for every contagious disease to which it may be exposed, and originates many other diseases from which we suffer.

It is not the design of this paper to fully discuss the results of breathing impure air or living in ill-warmed rooms, but to call the attention of thoughtful persons to this subject in such a manner as to show more clearly the importance of properly warming and ventilating our homes, and to illustrate the manner of accomplishing this desirable object. It may be proper to inquire, in the first place, What constitutes pure air?

1. Pure air is composed of 79 parts of nitrogen and 21 parts of oxygen; there are also about 4 parts in 10,000 of carbonic acid. Air containing more than 6 parts in 10,000 of carbonic acid is considered impure and injurious.

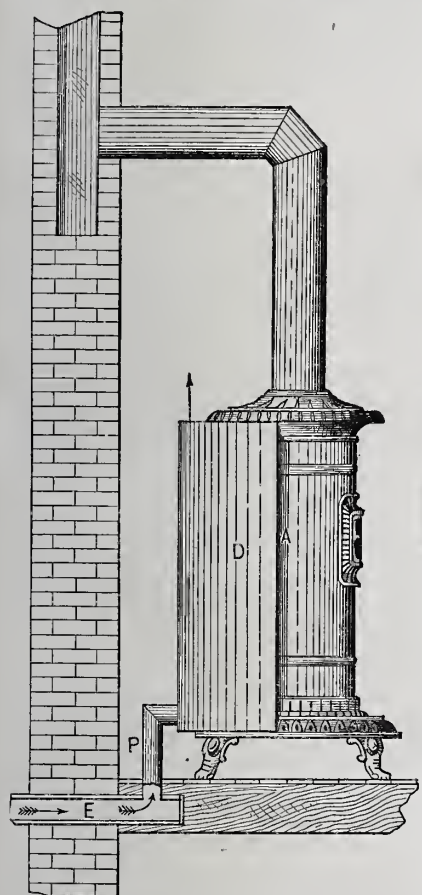
Nitrogen is a transparent gas without color or taste, noted for its chemical inertness, and is combined with other substances by indirect means. It does not support combustion or respiration; it will immediately extinguish a flame, and animals breathing it will die. In the atmosphere it dilutes the other gases by diffusion. It is a law that gases will intimately mix with each other, irrespective of their specific gravities; nitrogen thus minutely divides the oxygen, so as to secure to us its greatest benefit in respiration.

Oxygen is a tasteless, colorless, inodorous gas, a universal supporter of respiration, and is essential to combustion ; without it all animals would die.

Carbonic acid, when inhaled, is a poison and destroys life ; outdoor air contains about 4 cubic feet of this gas in 10,000. This is so diffused that it cannot do harm to the health of those who breathe it. If more than 6 parts in 10,000, the air is impure, and it would be unhealthy to breathe it. With pure air in our habitations and public buildings, we shonld be protected from most diseases which now destroy the health and lives of so many of our fellow men.

2. We inquire into the composition of impure air.

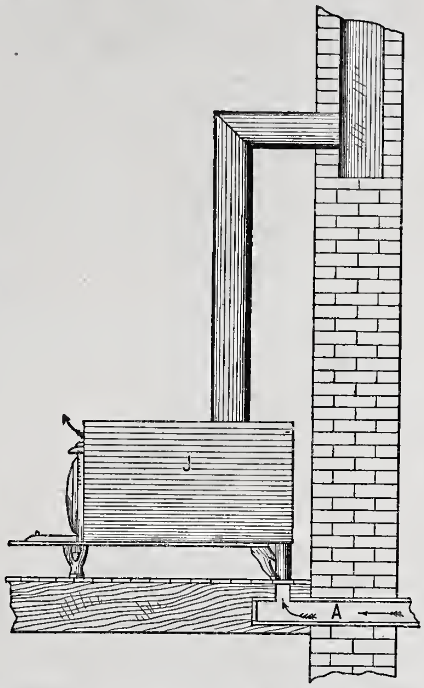
The impurities in the air are commonly represented by carbonic acid exhaled from the lungs; there are other impurities produced by respiration, perspiration, combustion of oils, gases, organic matter, excess of water, exhalations from the sick, decaying matter, emanations from sewers, house



Heating and Ventilation.—Fig. 2.—General View of Stove, the Plan of which is shown in Fig. 1. D, Sheet-Iron Jacket. A, Edge of Jacket Fitted Tight against Side of Stove. F, Wooden Box, 6 x 12 Inches in the clear. P, Supply Pipe conducting Outdoor Air against Back of Stove. Arrows show the Direction of the Current of Air.

drains, cesspools, damp cellars. These, with more or less of the constantly increasing amount of carbonic acid, which, in many instances in our dwellings, schools and churches, amount to from 30 to 70 parts in 10,000 of air, added to the continual decrease of oxygen, will invariably produce dangerous and often fatal results. Those who are exposed to this poisoned air are never in good health, and are subject to heaviness, headache, furred tongue, quickened pulse, febrile symptoms, thirst, loss of appetite, catarrh, bronchitis, consumption, typhus or typhoid fevers, diphtheria, scarlet fever, croup (in children), and are prepared for any contagious disease to which they may be exposed, and their lives are invariably shortened. These are mostly preventable diseases. Such results should teach us the responsibility of securing, at any cost within our reach, pure air in our homes and public buildings. The possibilities of a vigorous, healthy life, who can estimate? Yet health and life, with their possibilities, are endangered, if not quickly sacrificed, in the foul air of our homes. Pure air would save millions of money and diminish human suffering to a minimum.

The amount of fresh air necessary to keep pure the atmosphere of occupied rooms will be about 2000 cubic feet per hour per person. The practical question now is, How shall this amount of pure, fresh, warm air be pro-



Heating and Ventilation.—Fig. 3.—The Same Principles Applied to Box Stoves, the Jacket Enveloping the Entire Stove except the Front. A, Supply of Outdoor Air. J, Jacket. Arrows show the Direction of the Current.

cured in our homes or public buildings already constructed—1. During summer ; and 2. During the time when artificial heat is used for warming them ?

The great difficulty in summer is to distribute the fresh air equally through the room, so as to avoid producing currents of air, which are injurious to persons who are at rest, as standing, sitting or sleeping. This may, in whole or in part, be done by opening the windows or doors on the opposite side of the house from which the wind comes ; also by lowering the upper sash of the window, having a curtain before it ; or better, perhaps, by raising the lower sash about 4 inches and placing a board under the sash so as to fill up the space entire. This will give an opening between the two sashes where they meet which will admit the outdoor air without producing an improper or sensible current across the room. This method may be used day or night, whatever be the temperature or season.

During cold weather ventilation should be produced by the aid of heat. The following rules should be carefully observed in heating and ventilation :

1. Conduct, in some convenient manner, outdoor air against a heated surface.

2. Conduct the indoor air from the floor into a heated flue. In this manner a complete circulation of air may be had, and an abundant supply of pure warm air may be secured ; provided, first, that the ducts be sufficiently large ; and, second, that the dust in the air be not burned by a red-hot surface. If these rules are observed, the heating and ventilating will be very economical and satisfactory. Most of the buildings, public and private, for human use are constructed without any reference to ventilation ; indeed, most of them seem to have been planned to prevent the possibility of either the light of the sun or the pure air of heaven entering them. There is, consequently, much difficulty in properly heating or ventilating them. Those who prefer health to the sight of the changes necessary in each case to secure such an end, must not object to see an additional pipe to convey foul air out of the room, and also a pipe to convey the pure outdoor air into it.

There are many buildings heated by a furnace. In these the pure outdoor air is properly heated ; but where there is no preparation for ventilation this may be secured in the same manner as when heated by a stove. The great majority of houses are heated by stoves. The outdoor air in such cases must be conducted to the surface of the stove, as illustrated by the following diagrams. These stoves have various shapes; whatever they may be, the principles will here be explained, so that any person may modify the method so as to secure the result desired. Fig. 1 shows how a sheet-iron jacket may be fitted to the back of a stove for heating the outdoor air brought within the jacket against the stove. The jacket is seen at the top of the stove, and is represented by the line marked D.

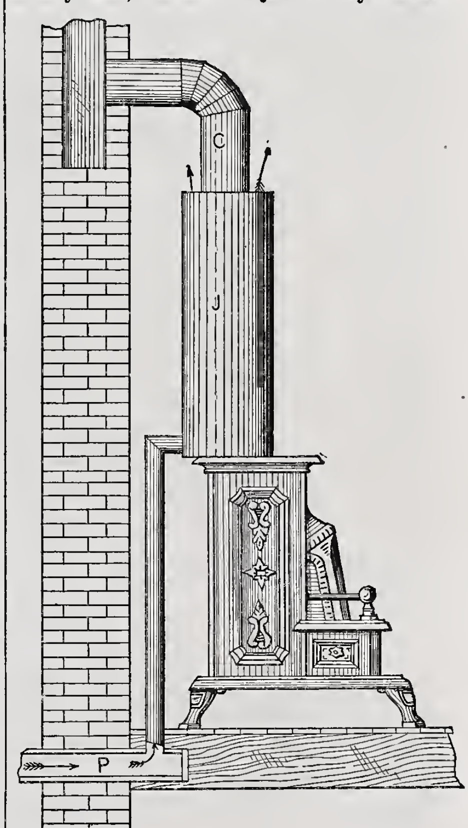
The jacket should never be more than 4½ inches from the back of the stove, and should always be closed at the bottom, so that the air in the room will never be reheated and breathed over again and again. This should be remembered whatever kind or form of jacket is used.

Fig. 2 illustrates the manner of conducting the outdoor air to the stove within the jacket for heating.

A wood stove may be jacketed in the same manner as a coal stove. In this case the jacket may be fitted to the sides of the stove very nicely, covering the back of the stove in the same manner as the wood stove, so that the sheet-iron jacket will be at an average distance of 4½ inches from the back ; never more than this.

Outdoor air may also be heated by conducting it within a jacket around the stove pipe of a wood or coal stove, as shown in section in Fig. 4.

In school-houses, where box stoves are mostly used, a sheet-iron jacket may inclose



Heating and Ventilation.—Fig. 4.—Heating Outdoor Air by Means of a Jacket Around the Stove Pipe. C, Stove Pipe. J, Jacket. P, Supply of Outside Air.

the stove excepting the front, which should be left open for the escape of the heated air. The space between the stove and jacket should be 4 inches—not more—on the sides and top ; on the back the jacket may be as wide as the hole in the floor—6 inches. An opening should be made through the floor at the back end of the stove near the jacket, 6 by 16 inches, if the jacket is wide enough to cover it. A pipe, the shape of the hole, should be fitted so as to reach a little above the bottom of the stove, that the air may reach the heated surface at once. Fig. 4, shows this arrangement.

(To be continued.)

CORRESPONDENCE.

We have allowed the unusually interesting and valuable array of practical articles which appear in the early portions of this number to encroach somewhat upon the space which we are in the habit of devoting to correspondence. We think, however, after perusal of what appears upon the preceding pages, none of our readers will regret our course in the premises this time. Besides this, owing to what causes we cannot say, we have been in the receipt of a less number of letters in the immediate past than has been customary during like intervals at other periods. We do not mean to say that we have lacked material out of which to fill up the correspondence department to the usual number of pages, but rather that if more letters are not sent along pretty soon we shall be in danger of running ashore. Will our practical correspondents take the hint and come to the rescue? Hip rafters, hopper bevels, division of a trapezoid, hanging doors, shingling, &c., although far from exhausted, have perhaps lost some of their freshness and interest for most of our readers. Who, then, will bring forward new topics for discussion, the investigation of which shall prove of equal profit and interest to those of the past? We desire to know from our readers just what they would like to find out. Accordingly, we invite you to make known to us what you are anxious to learn, and see if we cannot get the information for you.

Several inquiries of late have been addressed to us concerning the steel square, from which we infer that a knowledge of that indespensable tool is making progress among the craft, and that many mechanics are becoming very much interested in it. In order to show that *Carpentry and Building* has not been idle all these months, but that it has given this subject much more attention, perhaps, than the majority of our readers would believe at first thought, we append a partial list of the problems in the working of which the steel square can be used to advantage, and which have been explained in this paper during the time of its publication. We include in this list also those articles which we have published that have been descriptive and explanatory of the tool itself. Taken all together, what we have thus furnished our readers forms a far more practical treatise upon this most useful instrument than is to be found anywhere outside of our columns. But, with this said, it still remains that the list comes far short of exhausting the subject, and much more in the way of problems and rules can be added with material advantage. As we remarked in the article which appeared in the January number of this year, the steel square "in the hands of an intelligent mechanic becomes a simple calculating machine of most wonderful capacity." With this idea before our readers, we have a scheme to propose to them, the carrying out of which we believe can be made of great value. We want every practical reader of the paper to carefully examine the subjoined list, and then, if he knows of any rules which are not contained therein, to write us a description of them. Since the list is far from being exhaustive, it would seem that there are very few of our readers who cannot send us letters of this character. It is immaterial whether the rules thus forwarded are original with the writers or not. It makes no difference whether or not they have been already published in books or other papers. The only restriction which we shall place upon our correspondents in this matter is that no rule is to be forwarded which has not been practically tested by the party sending it, and concerning which he is not prepared to express himself definitely as to the advantages or disadvantages of its use. What we are after is not to acquire a list of theoretical problems which may be solved by the square—for this could be accomplished in a much easier manner than the one we have named—but a list of practical operations, the accounts of which shall come direct from the workshop and the framing yard, and which shall bear upon their face the stamp of practicability. By a considerable number of our readers giving attention to this matter we shall have the most useful kind of information to lay before our readers from month to month in this department, for it is hardly likely that the subject can be exhausted in a very short time.

THE STEEL SQUARE.

A partial list of problems in which the steel square may be advantageously employed, which have been described in *Carpentry and Building.*

Methods of testing steel squares for accuracy. Illustrated. Volume for 1879, page 32.

Obtaining the bevel for the foot of a post inclined in two directions by the square. Illustrated. Volume for 1879, page 133.

Finding the backing lines upon the foot of an inclined corner post with the square. Illustrated. Volume for 1879, page 172.

Obtaining the face bevels of girts in inclined frames. Illustrated. Volume for 1879, page 173.

Obtaining the top bevels of girts in inclined frames. Illustrated. Volume for 1879, page 187.

Calculating the length of posts inclining in two directions by the square (applicable to hip rafters). Illustrated. Volume for 1879, page 206.

Calculating the length of girts in frames which are of less width at top than at bottom. Illustrated. Volume for 1879, page 207.

Backing hip rafters. The square used for setting the bevel. Illustrated. Volume for 1879, page 217.

Calculating the length of braces by the square. Two rules. Illustrated. Volume for 1879, page 236.

The steel square described. Illustrated. Volume for 1880, page 12.

Marks and scales upon the steel square. Illustrated. Volume for 1880, page 12.

Diagonal scale of hundredths of an inch on steel squares. Illustrated. Volume for 1880, page 12.

The brace rules on steel squares. Illustrated. Volume for 1880, page 12.

Board measure on steel squares. Illustrated. Volume for 1880, page 12.

The octagonal scale upon steel squares. Illustrated. Volume for 1880, page 12.

Making a square stick octagonal by use of the square. Illustrated. Volume for 1880, page 56.

Obtaining the bevels in a square hopper by the square. Illustrated. Volume for 1880, page 57.

Can steel squares be improved? Volume for 1880, page 57.

Dividing a line or surface into equal parts by pocket rule or square. Illustrated. Volume for 1880, page 117.

Use of the steel square in backing hip rafters. Illustrated. Volume for 1880, page 118.

Use of square in obtaining hopper bevels. Four rules. Illustrated. Volume for 1880, page 134.

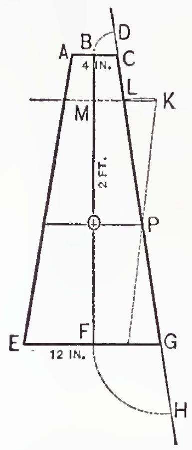
Determining circumference, diameter being given, by the square. Illustrated. Volume for 1880, page 139.

Laying off an octagon with the square. Illustrated. Volume for 1880, page 159.

Determining circumference from diameter. Illustrated. Volume for 1880, page 171.

The square in backing hip rafters. Illustrated. Volume for 1880, page 194.

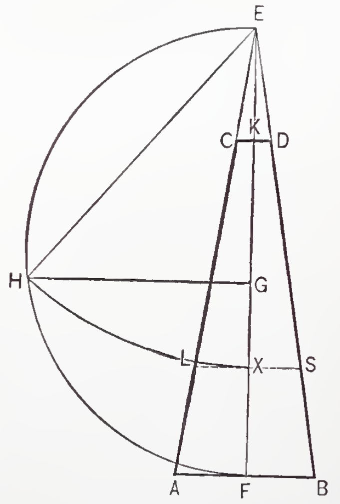
Problem of Equal Areas.



Problem of Equal Areas.—Fig. 1.—Solution Furnished by W. H. M.

From W. H. M., *Brooklyn, N Y.*—To my brother chips I would say that I have been somewhat interested in this problem of equal areas ever since it was first proposed. I was glad to see the solutions sent in, but from my limited skill they were not satisfactory. Please bear with me, therefore, in my simple effort at solving the problem. I first draw the board A C E G (Fig. 1). I then connect the center of the line A C with the center of the line E G by the line B F. After which extend the line C G indefinitely in both directions. Then make the distance from the point C to D equal to C B, and also the distance from the point G to H equal to G F, then will the center of the line D H, which is P, be the point through which, if a line be drawn parallel to the base of the given trapezoid, it will divide it into two equal parts. Now for proof. Set your compasses at G, and stretch to P; then with the radius G P swing from L to K. Now draw the line K M the same length as F G; hence it follows that P G and P K are of the same length, G H and G F of the same length, and also K M and L D are of the same length and O is the center.

Note.—The above attempt at a solution of the problem seems to be entitled to space in our columns by reason of its simplicity and novelty, without regard to its correctness, for unfortunately it seems to be wide of the mark. By experiment we have found that there are trapezoids of proportions to which it is applicable, but it will not solve the problem within the dimensions stipulated by the correspondent who first asked the question. We fail to see the relevancy of the proof adduced by our correspondent, and are left in doubt as to what he really had in mind when he penned that part of the letter.



Problem of Equal Areas.—Fig. 2.—Solution sent in by P. D.

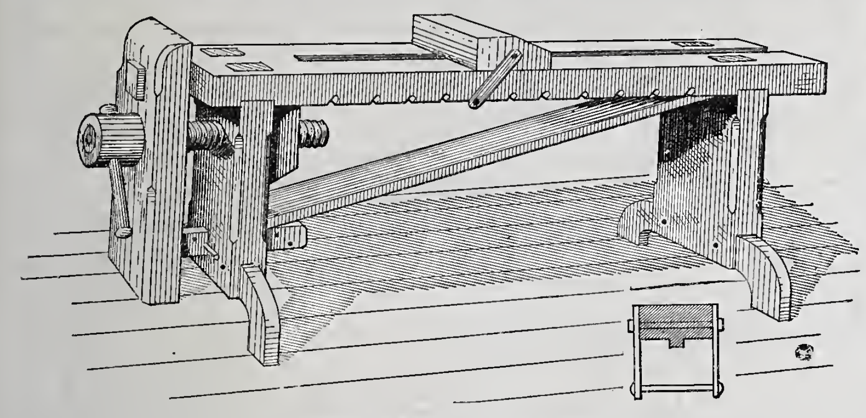
From P. D., *Wallingford, Conn.*—On E F (Fig. 2) describe the semicircle E H F. Divide the line E F at G, so that E G : E F : : M : N (M : N representing the ratio of the area of half the trapezoid plus the triangle E C D to the whole triangle E A B.) Erect G H perpendicular to E F, and join E H. Describe the arc, cutting the line E F in X. Through this point draw the parallel L S, which is the bisecting line required.

There is nothing but lines used in this demonstration. As for dividing the line E F in the point G in the given ratio, it is quite practical, as almost any one can divide a line into any required number of equal parts. In this case divide E F into nine equal parts; then take five of these parts from E toward F, and we get the point G.

Note.—This correspondent is evidently in error when he claims that the solution above given is in accordance with the original stipulations of T. V. D., which were to solve it by lines alone. This solution is mathematically correct, and indicates that our correspondent is more than an ordinary geometrician, but after conceding this much we are not disposed to acknowledge that he has solved the question by lines. This fact becomes evident by noting that he divides the perpendicular E F into nine equal spaces, and then counts from E toward F five spaces to determine the point G. If taking the steps which our correspondent has—that is, dividing the line E F into nine equal parts, &c.—were applicable to any trapezoid, whatever might be its dimensions, then we would at once admit that his method was strictly in accordance with the stipulations. But by every change made in the dimensions of the trapezoid there will have to be made a corresponding change in the number of spaces in the line E F, necessitating a new computation, arithmetical or otherwise. Hence the solution given by our correspondent, though correct, does not comply with the original request.

Clamp for Doors.

From W. H. C., *Tenn.*—I inclose you herewith a sketch of my clamp bench for clamping panel doors, sash, blinds or any other work that requires to be held in the same general manner. I have been using a bench of this description for some 24 years, and have found it quite satisfactory. It is made of hard oak, well seasoned and well put up. The size of stuff or clamp is 3 by 5 inches. The hight is 2 feet, and of course

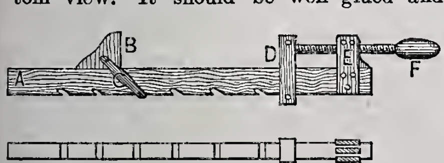


W. H. C.'s Clamp Bench, for Doors, Sash Blinds, &c.

may be made any length required. A tenon on the end on top of bench is made to go through the jaw, in order to keep the latter from working either right or left. A groove extends lengthwise of the top one-half inch deep and 1 inch wide, in which a tongue on the slide fits. The strap of the slide is made of eighth inch by 1¼-inch iron, with half-inch round iron pins riveted in. The small sketch shows the general construction of the slide.

From A. J. B., *Glyndon, Minn.*—I herewith send you a diagram of a wooden clamp for doors, sash, counter tops, wood shelves, table covers or any work which requires pressure, either for gluing or pinning. Wooden screws, although somewhat difficult to get in some localities, are preferable to iron screws in an article of this kind. Still, the iron screws may be used if wooden ones cannot be obtained. I suggest that if some manufacturer of carpenters' tools and machinery would make a good article of this kind and put it in the market, he would find ready sale for a large number. I hope this will catch some one's eye who has facilities for manufacturing.

The following is a description of my clamp: A, the bar, is about 4 feet long, 1¼ inches thick and 3 inches wide. The block B is of the same thickness; the slat C should be 1¼ inches iron, with a strong rivet at each end—one to hold the block and the other to catch in the notches on the bottom of the block. The block D should be 1¼ inches thick and 3 inches wide, and with mortise, through which the bar A passes. The head E should be 2 inches thick, firmly framed to the bar A, as shown by the bottom view. It should be well glued and



A. J. B.'s Clamp.

strengthened with pins at the upper end to prevent splitting. A good second growth hickory screw, 1 inch in diameter, and well-seasoned hard maple for the rest, completes the best tool for the purpose I have ever discovered.

Shingling.

From M. O., *San Jose, Cal.*—Responding to questions propounded by "Anon" in the April number, I will try to tell the few things I know about shingles and shingling. First, as regards the best timber for shingles. Here in California nature has solved the problem for us by furnishing wood superior to anything to be found in the Eastern States for the purpose. I refer to our red wood, which grows in great abundance. The trees are very large—from 3 to 10 feet in diameter at the butt—and are very free from knots or shakes. The timber lasts a long time, either as shingles or outside coverings for buildings, and also for underground work. It has another quality which recommends it for shingles—it is comparatively fire-proof. By this I mean that it ignites with some difficulty and burns very slowly. Next to red wood, cedar makes the best shingles.

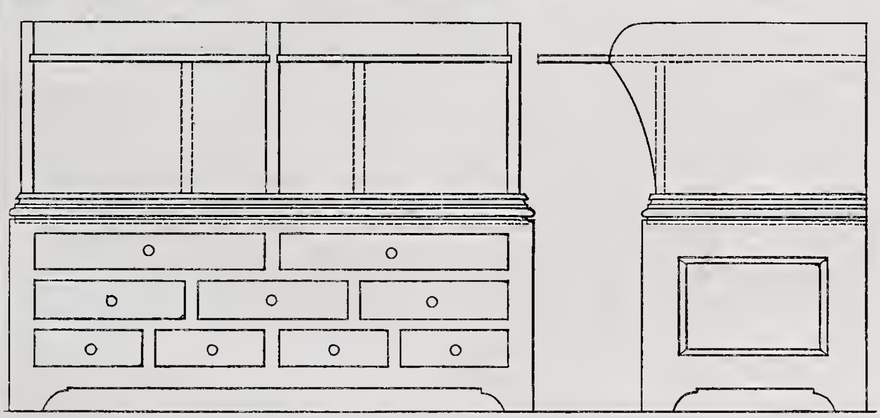
Shingles 16 inches in length should be laid from 4 to 5 inches to the weather. In most cases I prefer 5 inches rather than 4 inches. On steep roofs 5 inches is certainly good enough, and on flat roofs it is evident that the more courses laid the flatter the upper surface of the shingles will be. In my opinion narrow shingles from 4 to 6 inches in width make a much better roof than wide ones. In laying shingles upon a roof for myself, I should split all those which were over 7 inches in width before I laid them, and would use one nail only in each shingle near the edge, always nailing same side.

I think lime the best preservative for shingles. Allow the bunches to stand one end in a tub of lime water for a short time before using them; let them dry, as they will be cleaner for handling. Every tumble-down building in the country containing a chimney laid up in lime mortar, is a witness to the good qualities of lime as a preservative of shingles. I have frequently noticed that the shingles below the chimneys in such cases are firm and smooth, while all the rest of the roof is more or less used up. I have had but little experience in painting shingles, except for show. But I see no reason why paint should not have a good effect on shingles. I should in all cases lay the shingles first, and paint them afterward. Boarding under shingles should be tight or open as the building is required to be more or less warm. The difference in time that shingles will last will not make up for the defects in the warmth of the building. In shingling hip roofs, put the shingles on and nail them as usual, allowing them to project over the hip. Then, with a sharp chisel—a large framing chisel is best—cut off all that project above the line of the other side. Next lay the adjacent side, and cut in the same manner. By laying courses clear around the roof the hips will come on as desired. It is good policy to nail a strip of tin or zinc about 4 inches wide over the top of shingles on the hip. If smooth cut and carefully laid, this will last as long and be as tight as any part of the roof.

From W. W. Y., *Stillwater, Minn.*—My advice to the shinglers is, never shingle without a straight-edge, so called, if it is possible to have one. If the straight-edge in width is equal to the amount you are putting to the weather, so much the better. If not, size it every 4 or 5 feet to the width required, so that you can tell at a glance when you have it in the right place. I use siding for a straight-edge if I can get it handy; when I can't get siding I make the next best shift I can. Division of labor in shingling, one to lay and the other to nail, changing off from time to time, is a great advantage. In this way much more will be accomplished by two men in one day than one man can do in two days. I think it is always best to nail about a half inch from the edge of the shingle and to put but two nails in each shingle. Every shingle over 8 inches wide should be split in two. For driving, I use a light lathing hatchet.

Flour Chest.

From A. G. S., *Chattanooga, Tenn.*—I inclose a sketch of a flour chest, which you may present to the readers of *Carpentry and Building* if you see fit. Each of the larger bins will hold one-quarter barrel of flour, while the smaller ones will contain one-eighth barrel. In hight the chest is made so that the sliding lids come at the right point for use as molding boards. They are made reversible, so that one side is always kept clean for that purpose. The drawers below the bins may be used for various kinds of supplies, spices, &c. It is evident from the construction that they may be changed in size and shape to suit the notion of the person making the chest. I got up an article of this kind to suit myself. In the first place, it was so well liked by those who inspected it that I have had two more to make since. For convenience in handling I make the chests in two parts, the upper part sitting down on the lower, as indicated by the dotted lines.



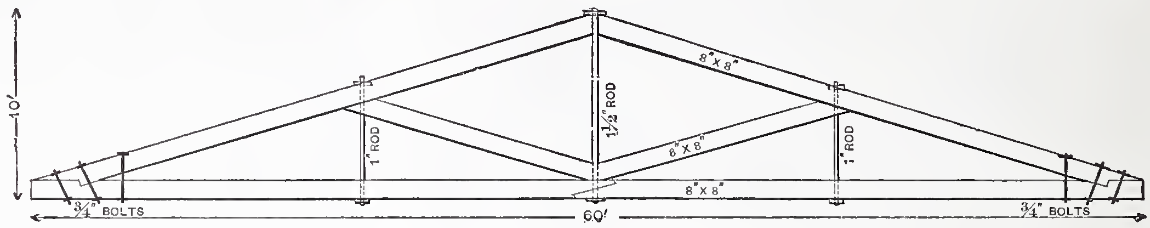
Flour Chest.—Contributed by A. G. S.

Estimating Stairs.

From T. S. W., *Cleveland, Ohio.*—In my letter on the matter of estimating cost of stairs, which was published in the September number of *Carpentry and Building*, I notice an error. It reads: "Figure walnut at 8 cents, cost 5 cents per foot." It should be "cost 10 cents per foot," the price of first quality here. By doubling the cost of lumber at 8 cents it gives 16 cents per foot, leaving 6 cents per foot for labor. In like manner, if oak costs 3½ cents per foot and is figured at 5 cents, doubling the cost—making 10 cents per foot—leaves 6½ cents per foot for labor. This is entirely correct, as oak is harder to work than walnut.

Examples of Roof Trusses.

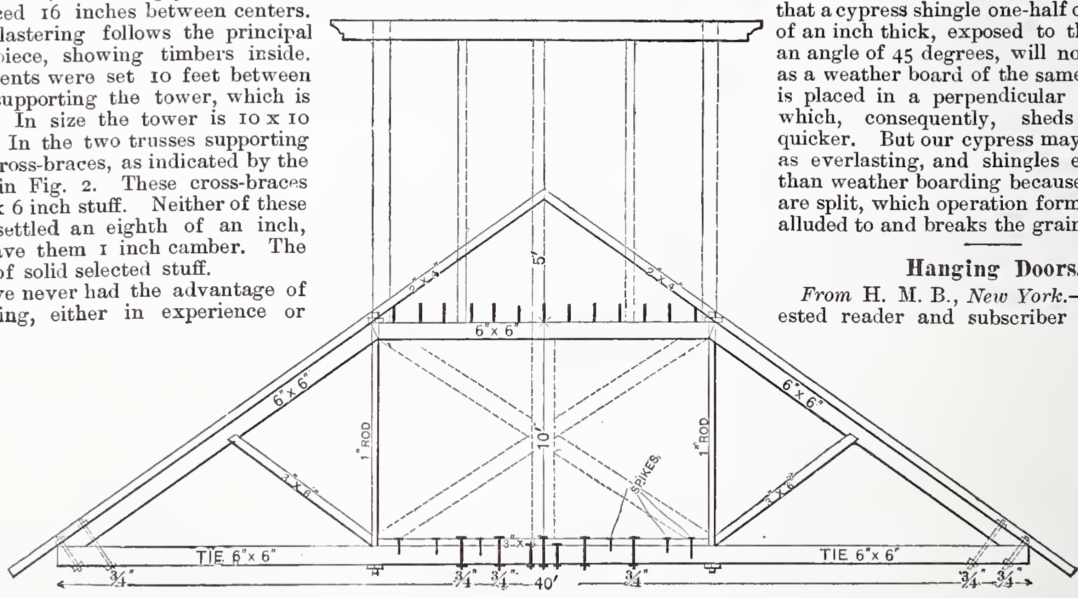
From W. A. W., *Tyler, Texas*.—Since I have been a subscriber to *Carpentry and Building* I think I have been much benefited by it, and as your columns are open to all, perhaps a word from Texas will not be amiss. I have been watching the truss roof question with considerable interest. I notice all your correspondents send in designs employing heavy timbers. This is not at all necessary, at least in our country, as the timber we employ (pine) sustains, I think, from actual experience, quite as much strain



Roof Trusses.—Fig. 1.—Truss in Opera House Roof.—Sketch Accompanying Letter from W. A. W.

as oak. I inclose you two sketches of trusses which I have recently erected. Fig. 1 was used in an opera house, and that shown in Fig. 2 in a church. Both have come fully up to my expectations. The truss shown in Fig. 1 was covered with a tin roof. It was sealed underneath with ⅞-inch stuff. The bents were set 15 feet between centers; the purlins used were 3 x 8 inches in size, and were placed 6 feet between centers. The ceiling joists were 2 x 8 inches, and were placed 24 inches between centers. The roof over the truss shown in Fig. 2 was covered with shingles. The ceiling below was plastered. In the church the bents were 15 feet between centers, the purlins were 3 x 6 inches; the ceiling joists were 2 x 6 inches, placed 16 inches between centers. The line of plastering follows the principal cross-collar piece, showing timbers inside. Two of the bents were set 10 feet between centers for supporting the tower, which is 60 feet high. In size the tower is 10 x 10 feet square. In the two trusses supporting it I put in cross-braces, as indicated by the dotted lines in Fig. 2. These cross-braces were of 1½ x 6 inch stuff. Neither of these trusses has settled an eighth of an inch, although I gave them 1 inch camber. The timbers are of solid selected stuff.

Since I have never had the advantage of much schooling, either in experience or theory, and as I am only 25 years of age, and am obliged to learn what little I can here in Texas passing through many difficulties, I appreciate *Carpentry and Building* very much. I find among its correspondents some very practical men, and it is in order to bring the trusses, the designs of which I inclose, to their notice, that I send them to you for publication. I shall be glad to hear their criticisms.



Roof Trusses.—Fig. 2.—Truss in Church Roof.—Sketch Accompanying Letter from W. A. W.

Books for a Young Carpenter.

From W. G. G., *Lenox, Iowa*.—A plain statement of my case may be made as follows: My architectural knowledge is quite limited. I am not in the least scientific. I cannot understand the technical terms ordinarily used by writers on architecture. In fact, my education is limited to the common branches. I don't understand algebra. I have taken up the carpenter's trade with the determination to succeed—to become a master builder in the best sense of the term if I am capable of it. Whenever I have leisure I desire to study to employ my time in such a way that it shall benefit me. What I especially desire at present is advice as to where I shall begin and what books I ought to get. My library of books of this kind at present is restricted to a full set of *Carpentry and Building*, and the numbers for a couple of years back of another building journal.

Answer.—So far as we can judge of our correspondent's wants from the above description, we think a practical work on carpentry would be of great use to him. "Hatfield's American House Carpenter" contains a brief outline of architecture, which is followed by a chapter on construction, after which the practical parts of house building are thoroughly described and explained in detail. In part second, which occupies nearly one-half the book, there appears a brief treatise on geometry, following which is a chapter on ratio and proportion, another on fractions, and another on algebra, &c So far as any one book is concerned, we think this will more nearly meet his requirements than any other we can recommend. "Newland's Carpenters' and Joiners' Assistant," an English work, is a valuable one to have also. It contains preliminary chapters on geometry, drawing instruments, projection, sections of solids and descriptive carpentry. Then follows practical directions concerning roofs, &c. It also has chapters on timber descriptive of the various woods and the treatment of wood for different purposes, strengths of material, the whole followed by a treatise on stairs and hand-railing, and a chapter on drawing. An index and glossary accompany the work, which is profusely illustrated. Both of these works—one American and the other English—treat of architecture from a builder's standpoint. There are several other desirable works which might be mentioned, but which we think are less suited to his needs than those named. Either of the books above described may be ordered through this office.

Cypress Shingles.

From W. P. R., *Charleston, S. C.*—I have noticed the remarks of C. E., of Kentucky, about the durability of shingles. I beg to say that we have a building in this city shingled with split cypress shingles which have been in use for 100 years, and that, though moss-covered, the roofs are tight to this day. Our shingles are ½ inch thick at the butt, 4½ inches wide and 22 inches long. Six hundred cover a square when laid 6 inches to the weather. They cost at retail, delivered from the yard to the building, within the limits of the city, from $5.50 to $6 per thousand. Split cypress shingles don't soak water, the surface being a series of small gutters or grooves, made by the process of splitting, which carry off the water as fast as it falls. Our shingle roofs are never painted, for one reason in particular, because up to the present time we have been solely dependent for drinking water on the rain caught from the roofs of our houses and conveyed to large cisterns built of brick in the earth. This arrangement gives us pure, wholesome water. To paint our shingles would injure the water. There is an almost endless amount of cypress in this State, and lying directly on our lines of railroads. Of course, any one will admit that a cypress shingle one-half or five-eighths of an inch thick, exposed to the weather at an angle of 45 degrees, will not last as long as a weather board of the same wood which is placed in a perpendicular position, and which, consequently, sheds the water quicker. But our cypress may be described as everlasting, and shingles endure longer than weather boarding because the shingles are split, which operation forms the grooves alluded to and breaks the grain of the wood.

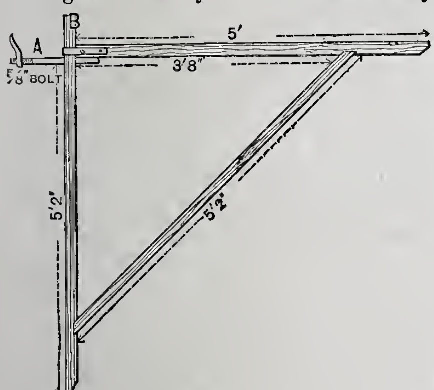
Hanging Doors.

From H. M. B., *New York*.—As an interested reader and subscriber to *Carpentry and Building*, I desire to have my say with regard to hanging doors. E. G. H., of Ossian, Iowa, ridicules the idea of any one fitting and hanging 20 doors in a day. Let me inform your correspondent that some things can be done as well as others, and the "nigger in the fence" in this instance exists only in his imagination. There are no screws loose. This feat has been performed, and I dare say can be done again. I know it is not a common occurrence, but it is nothing very wonderful either. It depends upon the method as well as the quickness of the workman.

T. H., of New York, strikes the key note in this matter. I should like to hear from him in detail. It seems to be a very simple matter to fit a door to a square opening, but there are several things to be considered. If the frames are perfectly straight, the heads square and the floor level, it is really quite simple, but openings are not always as just described. For putting on hinges, a gauge is easily applied to both side and edge, but on the jamb it is more difficult, because one cannot apply the same gauge on a bead casing with any degree of accuracy, as any carpenter well knows.

I should like to hear from these people how to hang doors first pop, without using any sand paper behind the hinges, without any wedges or putty, and how to determine the depth of hinge in both door and frame.

From S. F F., *Waverly, Va.*—I notice that hanging doors is being discussed in *Carpentry and Building.* Although I have never hung 20 doors a day, nor do I expect to get up to that high standard, I will just give an idea of how I perform the operation. I first joint one edge and then try the door. I can tell very



Staging Brackets.—Fig. 1.*—A. N. H.'s Plan of Construction.*

nearly how much to take off. I then take off what is needed and next put the door in its place. I do not put my threshold down until the door is hung; then I can very easily scribe off when the door is too long. I next slide it up to the head and scribe it to the jamb. After I have thus fitted a number, say 10 doors, I begin to hang. I set one gauge to the thickness of the butt, and another, say, one-half inch. I never let the butt go through the door. I next get a strip about 12 inches long by a half inch wide. I place my lower butt about 10 inches up and top butt about 8 inches down. I stand the door on edge and mark distances. I place the butt in position, and with a knife mark length of the butt on the door; then I square across, gauge on thickness of butt and the half inch from back of door, and then with the chisel cut out for the butt. After the butts are screwed to the door I place the door in position and mark with knife on jamb for the butt, and use gauge as before. After my 10 doors are hung, I then trim just as most mechanics do I suppose. I finish the 10 doors in one day, which, I think, is a little more than an average day's work.

From J. W. P., *Maryland, N. Y.*—My plan for hanging doors is to fit all the doors first, then put the butts on in good shape, and, last of all, put on the locks. In this way I don't have to carry so many tools around with me, and, indeed, it is quite a job to keep track of as many tools as are ordinarily used in door hanging. By managing in this way, I have fitted and hung 14 pine doors of common size in 10 hours on a job which I finished this summer. In this lot I put on three mortise locks and five mortise latches. The other doors we refitted with surface trimmings. The entire lot was hung in good enough style for any one, and they were not hung with a hangman's knot, either.

From W. W. Y., *Stillwater, Minn.*—I will venture a few hints with regard to hanging doors, also fitting doors in a new building before the casings are put on. If the person fitting would sooner have the saddles down first, stand the door on the saddle and scribe around it. There is no trouble in making the door fit every time. If the door does not set plumb for sawing the stiles, raise the lower corner with a wedge and scribe with compass, allowing the quantity on the top that comes off below. Generally it will be found that doors set plumb enough.

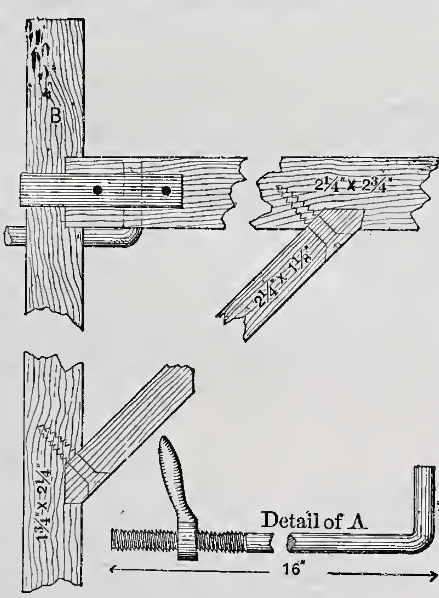
Door Hanging and Shingle Laying.

From W. G. S., *Chattanooga, Tenn.*—Allow me to state that I think the space devoted to correspondence in *Carpentry and Building* is limited enough, and should be restricted to good, solid, sensible matter—which, I admit, it is in the main filled with—without being taken up by such long-winded statements as those of the bragging shinglers and door hangers. I trust that hereafter, whenever a 4000-per-day shingler, or a 20-door-per-day man comes along, his statement will be duly branded—not as "shaky"—that is not strong enough—but as entirely rotten. Now, by this I do not mean to say that a man might not put 20 doors per day on hinges, but I do mean to say that it is impossible for him to hang them in the best manner in that time. I don't say that a man could not put 4000 shingles in a day on a roof, but he could not lay and nail them in a proper manner in that time. I have taken shaved white pine shingles that have been in use for 20 years off of roofs. The points in many places were as sound as when first placed there. The roof turned water comparatively well, and it lasted so well that the house was still inhabited. Does any sensible man suppose for a moment that a 4000-per-day shingler laid that roof?

I have seen men fit and hang from 12 to 16 doors per day, but what kind of workmanship did they show? I will let mechanics answer. My old boss told me that a door should never rattle nor bind at any point whatever, and that it should be fitted so that a try-square blade should just fit in all around between it and the jamb. Is this the way your correspondents' doors are hung? I don't believe it.

Staging Brackets.

From A. N. H., *North Adams, Mass.*—I inclose you a design for a staging bracket (Fig. 1), which possibly you may find of sufficient merit to publish. I consider the bracket quite as good as anything I have ever before seen for staging around wooden buildings. I screw a staging to the building, so that the wind will not blow it down, and is, consequently, quite safe. The drawing, I think,



Staging Backets.—Fig. 2.*—Details of Construction of Brackets shown in Fig.* 1.

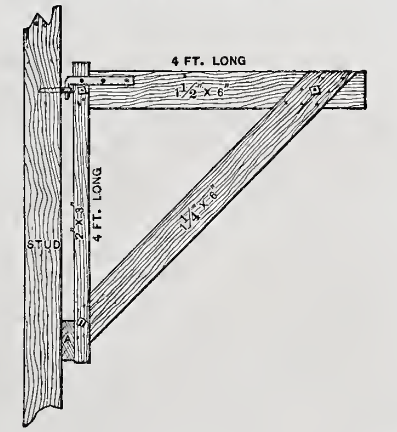
is self-explanatory as to the way the staging is applied. Fig. 1 shows the bracket complete and the dimensions. Fig. 2 shows details of construction, the size of stuff employed and the relationship of parts.

From T. J. L., *Stockbridge.*—I wish to return thanks to J. H. T., of Paris, Arkansas, for the design of a well-house which he furnished in answer to my inquiry in the April number. The plans will, I think, suit my purpose very well.

Not noticing any plans of scaffolding in the July number, I inclose you a draft of what is in common use in this locality (Fig. 3). I believe it has been in current use some 12 or 15 years, and I have never yet heard of any accident which could be attributed to its employment. The sketch which I inclose illustrates the construction quite as well as a specific description. The eye is made of ⅝-inch iron with the points somewhat tapering, and a coarse thread cut upon it to the extent of 3 inches at the bottom. A represents a block 12 inches long, spiked on the back of the bracket to keep it from turning. When the staging planks are put on, the strap or hook is bolted on with three or four bolts. The top piece is mortised in and spiked as well as bolted. I think this style of scaffolding has several important advantages over that contributed by A C H in the May number. If I have succeeded in making it plain to your readers I think they will be pleased with it.

The Grindstone Problem.

The problem of the equal division of a grindstone, which was proposed by a correspondent in the September number, has called forth quite an array of answers, a perusal of which will repay many of



Staging Brackets.—Fig. 3.*—T. J. L.'s Plan of Construction.*

our readers who are not especially interested in the problem. This discussion affords another illustration of the many different ways in which a result may be obtained, and the different standpoints from which a thing may be viewed.

The following solution is from the correspondent who originally proposed the problem:

From H. D. C., *Philadelphia, Pa.*—The inclosed drawing (Fig. 1) presents a solution to the problem of equal areas, proposed in my communication published in *Carpentry and Building* for September. Let A E G F represent the grindstone. Draw any radius, A B, which divide into two equal parts. From the center of the radius D erect a perpendicular, D C, producing it until it meets a semicircle described on A B, as shown in the point C. Join C and B. Take B as center and B C as radius and describe the circle C K H L; then this line will divide the grindstone into two equal parts.

Answers based upon the same principles and illustrated by diagrams which are, to all intents and purposes, duplicates of the one referred to in the above letter, have also been received from O. W., T. M., B. T. B., of Panora, Iowa, R. K. H., of Philadelphia, and B. F. D., of Lima, Ohio.

Our correspondent R. K. H., of Philadelphia, mentioned above, in addition to the instrumental solution sends the following:

"I would measure the diameter of the stone, from which I would calculate the superficial area. I would divide this amount by two, in order to obtain an equal division of the stone between the parties. Then having the area of either portion, I would proceed to find the diameter of the center portion, one-half of which would give me the radius on which to strike the circle on the stone itself, which would make an equal division of it. The rule for performing this calculation is as follows: To find the area of the circle, multiply the square of the diameter by the decimal, .7854, which will give the area. Or, on the other hand, divide the area of a circle by the decimal .7854. Extract the square root to obtain the diameter. For illustration, I will suppose the stone to measure 36-inches in diameter, from which I deduce the following: $36 \times 36 \times .7854 = 1018.7834$, area of the stone. This divided by 2 gives 509.4392 as the area of one-half the stone;

$$\sqrt{\frac{509.4392}{.7854}} = 25.4683$$

the diameter of center half of stone; one-half of this is 12.7341, which is the radius of the circle dividing the stone into two equal parts."

This correspondent concludes with the following general remarks:

"By the way, if this was a melon I would prefer Smith's portion (the center), but as it is a grindstone, I think if Jones grinds first he will get the best of the bargain. Smith, however, can console himself in the fact that Jones' share will not last so long as his, even if it has a much larger circumference. I suggest that Smith ought to keep his eye open, lest Jones should grind him too close. The grindstone should be kept clean, so that the mark will not be lost, for when Smith comes to grind his share, he will find that it is not practicable to grind so close to his inside boundaries as it was in Jones' case."

Our correspondent B. F. D., also mentioned above, in addition to forwarding the solution referred to, sends a rule for dividing the circle into four equal parts, which, perhaps, it may be well for us to refer to in this connection. The same rule is also applicable for dividing the circle into any number of equal parts. Referring to Fig. 1, in order to make the explanation clear, the rule is given as follows: "Divide the radius A B into as many parts as it is desired to make of the circle. From the points thus obtained erect perpendiculars to A B until they intersect the arc A C B, and through these points describe circles, which will be the divisions required." This same correspondent, in demonstrating the accuracy of his rule by arithmetical methods, makes the following remarks: "H. D. C. did not give the size of the stone, but I will suppose it to be 8 inches, for I rather think it was a sort of a one-horse shop any way."

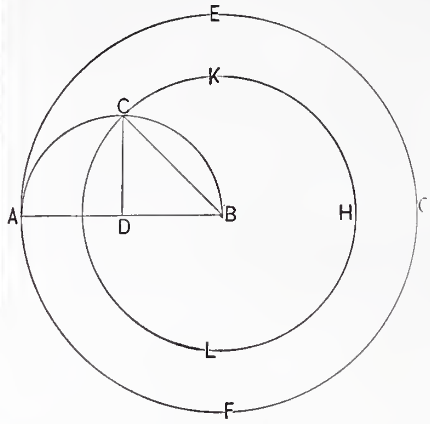
From I. G. T., *Florence, Mass.*—The enclosed drawing represents my method of solving H. D. C.'s problem of equal areas. Let A B C D (Fig. 2,) be the given circle. Draw the two diameters, A B and C D, at right angles to each other. Draw the chord A C. Bisect it, thus obtaining the point I; then will I A or I C be the radius of a circle that will contain one-half the area of the given circle.

From A. M. *Baltimore, Md.*—I think the following is a correct solution of the grindstone problem: Inside the circle, representing the circumference of the grindstone, construct a square; then with a radius equal to half of one of the sides of the square inscribe a circle in the square. The line thus drawn will divide the grindstone into two parts of equal area.

The communication from A. M. is dated at the "shop," and is neatly inscribed upon a pine shaving; the drawing which accompanies his letter is also upon the same material. Evidently this correspondent had in mind the habits of one W. B. when he got up his letter in this unique and interesting shape. Referring now to his solution, and the one which immediately precedes it above, it will be evident to all upon inspection that they are the same. I. G. T, however, does not complete the square, but draws one side of it. Further examination into these two rules will show them to be identical in principle with those which immediately preceded them. By adding to Fig. 1 the line drawn from A to E, which will correspond with A C of Fig. 2, and by inserting the two diameters on the original circle which appear in Fig. 2, their identity will become apparent.

S. B., *London, Ontario,* sends us a simple statement of the radius of the circle which will divide the stone into two equal parts, its diameter being assumed at 2 feet, without any rule by which it was obtained, although he incloses a diagram showing how it would be applied. It is probable that this correspondent has restricted himself to an arithmetical method.

From G. R. S., *Greenport, R. I.*—By multiplying the diameter by 29 and dividing by 41, the diameter of a circle will be obtained which will divide the stone into two equal parts, with such a close approach to accuracy that neither party will have occasion to find fault. Suppose, for example, the stone

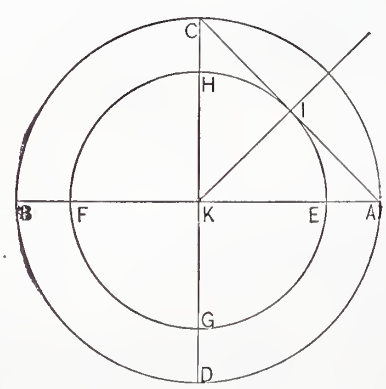


Grindstone Problem.—Fig. 1.—Diagram Accompanying Letter from H. D. C.

to be 60 inches in diameter, $60 \times 29 = 1740 \div 41 = 42.43$, which represents the diameter of the circle to be marked on the stone. The area of this small circle is 1413.9+; the area of the circle 60 inches in diameter is 2827.4+. If this rule is not sufficiently correct, multiply the diameter of the stone by 28.99146734 and divide by 41.

From J. H. M., *Brewsters, N. Y.*—As the whole stone is to the part remaining, so is the square of the diameter of the whole stone to the square of the diameter of the remaining part. As no size was given in the original problem I will assume the diameter to be 4 feet; then, according to the rule $1 : \frac{1}{2} :: 4^2 : x^2$, hence $x = 4\sqrt{\frac{1}{2}} = 2.828$ feet, which is the diameter of the stone after the first part has been ground off.

From Y. L. F., *Skaneateles, N. Y.*—Let A be the area of grindstone when first used. Let R be the radius of grindstone when first used; let a equal the area of grindstone



Grindstone Problem.—Fig. 2.—Diagram Accompanying Letter from I. G. T.

after the first part has been ground off. Now, by condition of problem A, $= 2a$. Since areas of circles are proportional to the squares of their radii, we have:

$$A : a :: R^2 : r^2.$$

$$\frac{R^2}{r^2} = \frac{A}{a} = 2$$

$$\text{Hence } \frac{R}{r} = \sqrt{2} \text{ or } r = \frac{R.}{\sqrt{2}}$$

Therefore, describe a circle on the grindstone with a radius equal to the original radius divided by the square root of 2.

It will be noticed that all the solutions above presented assume that the grindstone is revolved upon an imaginary axis and every part of it is available for use. It does not seem to have occurred to anyone that a certain core at the center is unavailable, and therefore should have been taken into the calculation in making an equitable division of the stone between Smith and Jones. The letter printed below is the only one which has reached us wherein the author seems to have thought of this feature of the case, excepting only the indirect reference to it made by R. K. H. above. If the correspondent who proposed the problem had suggested simply rules for dividing the circle into equal parts, this particular matter need not have been considered. But he proposed the question in a practical form, citing the grindstone and naming the parties who are to use it. The division was to settle a dispute. Hence it would be manifestly unfair to divide the stone by any of the rules above given. We commend the following to the consideration of our readers, and also to those correspondents who have sent in other answers:

From D. W. K., *Lockport, N. Y.*—In the issue of *Carpentry and Building* for September, H. D. C., of Philadelphia, proposes the question of an equal division of a grindstone between two men, whom he terms Jones and Smith. As no dimensions are given, I will assume that the stone is 3 feet in diameter. Then the question of H. D. C. is, as I understand it, what proportion of the diameter must the one who takes the first half of the stone grind off? Since this is a practical question, it occurs to me, in order to effect a fair and equitable division, that the space occupied by the axle should be considered. I will allow for the diameter of the axle and what will remain adhering to it after the stone has been ground down to the smallest practicable dimensions for use, say 3 inches. Then the question is, how much of the usable portion of the stone must Jones grind off?

1. I compute the number of square inches surface contained on one side of the axle and the portion of stone remaining on it by squaring the diameter, 3 feet, and multiplying the same by the decimal .7854, which gives 7.0686 square inches.

2. I determine the whole area of one side of the stone, including axle and waste, by squaring 36 and multiplying that product by .7854, which gives 1017.8784 square inches.

3. To ascertain the amount of surface which Jones should grind off, I subtract from 1017.8784 the superficial area of the waste, which is 7.0686, and divide the remainder by 2, which gives as a result, 505.4049.

4. I subtract the above amount (505.4049) from 1017.8784, which gives 512.4735 as the number of square inches surface remaining after Jones has ground off his share.

5. To obtain the diameter of a circle containing 512.4735 square inches, or, in other words, the diameter of the stone, including axle and waste, after Jones had used his share, I divide 512.4735 by 0.7854 and extract the square root, which gives 25.544 inches. Taking this amount from the whole diameter—36 inches—leaves 10.456 inches, the portion of the diameter to be ground off by Jones.

Defective Rule for Hopper Bevels.

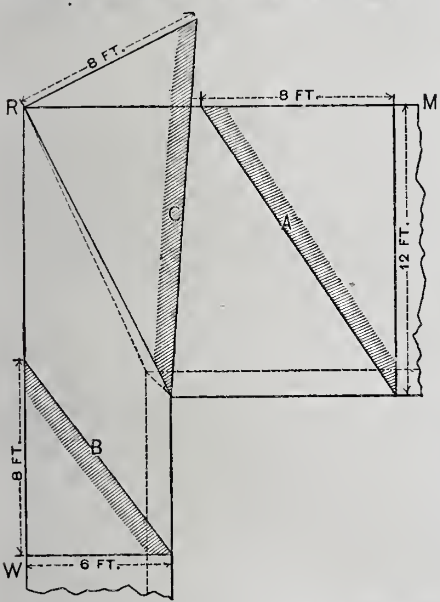
From W. C. M., *Eldon, Iowa.*—I have discovered that the rule for a butt joint in hopper bevels contained in my letter published in the July number is not accurate, and it will not work except for hoppers of very slight bevel. I am inclined to believe that the rule published in the March number of the paper is defective in the same manner. The rule published by E. W. C. in the July number is, I believe, wrong altogether.

When I read W. B.'s pathetic letter in the June number I felt like buying a peck of onions and weeping accordingly, but when I compared G. H. H.'s rule with his and found them to be the same and both correct, I wanted to start a subscription to buy W. B. a pair of leather spectacles.

The articles on truss roofs, strength of material, heating and ventilation, &c., would be very valuable if one had any chance to put them in practice, which is not the case very often in this part of the country. The man who can do work the cheapest, without regard to quality, is the one that gets the most work to do in this neighborhood. If a man wants to do work in a proper manner and for fair pay, he has to take what is left after the cheap men get loaded up.

Irregular Valley Rafters.

From A. J. H., *Lowell, Mass.*—In reply to the question asked by J. P. R. in the April number of *Carpentry and Building*, which refers to my former communication on wing roofs, I would say that in the sketch shown at that time there was no cornice supposed on roof, a plain roof without projection being contemplated. I now send you sketch similar to the one previously sent, which shows a cornice of 12 inches width, indicated by the dotted lines. R M represents the ridge of main roof, and R W the ridge of the wing roof. A and B show the common rafters, and C the valley rafter in elevation. In this case, in obtaining lengths and cuts of rafters the plates are thrown entirely out of the question; or, in other words, the line of cornice which is the lower edge of roof boardings, is assumed to be the plate. I then proceed as before. The rafters on the wing rising 8 inches more to the foot than those on the main, the wing plate should be set 8 inches higher than the main plate. It



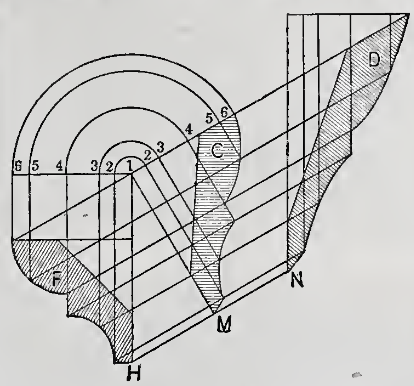
Irregular Vally Rafters.—Sketch Accompanying Letter from A. J. H.

will be seen that the seat line of valley rafter does not cut the angle of the two plates. Consequently, the valley rafter will rest on or be notched on to the main plate. If this explanation does not make the case as clear as may be desired to our Worcester friend, I have no doubt the answer from A. H. F. will. In this connection I take the opportunity of acknowledging the correction made by the latter correspondent. I think his plan is correct, but I have never discovered anything wrong in my own plan.

Raking Moldings.

From J. O. B., *Brooklyn.*—I prefer to see abler pens than mine fill up the correspondence department, but since you have stated, in a recent number of the paper, that you are not receiving as many letters as you would like, I will contribute what I am able. I send you herewith a method of drafting a rake molding to correspond with a given level molding; showing, also, how to get the cuts across the miter box, by which they can be mitered. I once had a cornice to put up on a building the roof of which was steep. Modillions were required in the cornice up the gable portion, as well as in the level. Not being familiar with that kind of work at the time, I experienced considerable trouble in doing it. I think, therefore, that the rule which I inclose will be a benefit to some of my fellow workmen if they are ever placed in a similar predicament. I don't claim originality for the method inclosed. I have drawn from whatever resources were at my command.

Draw the outline of the common level molding, as shown at F, in the same position as if in its place on the building. Draw lines through as many prominent points in the profile as may be convenient parallel with the line of rake. From the same points in the molding draw vertical lines, as shown by 1 H, 2, 3, 4 and 5, &c. From the point 1, square with the lines of the rake, draw 1 M, as shown, and from 1 as center, with the



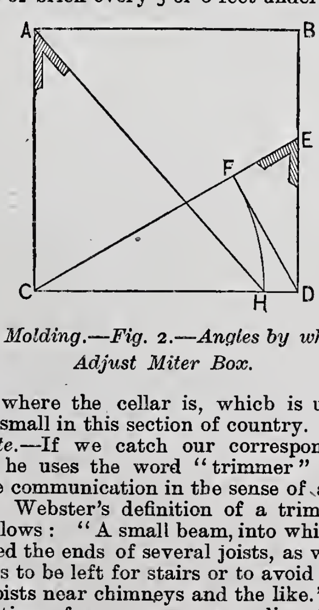
Rake Molding.—Fig. 1.—Manner of Developing the Shape.

dividers transfer the divisions 2, 3, 4, &c., as shown, and from the points thus obtained, on the upper line of the rake draw lines parallel to 1 M. Where these lines intersect with the lines of the rake will be points through which the outline C may be traced.

In case there is a molded head to put upon a raking model, the molding D shown at the right hand of Fig. 1 must be worked out for the upper side. The manner in which this is done is self-evident upon examination of the drawing, and therefore needs no special description. To make the cuts across a box by which the rake mold can be mitered, draw the square A B D C of Fig. 2. Draw C E to the same pitch as the roof; then from D draw D F perpendicular to E C. From C as center, with C F as radius, describe the arc F H, thus obtaining the point H. Connect H and A; then the bevel, as shown at A, is correct for the cross cut. The bevel shown at E may be used for the down cut. The moldings F and D must be cut by a square miter, and the cross and down cuts of the rake must be made by the bevels A and E respectively. I might also observe that, in placing the molding in the box, the line I M should be perpendicular against the side of the box when in position.

Construction of Floors.

From W. W. Y., *Stillwater, Minn.*—In framing my buildings I never gain my floor joists into a trimmer, as I frequently see done. I use 2 x 6 stuff, full width of building. I gain these pieces into the sills in the usual way, and in the center run a trimmer under them, having a small abutment of stone or brick every 5 or 6 feet under it, ex-



Rake Molding.—Fig. 2.—Angles by which to Adjust Miter Box.

cept where the cellar is, which is usually very small in this section of country.

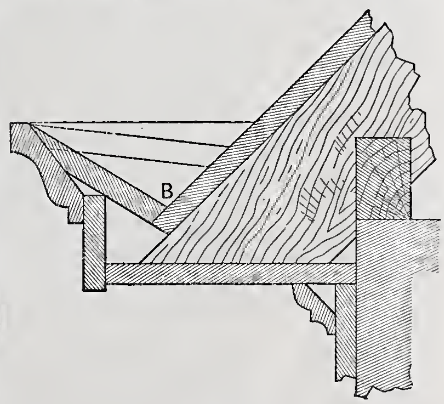
Note.—If we catch our correspondent's idea, he uses the word "trimmer" in the above communication in the sense of a summer. Webster's definition of a trimmer is as follows: "A small beam, into which are framed the ends of several joists, as when a hole is to be left for stairs or to avoid bringing joists near chimneys and the like." The definition of a summer, according to the same authority, is as follows: "A large beam placed horizontally on columns, piers, posts or the like, serving for various uses, as for the lintel of a door or window—the commencement of a cross vault, or a central floor timber supporting the joists."

Concrete Buildings.

From L. R., *Highland Falls, N. Y.*—The only complaint I have to make against *Carpentry and Building* is that it does not come often enough. In reply to your correspondent A. B., of Fredonia, Pa., published in the August number, I would say that I am not able to give the exact differences between the cost of a concrete building and a frame building, but the amount is not very large. A concrete building may be finished in squares, and colored in any way desired. Mix the paint with water until it is of the consistency of paste, and apply with trowel. Rub it in thoroughly before the cement gets too dry. As to the quantity of materials required, I would say that that depends upon how thick the walls are made. If the walls are 2 feet thick, it requires considerably more material than it would if they were only 18 inches. In this vicinity we use one part of lime to one part of cement and four parts of sand for the body of the building; one part cement, one part sand for the plastering coat on the outside.

Gutter in Cornice.

From A. N. H., *North Adams, Mass.*—The inclosed detail of a gutter in cornice roofs I think is a good way for constructing that part of a roof. The shape is such as to insure the gutter from breaking by the



A. N. H.'s Construction of Gutter.

formation of ice in it. I send it to you in reply to the question asked by M. F. P., of Berea, Ohio. The double dotted line in the sketch represents the highest point in the gutter, while the lowest point is indicated by B.

From J. L. F., *Milan, Ohio.*—I am a new subscriber to *Carpentry and Building*, but have already become very much interested in the correspondence department and will venture some opinions without further delay. Answering W. F. P., of Berea, Ohio, with regard to pitch and form of gutter cornice, I would say that the method I prefer is to frame the lookout or cornice support with a slight pitch inward. I notch around the end of the plate, and nail to the studding below and to the rafter above. I cut into the lookout for the pitch of my gutter, making the gutter very flat or shallow in the highest part and running more V-shaped to the lowest part. To get the pitch, I estimate the fall per foot, then make a straight edge as long as convenient, tapering in the same ratio as the pitch has required. I lay the straight-edge along the gutter, the wide end towards the outlet. Commencing at the highest point, I block up the narrow end of the straight-edge until it is level on top. Then I set a pair of dividers from the bottom of the straight-edge down to the bottom of the gutter seat. I next move down the line, spacing from the bottom of the straight-edge down on the lookout, to find the bottom of the gutter seat. I then trim down the back of the rafter, and on a line from the point of the lookout until it strikes the line of the rafter as low down as the spacing requires. This plan causes a slight twist to the outside of the gutter, but to that there is no particular objection, and altogether it results in the best form of gutter with which I am acquainted.

Sheeting on the Inside.

From J. L. F., *Milan, Ohio.*—I prefer sheeting on the inside of a house rather than the outside. One reason for this is, that in the latter case it is not necessary that the studding should all be of exact distance apart. Another is, I think, a stronger wall is obtained in plastering over sheeting. Still a third advantage is, that picture nails can be driven in any place after the room is finished. Your correspondent who writes in a recent number can put his tarred paper on the studding if he chooses, but I assure him, if his sense of smell is acute, that he is likely to be offended for a long period by the odor of the paper every time the sun shines on the siding.

Construction of Window Screens.

From T. J., *Sabbath Day Point, N. Y.*—My plan of constructing window screens is as follows: For sash 1¼ inch or 1½ inch thick I apply a ⅜-inch groove in both stiles about the center. I then get out a ⅜-inch square stop and nail it on to the inside stop, so as to let the screen work as a sash. I then furnish the sash with a window catch, so as to raise and fasten it at any point. If the top sash needs lowering, the screen can be raised to fill the space. I don't like plan of putting the screen under the upper sash. There are many people who prefer to have the upper sash lowered at night. By my way of constructing the screens either sash may be opened. I think H. H. will find this explanation sufficiently clear without a diagram.

Cleaning Brick Fronts.

From S. B., *London, Ontario.*—In answer to the queston propounded by G. F. N., concerning the matter of cleaning down brick fronts. I would say that I once asked a mechanic how he managed work of this character. The reply he gave me was about as follows: Take a bucket and nearly fill it with water; add as much nitric acid as a common tea cup will contain. Apply this mixture to the wall with a brush. The lime and dirt will be readily removed by it. I give the above as it was given to me. I have never tried the recipe myself, and, therefore, I cannot say whether it will produce the desired effect or not. Should your correspondent feel disposed to try it I shall be pleased to learn the result, if he sees fit to communicate the same.

Hight of Doors.

From C. H. C., *Hartford, Wis.*—I have noticed several communications in recent numbers of the paper concerning the hight of doors, &c. As I am a dealer in building materials, perhaps a statement of my experience may be acceptable. Five years ago a 7-foot door was sold only occasionally. At the present time carpenters seldom think of using anything else in tasteful buildings. It is customary in this neighborhood to use doors 7 feet by 2 feet 8 inches for outside, and 7 feet by 2 feet 6 inches for inside. The hight of rooms is seldom under 8 or 9 feet.

What He Especially Likes in the Paper.

From J. R. R., *Raymore, Mo.*—I think *Carpentry and Building* the best paper I have ever seen for the advancement of our trade. I am especially interested in the articles entitled "Practical Stair Building," and I hope they may take us through to the end in the same plain, practical manner with which they have been commenced. My interest in stair-building, however, does not detract from my interest in the correspondence department, which I think, all things considered, is the very best feature of the paper.

I am in the habit of making my own plans and drawings, although I do not claim to be an expert, yet I succeed sufficiently well for my purpose. I have the plan of a cupola for a barn or stable which I think is less expensive than any you have yet published. Those who have examined it are well pleased with it. I will send it to you if you think it will be of interest to your readers.

Note.—We are always glad to receive such frank expressions of appreciation of the work which *Carpentry and Building* is doing. They encourage us in our labors and stimulate us to greater exertion to meet all possible wants. With reference to our correspondent's design for a stable cupola, we shall be pleased to see it or anything else which he may feel disposed to send us. We extend the same invitation to all our readers to forward whatever they think is of any possible interest to their fellow readers. We prefer having a surplus of this kind of material rather than be restricted in the matter of selection.

Concrete Sidewalks.

From J. & W., *New York City.*—We notice the inquiry from W. R. J., in *Carpentry and Building* for September, concerning the matter of concrete sidewalks. We herewith hand you directions for using and mixing Saylor's Portland Cement for such purposes. The formula below was used in mixing and laying sidewalk on the corner of Broadway and Seventeenth street (Union square), Fourth avenue and Seventeenth street (Union square), Broadway and Eighth street and in numerous other places in this city. It has resulted in first-class work in every respect. Portland cement is the best for such purposes, and is the only cement that should be used for sidewalks, stable floors, cellar floors and all places over which there is a heavy traffic.

Sidewalks should be laid 4 inches thick, in two courses or layers. The first bottom course should be 3 inches clear, and the second or finishing, 1 inch. The top course should be laid before the bottom course is set. Lay foundation on which to put concrete with good coarse gravel or chipped stone, well rammed or levelled. For the bottom course use one part cement to four parts of clean sharp gravel. Mix cement and gravel thoroughly in the dry state before wetting; add sufficient water from a sprinkler to make a dry mortar, place at once and ram well in position. For top course mix one part cement to one part of clean sharp sand. Mix sand as for bottom course. Wet it to the consistency of plaster mortar.

REFERRED TO OUR READERS.

Strength of Brick Walls.

From S. B., *London, Ontario.*—I have a brick wall 9 inches thick, 10 feet high and 10 feet long, built with common mortar. I want to know how much weight I can safely place upon it. Will some practical reader of the paper give me a rule for calculating weight which brick walls of different thicknesses will sustain, the weight to be brought upon the wall perpendicularly and laterally?

I have watched with great interest the rules for calculating the strength of timber which have appeared in the paper, and have wanted to see something on the strength of brick and stone walls; hence, I have propounded this question, trusting that it will lead to a discussion which will be of general advantage to the readers. If some of the practical correspondents of the paper will take it up, I am sure others besides myself will be benefited.

A Practical Question.

From GLEANOR, *Toledo, Ohio.*—I notice in the September number a design for a frame dwelling by George Miller, architect, Bloomington, Ill. I desire to inquire of Mr. Miller, or other readers of the paper who have given the plans attention, how much head room there will be on the second landing of the stairs, and also how it will be possible to open the front door, which scales 9 feet—while the story is barely 10 feet—there being four risers over the door top of second floor? I trust the architect, who, I presume, has taken care in elaborating this design, will not deem it impertinent upon my part to ask these questions.

Horse Power for Wood-Working Machinery.

From C. P., *Cleveland, Ohio.*—I desire some of the practical readers of *Carpentry and Building* to inform me whether horse-power can be used to any advantage for operating wood-working machinery—say, a saw-molding machine, turning lathe, &c.—one machine only to be used at a time. I further desire to inquire which is the best style of horse-power for the purpose, a sweep or tread power? Or, if the readers have any ideas of their own derived from experience in this line, would be pleased to have suggestions. I am in a position to put two horses to work on such machinery if one is not sufficient. I shall be glad to have early answers to this question, as it is of considerable importance to me.

Wind Mill.

From H. C., *Stratford, N. Y.*—I wish to build a wind mill to pump water from a well 14 feet deep, by which to supply my cattle. Will some reader of *Carpentry and Building* furnish me with plans and directions for building such a thing?

Black Walnut Stain.

From B. H., *New York.*—Will some of the practical readers of *Carpentry and Building* give their recipe for making a cheap black walnut stain for pine wood? I also desire to know how to finish in varnish. I think directions of this character will be appreciated by many of the younger readers of the paper.

Tool Box.

From J. E. A., *Albany, N. Y.*—Will you please refer to the readers of *Carpentry and Building* the idea of designing a tool box which shall be suitable for carrying tools required to do ordinary jobbing, and which shall not be so clumsy or heavy as the present awkward box which is in use for the purpose? I think it about time that American carpenters introduced something better for carrying a jobber's kit than the uncouth box now in common use or the English bag. I have been working at this idea for some time, and yet have hardly got far enough along to warrant submitting what I have done to your readers. Possibly, by the time others are ready to respond to this suggestion, I may be able to give you a description of my idea. I should like to hear from the "jours" who read *Carpentry and Building*, in order to know what they have to say on the subject.

Slate Roofs.

From C. C. D., *Waterbury, Conn.*—I want to know all about a slate roof and how to measure it in all its forms. What are the extra measurements allowable in the case of hips? Are they the same as in connection with valleys? Is 6 inches or 12 inches a correct allowance for the under-eave course? Is it correct for slaters to measure 12 inches extra for the top course? What is the correct measurement of a valley which is 18 feet long from cornice to ridge? How many squares of slate ought a slater to lay in a day, the slate being, for example, 8 x 16 or 12 x 20, the roof being without valleys and hips? What difference would it make with the same sized slate if the roof did have valleys and hips? Are sea-green and unfading green slate both of Vermont? If some practical reader of the paper will answer these questions he will confer a favor.

Greenhouse.

From A. S., *Worcester, Mass.*—Will some of the many readers of *Carpentry and Building* favor me with a design for a greenhouse of moderate cost? I desire a building about 20 x 80 feet inside.

CARPENTRY AND BUILDING

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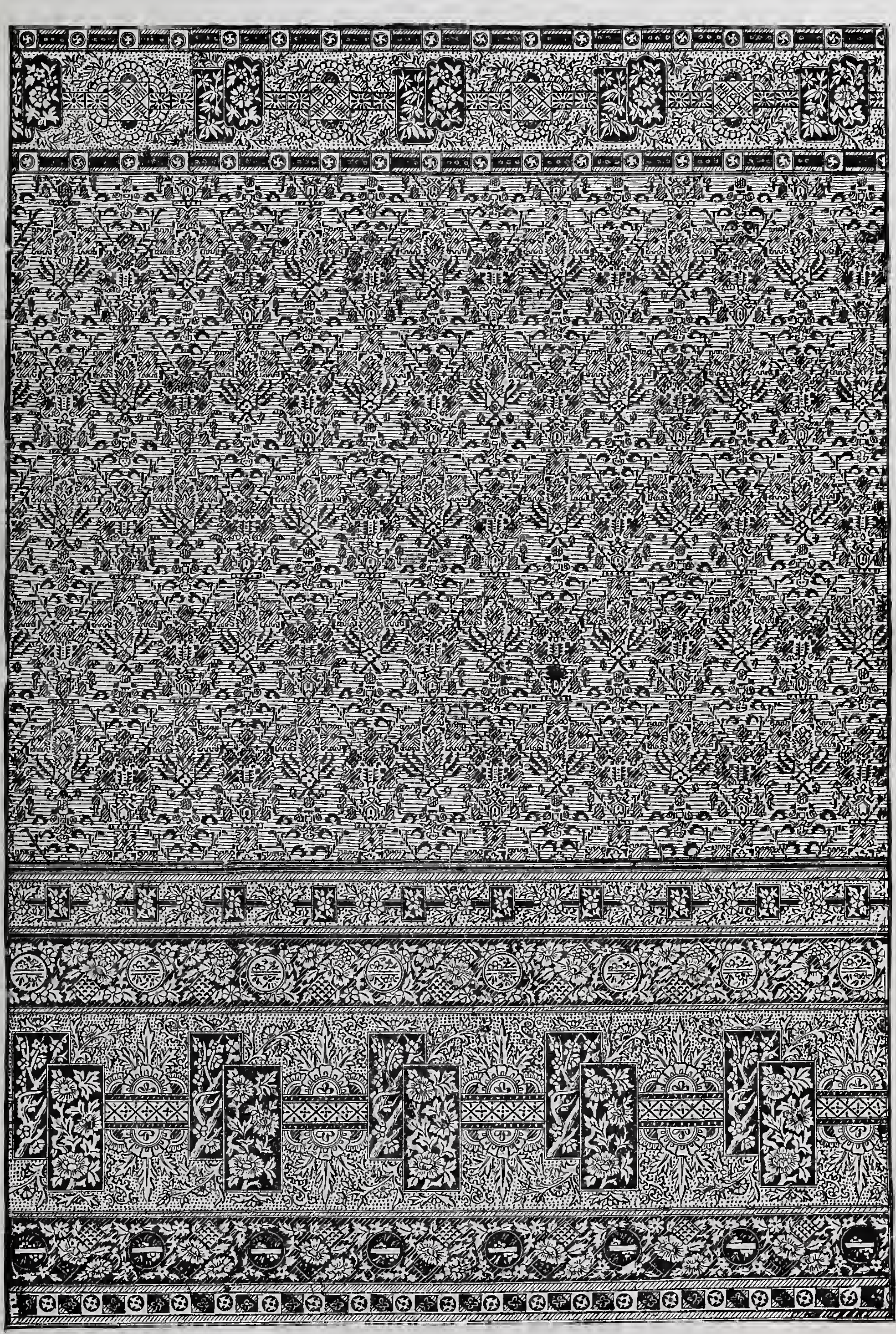
Wall Papers.

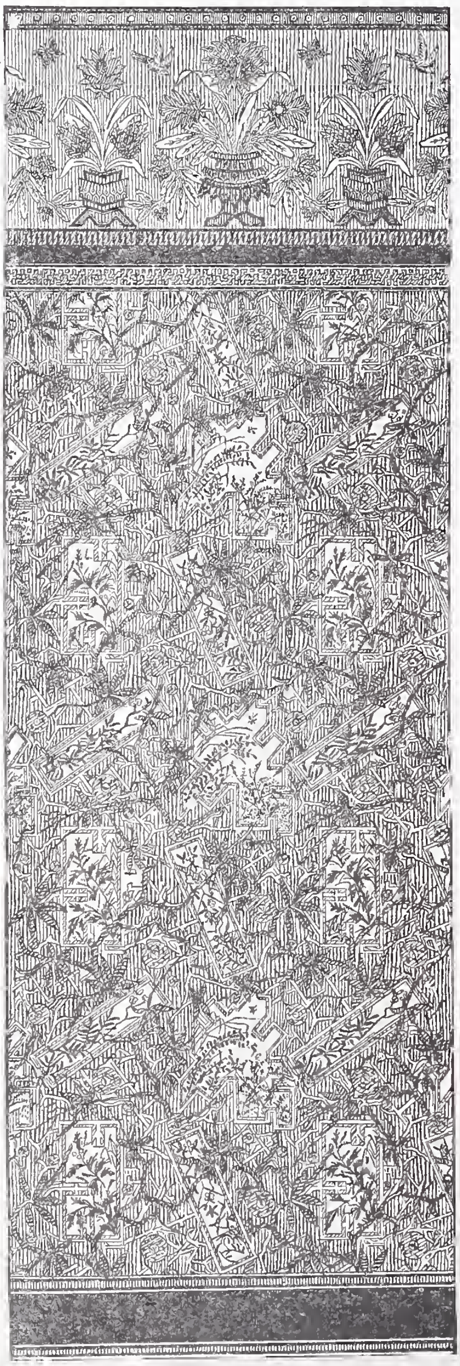
"Can the poor man afford to have a pretty house?" is a question often asked in every town and village in the country. Usually the asker is in a somewhat uncertain frame of mind. He, of course, hopes there is a chance for the poor man, but he is almost certain there is none. Our answer to the question is, "Yes; the poor man can have a pretty house, provided only that he knows what is pretty when he sees it." As to what is pretty and what is not pretty, very much might be written. Upon this occasion, however, our remarks will be confined to the matter of wall papers, the proper use of which goes far toward beautifying the interior of houses. In wall papers, as in other materials, there is a chance to display either good taste or bad taste, according to the individual employing them. A pretty wall paper, properly selected, with such trimmings and borders as are appropriate to it, will render almost any room charming, unassisted by either pictures or furniture. Indeed, it will often render the room pretty in spite of ugly furniture and pictures. Wall papers, at the present time, are made in a greater variety of styles and in a wider range of prices than perhaps ever before, and they are justly becoming more and more popular among people of all grades and conditions. A person who goes to select at any of the large stores has the choice of a great variety of qualities and styles, commencing with papers inferior both in texture and figure, and running upward in regular gradations, until those are reached which are very elaborate in design and finish, and which, in material, are of the very best and most expensive character. It is not always the case that the most ex



Wall Papers.—Fig. 1.—A Characteristic Treatment in Moderate Priced Papers.

pensive papers are the best in design, nor does it always hold that the most costly papers make the prettiest rooms; accordingly, there is a chance for the poor man. Whatever may be the amount he is able to expend, there is the opportunity presented of selecting such patterns, figures and colors as will be appropriate for his room, and which will be beautifull when they are upon the walls.

Paper wall decorations, as commonly applied at present, are made up of three parts. There is the broad band at the bottom, very much like a wainscoting, so far as general appearance is concerned, which is called the dado. This is finished at the top in certain cases with a band of some rich or bright color, very much as the cap molding would be applied to a wainscoting. These bands are known as trimmers. The next, or principal, division in the surface of the wall is covered by the wall paper proper, and is called the field. Above this comes what most mechanics would be very likely to call the cornice, but which is known among decorators

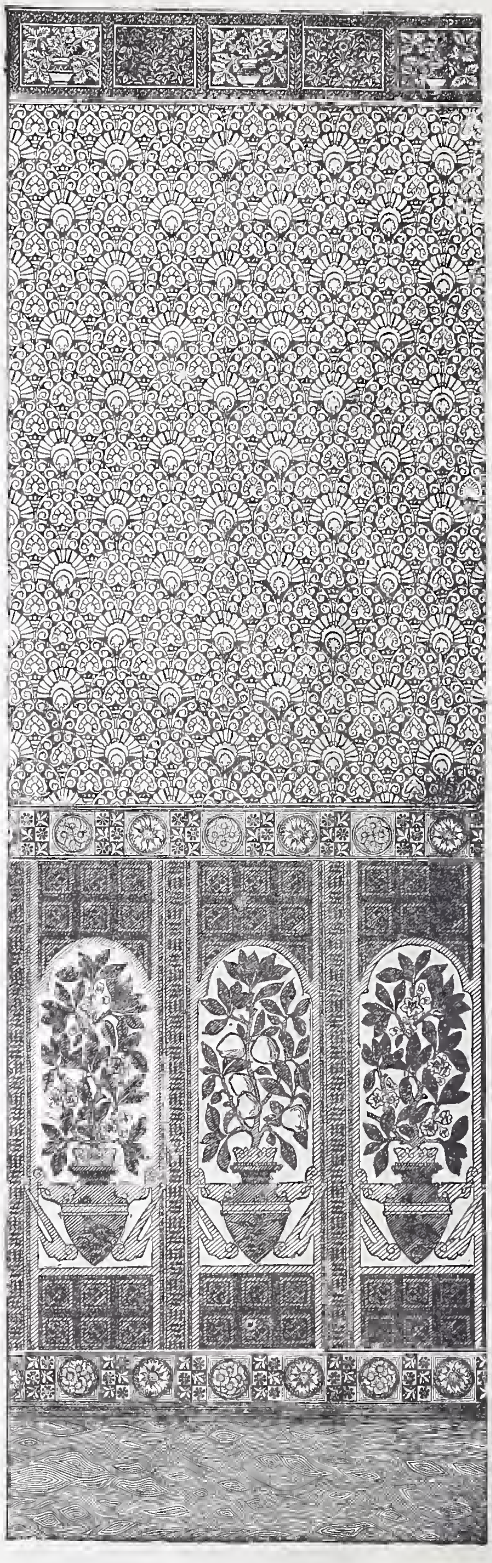


Wall Papers.—Fig. 2.—A Design in the Japanese Style.

as the frieze. These several divisions are clearly shown in Figs. 1 and 3 of the accompanying engravings. Fig. 4 represents a dado alone, while Fig. 5 represents a ceiling paper. In selecting wall papers, each of these several parts or divisions are to be taken into consideration. There must be a certain harmony and correspondence or a contrast between the several parts, in order to obtain the best results and to secure what would be entirely pleasing after the walls are finished.

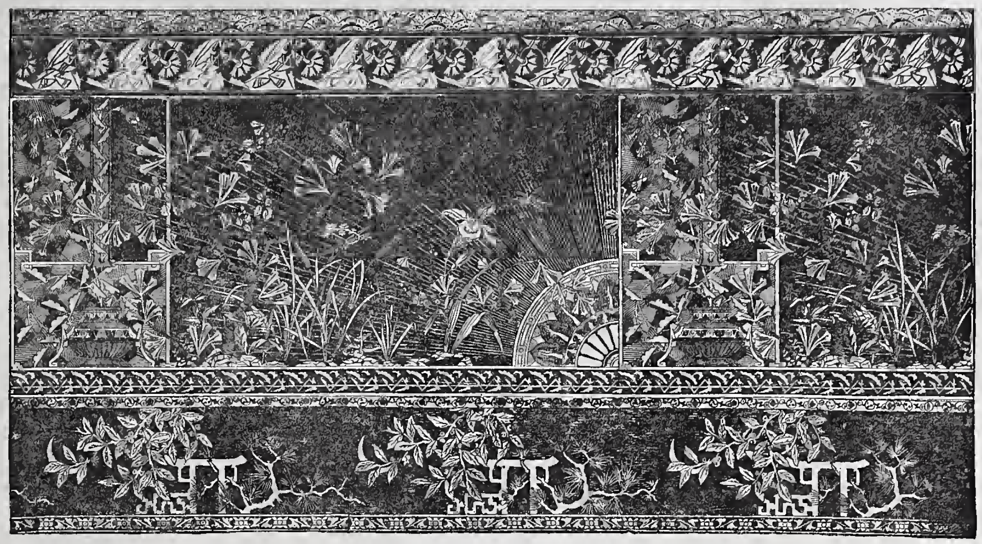
One of the cheapest grades of paper, although not the cheapest that is made, is known in the trade as French flats or French grounds, and, at current retail prices, is worth from 15 to 25 cents per roll. A roll in wall paper means eight yards. In some instances papers are put up in double rolls, in which case, of course, the price, as well as the quantity, is double. A grade above French grounds is known as single color bronzes. Papers of this description are worth at present retail prices from 40 to 50 cents per roll. Next in quality come what are called colored bronzes, which run from 65 to 75 cents per roll, after which follow what are known as solid golds, at from $1.75 to $2.50 per roll. The most expensive grades of paper are known as hand-made, which term, of course, refers only to the decoration applied to them. Papers of this description command prices from $1.50 upward. In this list we have included only leading and generally recognized grades. As above remarked, there are papers to be bought at even lower prices than the cheapest we have named, but they are of a kind, ordinarily, which no one wants to buy in an effort to make his house pretty. It is true that occasionally a 10-cent paper is to be found which is good in design and which will look well upon any wall, but such cases are the exception rather than the rule. In selecting wall papers, it is becoming the custom to employ a dado and frieze of a better grade than that of which the field is composed. Accordingly, frieze and dado patterns appropriate for use with each of the above grades of paper are to be had at a variety of prices. By this plan, while the wall itself may be covered with a comparatively cheap paper, the dado, frieze, border and trimming strips may be of a more costly pattern, and so make the room appear very rich, while the total cost does not greatly exceed a fairly good paper put over the whole room in the old-fashioned way. Besides these special dado patterns, there are made what are known as dado papers, which are of the same grade as the wall paper proper, and are put up in rolls the same as the wall paper, but which, in applying to the wall, are not run horizontally, like the dados. From them, however, very pretty and very appropriate dados can be made for the papers with which they match. Papers of this character correspond in price with the same grades in the above-mentioned list. Ceiling papers can be had in the same variety of styles and prices as other papers. The distinguishing difference between ceiling papers and the papers which make the field on the wall, consists of a difference in shade, they being generally lighter, and a difference in the figure, which is generally smaller or less pronounced than that of the paper on the side walls. A wall paper, as ordinarily furnished, is 22 inches wide, a fact which it is necessary to mention in this connection, in order to afford our readers all requisite data for making estimates.

What is bad taste in wall decoration is as necessarily a part of our subject, when treating of wall paper and wall decoration, as the opposite, or good taste. Both must in a certain way be treated together. The reasons for certain directions only appear when we explain the ugliness which would arise from disregarding them. Walls are not only flat surfaces, bounding our rooms and forming back grounds for furniture, pictures, &c., but it is desirable that they should appear so. It is undesirable,



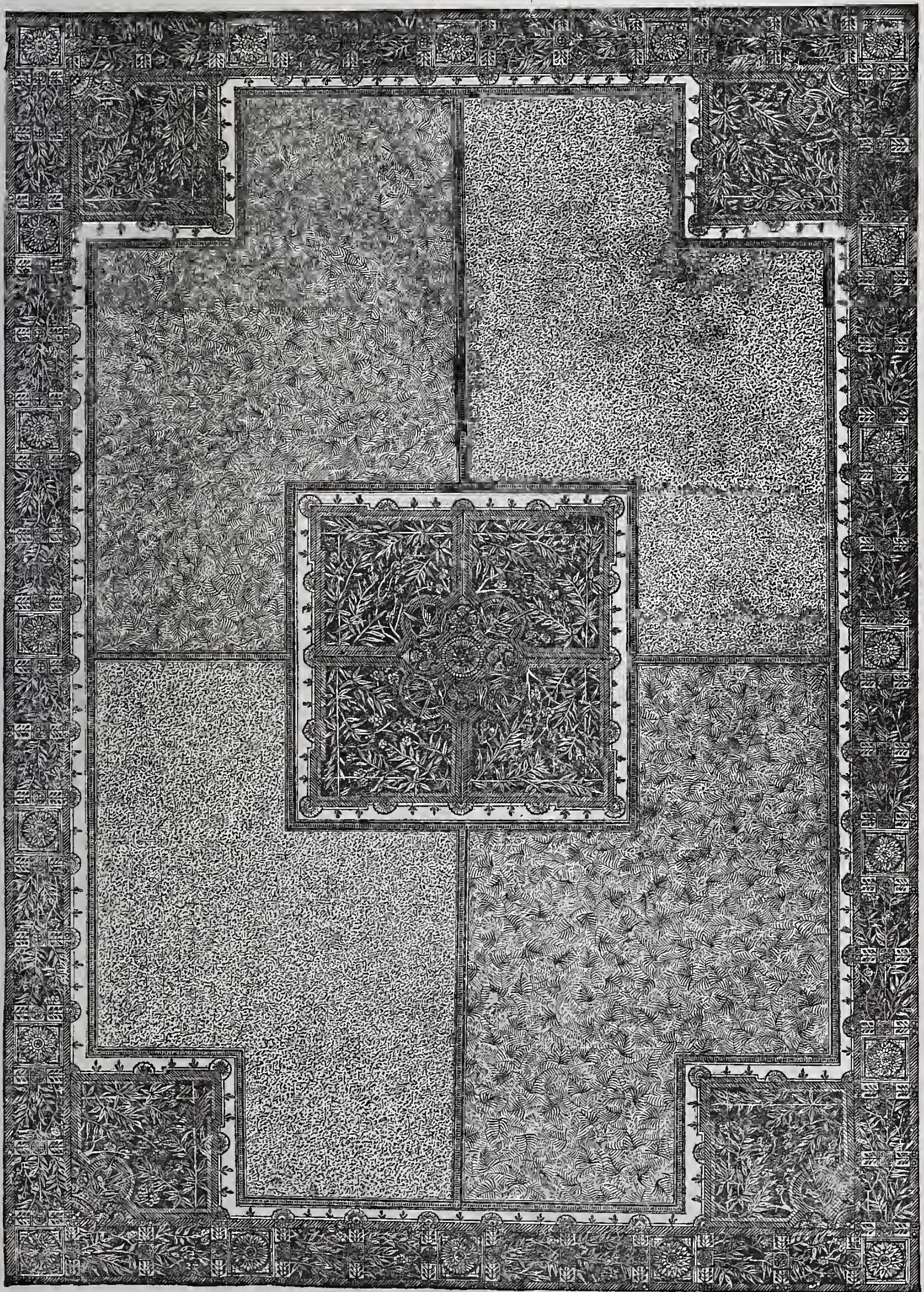
Wall Papers.—Fig. 3.—A Geometrical Pattern.

therefore, to put up wall paper which is in any way covered with pictures, real birds or other objects which are represented as though they were in relief and projecting from the surface. If this is not observed, pictures and furniture constantly cut the figures in two and produce a disagreeable feeling. In other words, do not make a picture a background for something which will partly cover it up. Vines and flowers, when represented as continuous and growing all over the surface, especially if in natural colors, are apt to grow tiresome. Indeed, flower or vine patterns do not please, after they have been on a wall for a while, as well as some more regular or geometrical figure. The exception to this is found when the vine is not made to follow nature closely, but is conventionalized, as it is called. Even sprays of natural flowers sprinkled all over a wall do not always make a satisfactory paper. They may be beautiful individually, but they do not form a pleasing pattern. Each spray is a picture, and when, as on the walls of a room, we get a thousand or two pictures all alike, they become horribly tiresome. In this is founded one of the objections which people of good taste have to natural objects as patterns, especially if the copy is exact. An intricate and formal geometric figure, on the other hand, gains in interest by repetition, and becomes rich and pleasing. It has the additional advantage that, if partly hidden behind a picture, no harm is done, while, if a bird's head is cut off by the picture frame, or a bunch of flowers left with the stems showing and the flowers hidden, the result is not altogether desirable.



Wall Papers.—Fig. 4.—A Dado Designed by Mr. L. C. Tiffany.

Paper is infinitely preferable, as far as beauty is concerned, to a white, hard-finished wall. The white surface is clean, it is true, but cleanliness is not the only desirable quality for the wall of a room in which people are to live. The cleanest wall we can imagine would be one painted with two or three coats of yellow ocher, and after being rubbed down smooth, finished with three coats of coach varnish. The result would not be uglier than the hard finish which has long been so popular. The hard-finished ceiling should not be left without its cover of paper. A pretty pattern, with a suitable border, will greatly increase the beauty of the room and at the same time give means for cleaning. Whitewashing does not always clean; it oftener covers up. Paper after being scrubbed, as many kinds can be, with a dry, soft cloth, can be taken off and replaced by new. The plastering must stay until it comes down by natural causes. All the dirt which its surface holds stays and is covered up each time it is whitewashed or kalsomined. Utility and beauty both say, paper the ceiling. Paper, if injured, may be repaired and no blemish detected. With hard-finish, when once the surface is marred the spot remains to tell the story of the injury.

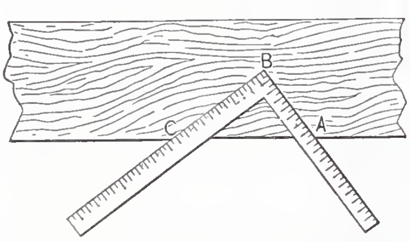


Wall Papers.—Fig. 5.—Examples of Ceiling Treatment.

Modern appliances in the manufacture of wall paper have done much toward enabling the poor man to have a pretty house. For example, Fig. 1 of our engravings represents a paper which is made by machinery to imitate the most expensive tapestry papers heretofore manufactured by hand, and which can be sold at a very low price compared with hand-made papers. This pattern is made in several different grades, even the cheaper ones being very fine. The design itself is so rich that the fact of gold being sparingly employed in it does not become specially noticeable. Without gold this pattern can be bought as low as 30 cents per roll. The article which it imitates—or, rather, which it takes the place of—formerly commanded $1.50 per roll. The pattern, when seen at its best, is a pale yellow, or golden ground, with a figure in brown and black. The frieze and dado are very rich rectangular figures upon gold grounds. The dado really appears considerably darker when in position on the walls than is shown by our engraving. This is an advantage, because it is very desirable to have the bottom of a wall darker than any other portion. In presenting engravings of wall papers we labor under a serious difficulty. It is almost impossible to give in mere black and white an adequate idea of a wall paper pattern which is represented in colors in connection with more or less gold. Accordingly, it will be necessary for our readers to bear this fact in mind in reading what follows. They must draw upon their imagination for such features as it is impossible for the printer's art to portray.

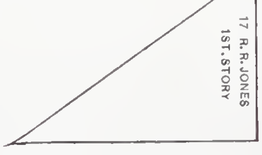
Fig. 2 is an example of paper and frieze, which is worth some study on account of the lessons which may be learned from it. When made up in harmonious colors and seen in the piece or in a sample book, very many persons would be pleased with it. The gilded vine, the pleasing light coming from what seem to be openings in the groundwork, and pretty sprays of colored leaves, make the paper very striking. When put upon a wall, some other things begin to tell against the paper. The irregular openings remind one of pictures hung at all sorts of angles, or of windows scattered over the wall without reason. Some combinations of color emphasize these effects, and the paper becomes annoying. It is copied from Japanese or Chinese designs, where irregularity is generally accepted as a part of the design. It is to be remembered, however, that when the Japanese artist makes a design irregular, it is with especial reference to the work in hand. Very often the repetition of irregularity in imitations makes the result irregularly monotonous. The frieze of this pattern, we think, has too much the appearance of a shelf filled with flower pots to be pleasant. We fancy that after a time the result will be found tiresome. In colors, many of the combinations of this pattern are very pleasant in themselves considered, and the design is, therefore, all the more likely to prove a deceptive one.

Straight Flight of Stairs with Cylinder.—Fig. 1.—Divisions of the Space Between Timbers Upon a Dimension Rod.



Straight Flight of Stairs with Cylinder.—Fig. 2.—Manner of Using the Square in Constructing the Pitch Board.

On the other hand, the paper on the field of Fig. 3 is likely to attract little attention when seen in the sample book, and to be passed over in the piece with only a comment. The pattern, like the last, is a deceptive one, but in exactly the opposite direction. When placed upon the wall it has all the appearance of a simple geometrical pattern, made up of quarter circles and straight horizontal lines. After a little the pattern begins to attract and detain the eye; there are details that need study and combinations of color that please, and we find the paper "improves upon acquaintance." The same is true of the frieze. Its beauties are not all seen at the first glance. The eye returns again and again to it, still finding some pleasing thing. Of the dado we can say little. The large flower pots, with the somewhat "loud" plants in each, were not particularly pleasant in color in the samples which we have seen, nor altogether suitable for the position in which they are used. The other portions of the dado are very good, and if the figures in the panels could be replaced with others, the effects might be improved.

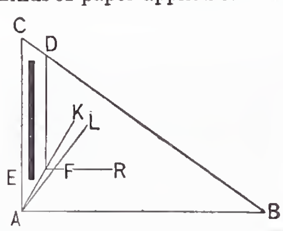


Straight Flight of Stairs with Cylinder.—Fig. 3.—Face of the Pitch Board and the Manner of Marking it.

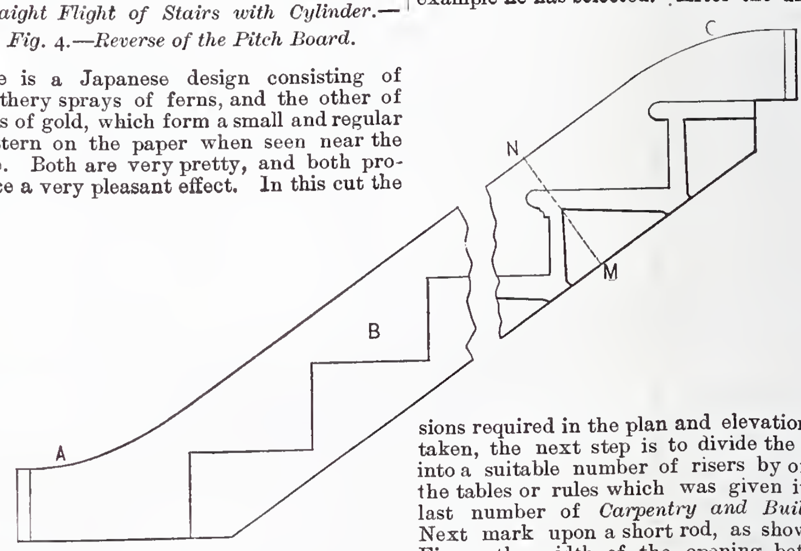
Fig. 4 is a dado designed by Mr. Louis C. Tiffany, a well-known New York artist. In this engraving the pure white portions represent gold. The paper itself has a rough surface to represent tapestry; the ground is made very dark, while the vines are in various shades of browns, relieved by lighter colors when necessary. The design is eminently good, though the price, $3 per roll, and the size of the panels make it somewhat unsuited for small rooms. It is very dark, in this respect matching very well with the prevailing fashion in this city. In looking at the samples the design appears so beautiful that it seems a great pity to have it wasted in a dado.

Fig. 5 gives two examples of how a ceiling may be treated, or rather it shows two different kinds of paper applied to the surface. One is a Japanese design consisting of feathery sprays of ferns, and the other of dots of gold, which form a small and regular pattern on the paper when seen near the eye. Both are very pretty, and both produce a very pleasant effect. In this cut the solid block portions represent the gold. It will be noticed that the groundwork of both the centers and the borders is gold. The effect in the paper is quite different from that in the engraving, being exceedingly rich and brilliant. Centers and borders for ceilings are especially designed to match each kind of paper, from the commonest to the most expensive grades.

In the preparation of this article we are under obligations to Messrs. Warren, Fuller and Co., of 129 East Forty-second street, New York, and Mr. William Campbell, of No. 513 West Forty first street, New York, both for cuts and information furnished.



Straight Flight of Stairs with Cylinder.—Fig. 4.—Reverse of the Pitch Board.



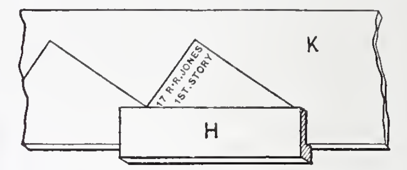
Straight Flight of Stairs with Cylinder.—Fig. 5.—The Wall String, showing Housings for Treads and Risers.

Bric-a-Brac.—A foreign author writes the following concerning the term "bric-à-brac": "It probably comes from the old French expression *de bric et de broque*, which means from right and from left—from hither and thither. The word *bric* signifies in old French an instrument used to shoot arrows at birds; and some etymologists derive the word *brac* from the verb *brocanter*—to sell or exchange—the root of which is Saxon, and also the origin of the word broker."

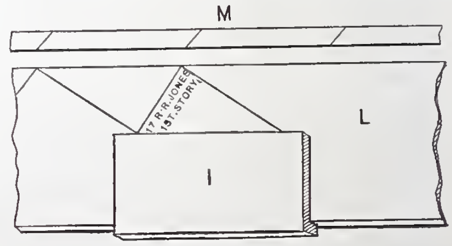
Practical Stair Building.—V.

CONSTRUCTION OF A STRAIGHT FLIGHT OF STAIRS WITH CYLINDER.

The first practical problem to which we shall give consideration will be that of building a straight flight of stairs with a cylinder. The first requirement is to take the dimensions. Measure the hight, the run, the length and the width of the opening, the depth of the joist and the thickness of the flooring. By the dimensions thus obtained, lay off to scale, on paper, a plan and elevation of the stairs just as they are to be constructed. We shall omit engravings of these drawings at this time because there would be little about them requiring explanation, and because the cuts necessary to illustrate what we have to say now are alone more in number than we have room for without crowding. The careful student in perusing this article will do well to assume dimensions as above enumerated, and proceed to draw both an elevation and plan. Then let him follow with drawings of each step hereafter explained, adapting the work in all particulars to the requirements of the example he has selected. After the dimensions required in the plan and elevation are taken, the next step is to divide the hight into a suitable number of risers by one of the tables or rules which was given in the last number of *Carpentry and Building*. Next mark upon a short rod, as shown in Fig. 1, the width of the opening between timbers. Divide up this distance as in the engraving, showing the thickness of the landing fascia, the diameter of the cylinder, the nosing, the length of the risers, the thickness of the wall string, with the depth of its housings and the thickness of the lath and plaster. In the engraving, the first space at the left hand represents the furring; the next the lath and plaster; the third and fourth together the thickness of the string. The arrow head reaches to the depth of the housing, thus indicating the full length of the riser. The small space between the space marked riser and that marked cylinder, represents the nosing of the

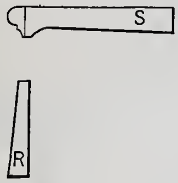


Straight Flight of Stairs with Cylinder.—Fig. 6.—Method of Laying Out the Wall String.



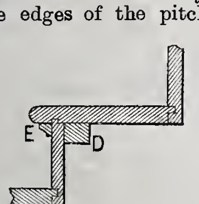
Straight Flight of Stairs with Cylinder.—Fig. 7.—Method of Laying Out the String Pieces.

stairs, the thickness of the front string coming within the length of the riser, and therefore not represented by a special space on the rod. The first space to the right of the cylinder represents the nosing of the floor; the second space represents the thickness of the fascia; while the space at the end represents the joist or floor beam.



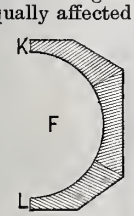
Straight Flight of Stairs with Cylinder.—Fig. 8.—Patterns for the Mortises or Housings for Steps and Risers.

After this dimension-rod has been prepared, the next step is to construct the pitch-board, which may be done as follows: Upon a piece of well seasoned board five-eighths or three quarters of an inch thick, one edge of which is jointed and straight, lay the corner of a steel square, as shown in Fig. 2. Make A B equal to the riser, and B C equal to the tread. Mark along the edges with the blade of a knife and cut by the marks, making the edges of the pitch-board per-



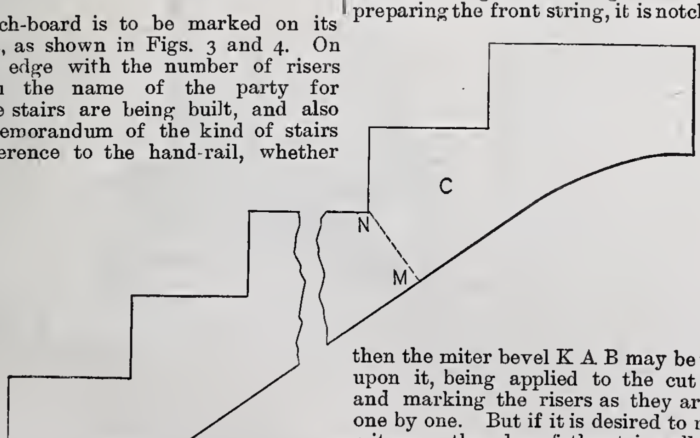
Straight Flight of Stairs with Cylinder.—Fig. 9.—Approved Form of Step and Riser Connection.

fectly square. Since the pitch board is liable to shrinkage, and to being lost or broken, the dimensions of the riser and tread should be preserved in figures, so that in case of an emergency a second pattern may be made. The grain of the wood in the pitch-board should run in the direction indicated in Fig. 2—that is, parallel to the hypothenuse—because in case of shrinkage the rise and tread will then be equally affected by it.



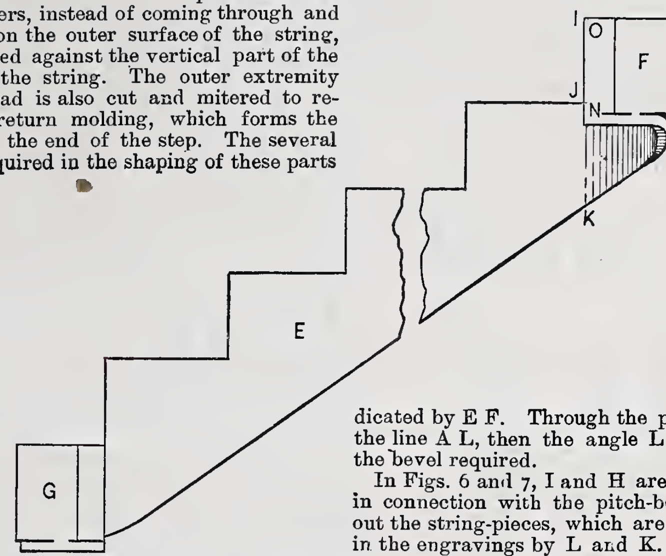
Straight Flight of Stairs with Cylinder.—Fig. 10.—Horizontal Section through the Cylinder.

The pitch-board is to be marked on its two sides, as shown in Figs. 3 and 4. On the riser edge with the number of risers and with the name of the party for whom the stairs are being built, and also with a memorandum of the kind of stairs with reference to the hand-rail, whether



Straight Flight of Stairs with Cylinder.—Fig. 11.—Elevation of Front String where Landing is made without a Cylinder.

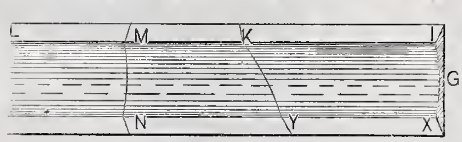
right hand or left hand. Thus in Fig. 3 "17 R R" means 17 risers right hand. The reverse side of the pitch-board shown in Fig. 3 contains at the left, parallel to the riser edge, a heavy mark, which is a device for distinguishing the riser edge from the tread edge, when they are very nearly alike. The reverse also serves a useful purpose for determining and recording the bevels to use in connection with cut and mitered strings. In stairs of the better description the ends of the risers, instead of coming through and showing on the outer surface of the string, are mitered against the vertical part of the notch in the string. The outer extremity of the tread is also cut and mitered to receive a return molding, which forms the nosing of the end of the step. The several bevels required in the shaping of these parts



Straight Flight of Stairs with Cylinder.—Fig. 12.—Elevation of Front String, terminated by a Cylinder at the Top.

are very frequently laid off on the reverse side of the pitch-board, as shown in Fig. 4. For the bevel for the ends of the risers, and also for the bevel to use in mitering the nosings, proceed as follows:

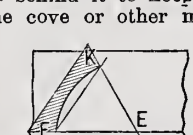
Draw a line parallel to the riser edge A C, as shown in Fig. 4, making the distance between the two lines equal to the thickness of a riser. Draw a similar line parallel to the tread edge of the pitch-board, as shown in the engraving, making the distance



Straight Flight of Stairs with Cylinder.—Fig. 13.—A Piece of Cylinder Stuff, showing how it may be most Advantageously Cut.

equal to the thickness of the front string, including the brackets, if any are used. From the corner A of the pitch-board draw the line A K, intersecting the angle made by the two lines which indicate the thickness of the parts. This line A K then shows the proper miter for the riser and front string, the risers being cut with the angle K A C, and the string with the angle K A B. If, in preparing the front string, it is notched first, then the miter bevel K A B may be used also upon it, being applied to the cut surface, and marking the risers as they are sawed one by one. But if it is desired to mark the miters on the edge of the string all at once, as shown at M in Fig. 7, a different bevel must be used. The necessity for this will be apparent upon a moment's consideration. The angle of the risers is determined upon a horizontal line, but the edge of the string is a pitched or inclined line. Therefore, the angle to be applied to the edge of the string must be so increased as that lines dropped vertically from its points shall coincide with corresponding points in the angle used in the horizontal parts. Therefore, to find this bevel take the distance C D on the hypothenuse of the pitch-board, Fig. 4, and set it off from the side A C upon the line E R, drawn parallel with A B, all as indicated by E F. Through the point F draw the line A L, then the angle L A B will be the bevel required.

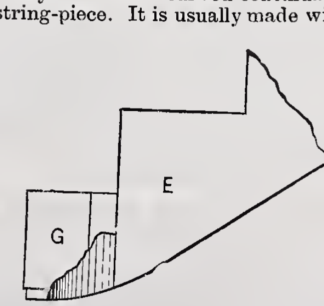
In Figs. 6 and 7, I and H are slides used in connection with the pitch-board to lay out the string-pieces, which are represented in the engravings by L and K. When the string-pieces are very long it is well to line with the slide, and upon this line to space off with a large pair of compasses the length of the pitch-board, using the same compasses for both stringers. This prevents variation and inaccuracy. In Fig. 5, B represents the wall string of the stairs. The easements at the top and bottom—A and C—are made suitable to connect the string with the base, which laps on to it with a splice. The curves constituting these easements may be marked by bending a thin strip of wood into the angles formed by the horizontal lines of the base meeting the pitch line of the stringer. S and R of Fig. 8 represent patterns for the housing in the wall string for the steps and risers. After laying out the wall string by the use of the pitch-board, as shown at K, Fig. 6, these patterns are to be used in describing the shape of the required housings, as shown in the upper part of Fig. 5. Fig. 9 represents a section of a step and riser connection, joined after the most approved manner. Each step and the riser which supports it are first fastened together on the bench. The riser is glued into the step, and two or three short blocks, D, are glued and ailed on behind it to keep it square and firm. The cove or other molding is then



Straight Flight of Stairs with Cylinder.—Fig. 14.—Easy Method of finding the Bevel of Cylinder Stuff.

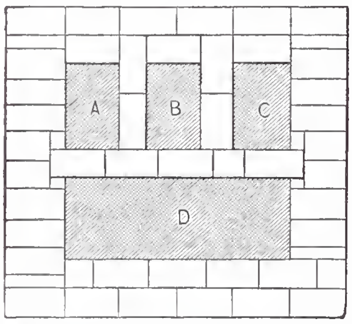
nailed and glued on. In some cases the cove E is planed up square and glued in, and is stuck or molded after the glue has set.

The cylinder is a curved continuation of the string-piece. It is usually made with the



Straight Flight of Stairs with Cylinder.—Fig. 15.—Front String, showing a Starting Cylinder and Joint with Splice.

grain of the wood vertical, as shown in Fig. 10, which is a horizontal section through a cylinder. The edge K is shown cut to the proper thickness to lap on to the splice of the string-piece, and the edge L is cut to the same thickness as the landing fascia to which it joins. In Fig 13, G represents a piece of cylinder stuff, and the lines across it show how it may be cut to the best advantage in working. To cut the pieces to make the cylinder shown at F in Fig. 10, set off the distance I K on one side of the piece a little longer than is actually required, which is determined by I K in Fig. 12. Make K M and M L equal, and each an inch or so longer than the width of the landing fascia. Cut square across at L and M. Divide the space N X into two equal parts, thus obtaining the point G. Then K Y will be the remaining cut. The three pieces thus obtained will be sufficient to form the cylinder shown in Fig. 10. They are to be glued up in a



Heating and Ventilation.—Fig. 5.—Construction of Chimney for both Smoke and Ventilation. D, Smoke Flue. A, Ventilation Flue for First Story. B, Ventilation Flue for Second Story. C, Ventilation Flue for Third Story.

careful manner with the square ends at the top, and all even.

The cylinder is to be finished as follows: After cutting the edges L and K as before mentioned, K to splice with the stringer and L to suit the landing fascia, put the cylinder in its place upon the splice of the string, making the distance I J (Fig. 12) equal to the hight of a riser. Then with a flexible straight-edge make a short mark through K upon the cylinder, keeping the straight-edge fair with the edge of the stringer. On the other edge of the cylinder, make the distance O N equal to the width of the landing fascia, and from it draw a short line upon the inside of the cylinder square with the edge O N. Then beginning with the straight lines, at K and N, connect the points K and N with a curved easement line, drawn by hand to suit the eye. Cut to this line with a narrow saw.

In Fig. 14 is shown an easy method for finding the bevel for cylinder stuff. The two arcs which intersect at K are drawn with the radius F E from F and E as centers. Then the arc F K, represents a segment of the cylinder, and, in connection with the bevels at F and K, constitues the profile to which the stuff is to be worked. The thickness of the stuff necessary to use is determined from this segment, as indicated by the shaded portion of the cut.

The captions under Figs. 11 and 15 make their meaning sufficiently clear without detailed description here. They are introduced to illustrate other phases of the general subject by way of comparison.

When it is necessary to splice a stringer, it may be done by halving and lapping the pieces, fastening them with glue and screws. The splice should not be less than 6 inches in length. The face joint should be square across the stringer at one of the narrowest points, as M N in Figs. 7 and 11.

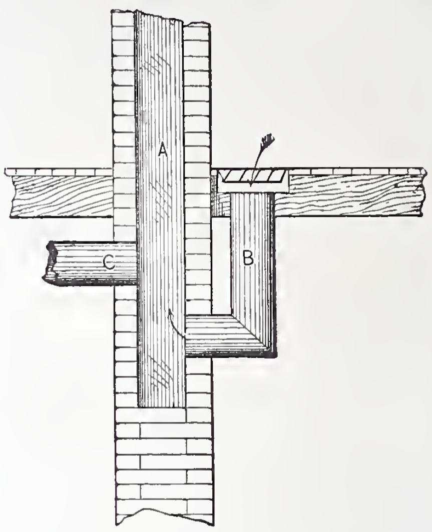
Eastlake Principles and Eastlake Fashion.

Fashion in furniture is at last changing in the direction of the more beautiful lines of the Italian styles, and rebelling against what has been designated Queen Anne and Eastlake, but which should have been called the "ship-carpenter" style. At this every lover of the beautiful will rejoice, for the horrible things that have been perpetrated under the name of Eastlake have been bad enough to cause a rebellion in the heart of every artist.

Eastlake's designs have been used for the foundation of a so-called style, yet it was furthest from his intention, when writing his work on household taste, to have anything to do with a fashion or a style. He designed various articles with little or no ornamentation, and his aim in those designs was mainly to illustrate the principles involved. The legion of people who have made or manufactured Eastlake furniture have made this into a fashion which, as we have said, properly deserves to be called the ship-carpenter style. It is rough, square, ugly and ungraceful, and the most of it lacks in every detail those things for which Eastlake pleaded with all his eloquence.

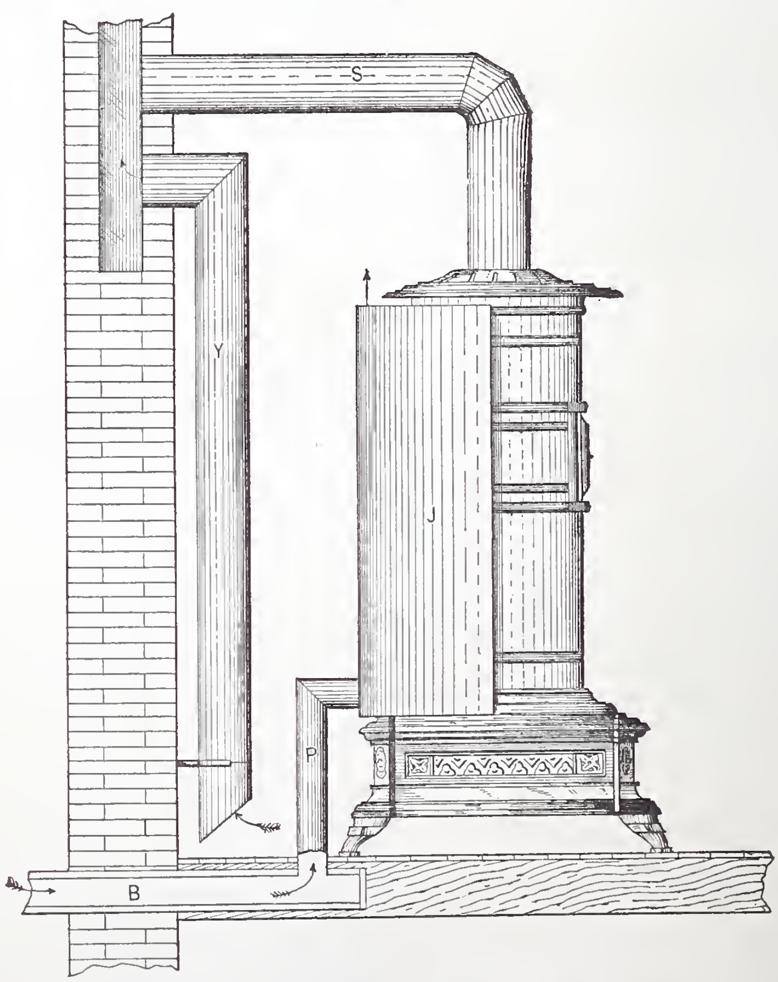
The aim and burden of his writings was in the direction of proper and honest construction in wood. He wanted wood used so that its strength should be applied to the best advantage, and that its weakness should be protected. Many of the illustrations which he gives in his work were the best things he could find in his own evil days. To the great majority of builders the lessons that he wished to teach have been lost; they followed his examples in form, but lost the spirit.

Those with most experience in woodworking tell us that a panel made up with narrow boards set diagonally will be stronger, and show the effects of shrinkage less, than in any other way. The followers of the "Eastlake fashion" put in panels of a single piece, and then with a beading plane make beads diagonally across these panels to imitate narrow boards. A case or a book rack put together with dowels and pins is strong, can be easily taken down, and can also be kept tight, even when the wood shrinks. This construction is not pretty, and is really best suited for heavy work; yet we have seen book cases put up to imitate this construction where the shelves were put in with screws, and the dowels and pins glued upon the outside of the end pieces. Such construction is utterly useless and wholly dishonest. Honest construction in wood is possible, however, even with the beautiful shapes toward which the Italian revival is leading us. Curved brackets in a corner may be made so as to have the straight grain of the wood running through them from end to end, and yet possess very graceful outlines. Curved legs



Heating and Ventilation.—Fig. 7.—Ventilating a Church by Connecting an Opening in the Floor with the Main Chimney Flue, Making the Connection Below the Entrance of the Furnace Pipe. A, Chimney Flue. B, Ventilation Tube. C, Position of Furnace Pipe.

can also, with a little care in designing, be given ample strength without cross-grained portions to give the observer a feeling of uneasiness. Perforated woodwork such as is produced by the scroll-saw, if set in such a fashion as to be protected from violence and allowed to shrink without injuring itself, is as permissible in honest construction as gilding or painting. The use of bent timber—which, if we remember correctly, is not mentioned by Eastlake—gives great



Heating and Ventilation.—Fig. 6.—A Method of Ventilation where Proper Flues have not been Provided. S, Stove Pipe. Y, Ventilator Pipe, 6 Inches Diameter, and Open Near Floor. B, Supply of Outdoor Air. P, Supply Pipe (Oval in Section). J, Jacket of Stove.

freedom in design, while securing all the advantages of the straightest members. Many of the latest designs which we have seen, while as far in style from Eastlake's designs as can well be imagined, do not in any respect violate those principles of sound construction in wood which he laid down.

The Swiss architects of the olden time were famous for the beauty and the strength of their woodwork, and while they adhered carefully to such forms of construction as would give them the greatest strength of the timber, they frequently introduced curves of surpassing beauty and made light and graceful structures. The designer who carefully studies the best works upon furniture and cabinet work, will find that he can easily keep the principles in mind which they lay down, and at the same time produce furniture which shall be light, beautiful, and, at the same time, strong and durable.

HEATING AND VENTILATION.

Expedients for Use in Buildings Already Constructed.

BY REV. DANIEL C. JACOKES, D. D.

(Concluded from page 212 of November number.)

Ventilation, according to the second rule stated in that portion of this paper published last month, should always convey the indoor air from the floor into a heated flue. If the chimney is properly constructed, this may be done with little expense or trouble. Usually, however, this is not the case. The general rule is to build chimneys very small—mostly 4 x 12 or 4 x 16 inches on the inside. This narrow space will soon be more or less filled with soot. In such cases ventilation will be difficult, if not impossible. If the chimney has been constructed with an apartment for ventilation, it will be sufficient to make an opening into it at the floor—that is, the bottom of the opening must in all cases be exactly even with the top of the floor, otherwise the ventilation will be imperfect; this will give good ventilation. All chimneys should be constructed with an apartment for each story, as shown in Fig. 5, and should be plastered smooth; the partition should be made of brick, and built single width, so that it will be 4 inches thick. This wall will be constantly heated, and therefore will keep a continual draft in the ventilating flue.

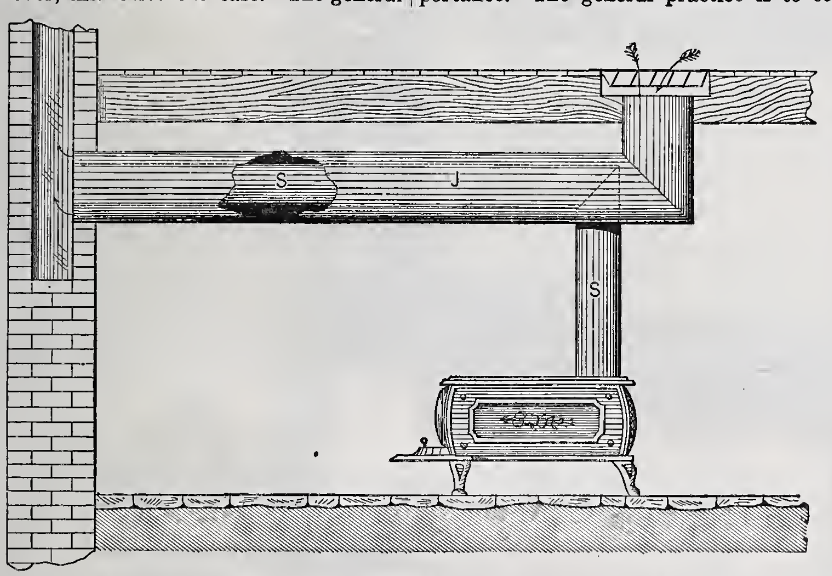
If a chimney is sufficiently large, a 7 or 8-inch stove pipe—or larger, if possible—may be let down inside of the chimney and turned into the room at the floor by an elbow; this will make an efficient ventilator. If there is not sufficient room, or if for any other cause, as a crooked chimney, this cannot be done, ventilation may be effected as illustrated in Fig. 7. Take a pipe 1 inch smaller in diameter than the supply pipe which is to conduct the outdoor air to the stove, and carry it into the chimney—if possible, below the entrance of the smoke pipe. This plan can be adopted more frequently and at less cost than any other as chimneys are generally constructed.

In many houses the chimney is so constructed or situated that the ventilation would not be equal to the work required. Such an instance would be when the chimney is short, the bottom being near the ceiling in the upper story, with a stove in each story connected with it. In such cases ventilation would be hardly possible. To remedy this the following plan may be adopted: The stove pipe in the second story may be surrounded by a much larger pipe; a 6-inch pipe may be surrounded by a 10-inch pipe; a 7-inch by a 12-inch jacket pipe, and the ventilator may be connected with this surrounding jacket. The stove pipe and the jacket are both to be carried into the chimney as one pipe; the stove pipe within will so heat the surrounding air that a strong ventilation will be the result. The ventilator should enter the jacket at or near its bottom, as seen in Fig. 6.

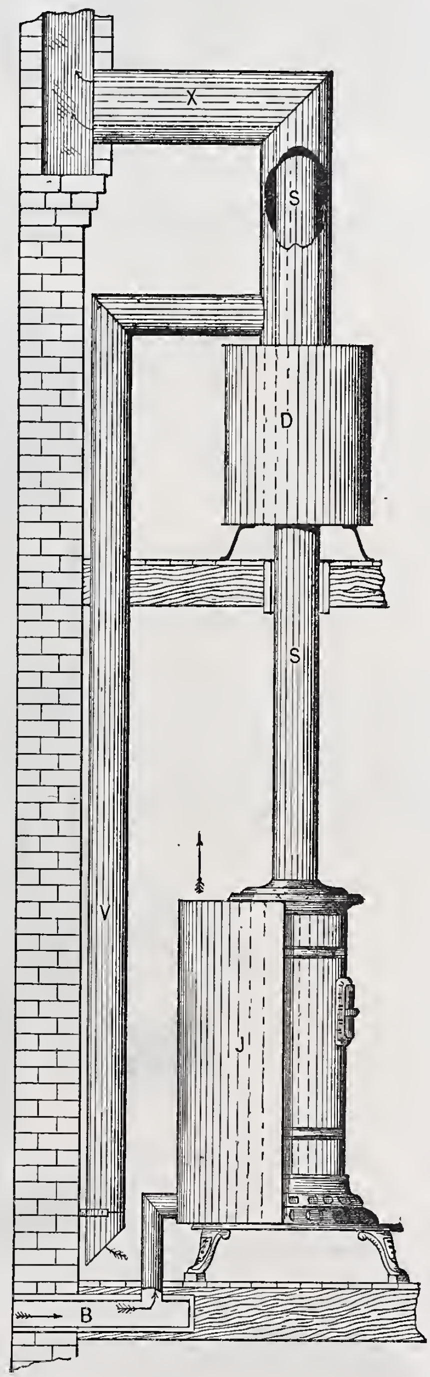
This plan, as well as the others recommended, will secure good heating and ventilation at a very moderate cost. I have known it to cost from 10 shillings in the simpler forms to $10 by the more complicated forms; so that healthy and comfortable homes may be enjoyed by the poor as well as by the more favored of our fellow citizens.

The ventilation of churches, schools and other public buildings where large numbers of persons assemble, is of the highest importance. The general practice is to construct very small chimneys, which renders it difficult to secure efficient ventilation. In all these cases it would be better to reconstruct them, making them, say, 16 by 36 inches inside, dividing the space into two or more apartments, if there is one story to be warmed, or into three if two stories—one for the smoke, the others for ventilation—with an opening into each ventilating flue, always at the floor. One church has a chimney 16 by 36 inches inside, divided by putting a 16-inch pipe of heavy sheet iron so as to make the side flues of equal size; the pipe is fitted close to the brick wall to secure it to its place. This is the smoke pipe, and it warms the air almost instantly in the foul-air flues at its sides, making a very powerful ventilator. This church has a basement story, and needs two flues, one for each room. If this pipe should ever be destroyed, another can be slipped inside of it and thus renewed. In public buildings which are heated at intervals this sheet-iron pipe is the best, as it heats the air on each side at once. In a building constantly heated the best way would be to build the partitions in the chimney with brick. The flues should always be plastered smooth. When this cannot be done, the ventilation must be made in the same manner as for dwelling houses, the ventilating pipes being correspondingly large.

In another church a jacket pipe 16 inches in diameter was put around a stove pipe 7 inches in diameter, connected with a stove —all in the room below—and carried into the chimney. The end of the jacket opposite to the chimney was turned up through the floor by an elbow to receive the foul air of the room above and discharge it into the chimney. The 7-inch pipe enters the 16-inch pipe about 4 feet from the end furthest from the chimney and passes through it to the chimney. A fire in the stove below will warm the foul air in the large pipe, and thus carry it away into the chimney. This fire must be made as soon as that made in the furnace or other heating apparatus and continued as long. This church is finely heated and ventilated. (See Fig. 8.)



Heating and Ventilation.—Fig. 8.—Method of Ventilating a Church. The Pipe of a Stove in the Basement is Jacketed through its Horizontal Length, thus Inducing a Draft from the Opening in the Floor Above Connected with it. S, Stove Pipe. J, Jacket Around Stove Pipe.



Heating and Ventilation.—Fig. 9.—Method of Ventilation where Flue Opening is in Second Story. B, Supply of Outside Air. V, Ventilating Pipe. S, Stove Pipe. J, Jacket to Stove. D, Drum, Located in Second Story. X, Jacket to Stove Pipe, by which the Air Withdrawn from Lower Room is Somewhat Heated before Entering Chimney Flue.

Another church, which is heated by a furnace, is ventilated in the following manner: It has a chimney 16 by 36 inches inside; to secure good ventilation, a hole is made through the floor near the chimney 16 by 20 inches inside; a tube is fitted into this, and reaches down into the room below, near an opening made into the chimney; an elbow connects the tube with the chimney; the foul air from the room above passes through this tube into the chimney below, and this ventilates the church, giving it pure warm air. The opening into the chimney is made below the entrance of the smoke pipe from the furnace, so that the smoke does not enter the ventilating tube. (See Fig. 9.)

In all these illustrations the two rules given have been observed, and may be applied in many other forms: First, conduct the outdoor air against a heated surface; second, conduct the foul air in the room from the floor into a heated flue, and good heating and ventilation will be secured.

Ladies' Sewing Table.

We show in the accompanying perspective view, elevations and details, a very neat table, adapted for use in the sitting room, or in the ladies' sewing room, or in an office. The table from which our engravings were made is built of walnut, and the design executed in that wood presents a very neat and attractive appearance. The same design executed in other woods, or finished by ebonizing, would undoubtedly present an equally attractive appearance. By examination of the illustrations our readers will notice that the parts are very simple, and that the construction is of a character requiring few or no other tools than those ordinarily employed by carpenters and joiners; hence it is something which recommends itself to those who occasionally build odd articles of this kind, either for their own use or for presents to friends. The lower drawer, a section of which is shown in Fig. 4, would be employed for the reception of work when the article is used as a ladies' sewing table. It also forms a convenient receptacle for books or papers when the table is used for a different purpose. The upper drawer may be variously divided, adapting it to the reception of thread, tape, needle cases, buttons, scissors, &c., or it may serve the purpose of a desk, and be so divided as to adapt it to paper, pens, ink, envelopes, stamps, &c. Fig. 3 shows a full size section of the bottom rail, and Fig. 4 shows a full-size section through the edge of the table. The small amount of ornamentation in the way of carving, or, as it may be more properly designated, engraving, is composed of very simple lines, and the patterns are such that the merest novice can execute from the drawings which we have presented.

Ladies' Sewing Table.—Fig. 1.—Perspective View.

Mathematics for Mechanics.

The saying that practice makes perfect implies that something else is wanted besides practice, something which practice crowns and completes. That something is theory, or a knowledge of the principles on which the practice is based.

Mechanical operations draw largely on the various departments of mathematics for their principles. Arithmetic, algebra, geometry and the calculus are constantly levied upon and often taxed to their utmost to supply the demands of mechanics. And these demands are sometimes so tremendous that even the vast resources of modern mathematics cannot satisfy them. The drafts of the physical on the abstract sciences frequently resemble what is known as "a run on the bank," when the funds run out and the bank has to close its doors. In other words, physical problems are constantly arising that baffle the profoundest mathematical analysis.

But while it is not necessary or possible for every one to be a great mathematician, every mechanic may get a vast deal that is needful for him from the field of mathematics, and that not very abstruse or difficult; and the mechanic who is wholly ignorant of mathematics is like a blind man groping his way. He may tread with confidence a familiar, well-beaten path, but the moment he swerves in the least from it, in any direction, he is at sea. If a mechanic would not wish to be a mere automaton, he should be fairly acquainted with the following subjects:

1. *Arithmetic.*—This is learned by every one at the common school; but in after life, without practice, its rules and processes easily slip from memory. Everybody, of course, should be familiar with the four common rules—addition, subtraction, multiplication and division—and there are certain other rules that a mechanic especially should be at all times up in. He should be perfectly at home in both vulgar and decimal fractions and be able to handle them like an expert. He may often have occasion to extract square and cube roots, and should be able to do so with facility.

2. *Mensuration.*—Every mechanic should know how to measure and calculate the areas of common plane figures, particularly those of the triangle and circle. He should also know how to measure and compute the surfaces and contents of the commonest solids, as the parallelopiped, pyramid, cone, cylinder and sphere.

3. *Algebra.*—He should know as much of algebra as to be able to solve simple and quadratic equations. He should also be able to use the binomial theorem. And especially he should be thoroughly familiar with algebraic formulæ and transformations, as he will constantly meet them in books if he attempts reading; and he should be able readily to calculate the value of any expression when the letters in it are assigned numerical values.

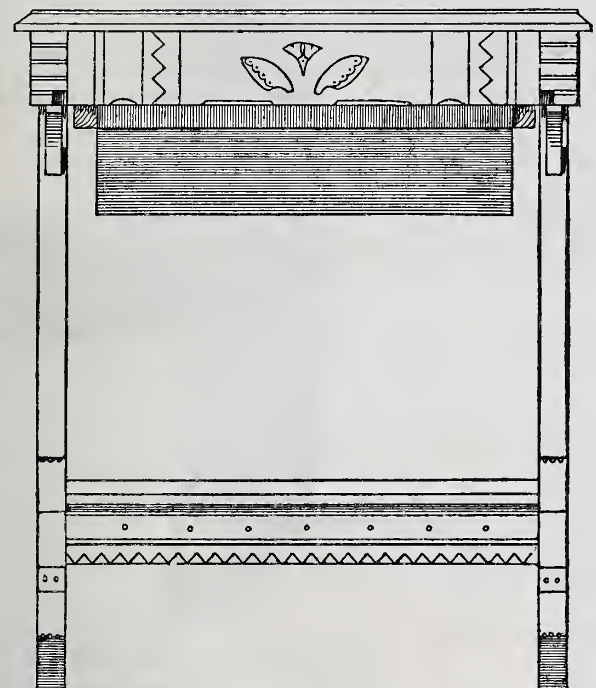
4. *Logarithms.*—Without necessarily being acquainted with their theory and construction, he ought to be able to use a table of logarithms.

5. *Geometry.*—A knowledge of the principal properties of plane figures would be highly useful; also an acquaintance with the geometry of the most familiar solids, as the cylinder, sphere, &c.

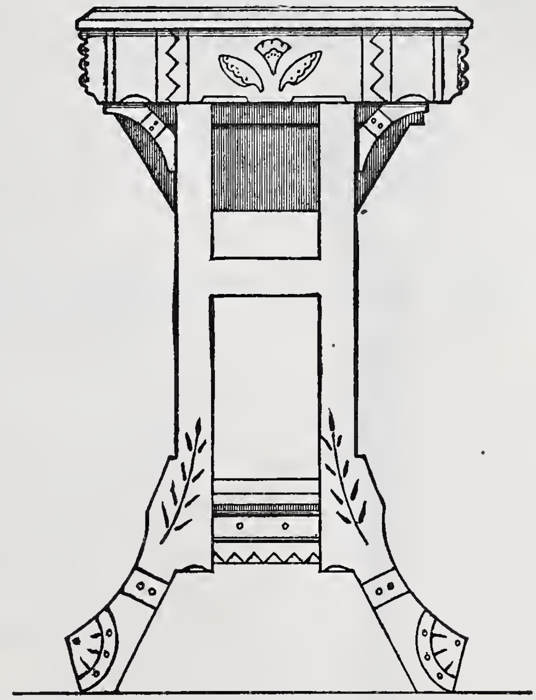
6. *Trigonometry.*—The meaning, at least, of the terms sine, cosine, tangent, &c., should be understood; also the solution of plane triangles.

7. *The Calculus.*—The differential and

integral calculus is the powerful machine with which mathematics achieves its greatest wonders. It is commonly treated as something too lofty, too sublimated, to be within the comprehension of ordinary people. This is a mistake. The radical and essential ideas of this great two-fold calculus are

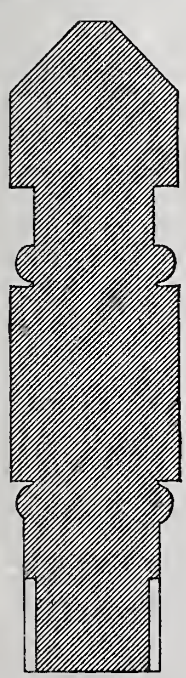


Ladies' Sewing Table.—Fig. 2.—Side Elevation.—Scale, 1½ Inches to the Foot.



Ladies' Sewing Table.—Fig. 5.—End Elevation.—Scale, 1½ Inches to the Foot.

easy of comprehension; and while it covers an illimitable field, there are parts of it—and those the most useful—that can readily be mastered by any one with a very small stock of algebra and geometry at command. No mechanic with such a moderate equipment need dread the calculus. He can acquire some of its best formulæ with ease, and should by all means do so. The notation and processes of the calculus pervade all scientific books of any account, and without a knowledge of such notation and processes,



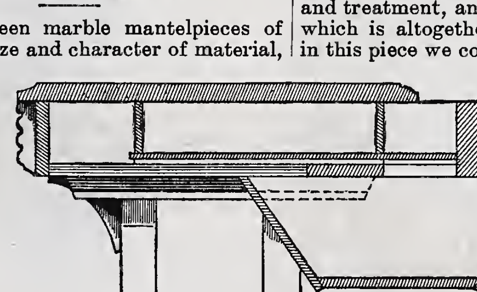
Ladies' Sewing Table.—Fig. 3.—Section through Rail at Bottom.—Full Size.

the books will be as unintelligible as the hieroglyphics of Egypt.

The facilities for acquiring knowledge in these days are numerous, and no one can plead in excuse for his ignorance that he has not opportunities. If he is debarred by age or occupation from attending day school, there are night schools which he can attend, if he is not too lazy, when his day's work is done. At these schools he can study arithmetic and some other things that will make a good basis to build other subjects upon, not taught in these elementary places of learning. But if he can afford it, let him by all means have a competent private teacher; he will find it the best economy.

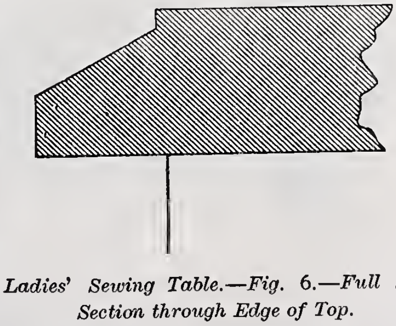
Marble Mantelpieces.

We have seen marble mantelpieces of almost every size and character of material,



Ladies' Sewing Table.—Fig. 4.—Vertical Section, showing Construction and Arrangement of Drawers.—Scale, 1½ Inches to the Foot.

but we have not before heard of a porcelain mantelpiece. One has, however, been constructed of hard and soft porcelain by a Swedish company. It stands 12 feet high, and its general color is lavender and celadon, picked out with gold, but there are other colors blending with these, and making a harmonious whole of great delicacy and richness. The fire-place is surrounded with a beautiful border of flowers and leaves in white porcelain, picked out with gold. The columns on either side are divided into plain panels of lavender and gold, separated by richly ornamented medallions. Above the columns is a frieze with scroll-work of singularly beautiful design in celadon, lavender, and fine tracery in gold, while above that again is the white porcelain shelf, resembling in its purity and polish the richest marble. Above this, in the center of a long horizontal panel, ornamented with an elegant scroll pattern in relief, is a charmingly modeled figure of Cupid, in the round, a most beautifully executed porcelain. Just over the Cupid, in a niche prepared for it, is an Etruscan vase standing some 3 feet high. The design and coloring of this vase may be said to be the *motif* for the rest of the chimney-piece, which is, so to speak, built up around this central figure. On either side of the vase are columns banded into diamonds below and ornamented above with medallions containing the insignia of the arts and sciences. The whole space between the niche and columns is filled with scroll-work, highly elaborated, yet of the most chaste design. The upper part of this superb work is in harmony with the richness of its lower portion. While the ornamentation is equally elaborate, it is lighter in color and treatment, and gives an effect of finish which is altogether satisfactory. Whether in this piece we consider the adaptability of the material to the use proposed, or the character of the ornamentation allowable in an object of this kind, or simply the effect of the whole as we see it, there can be but one opinion of its merit—its purity and har-



Ladies' Sewing Table.—Fig. 6.—Full Size Section through Edge of Top.

mony of design are admirable. We live in an age of striking innovation.

Cloth coated with linseed oil, to which a little wax and litharge have been added, will be water-proof.

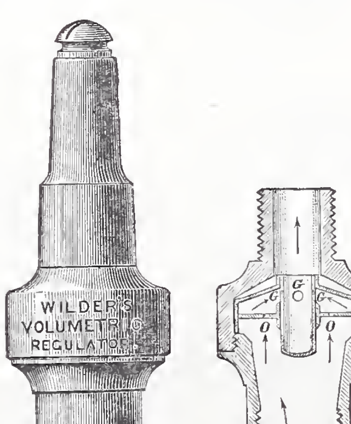
Novelties.

Under this head this month we have included some things which are not altogether new, but which we believe will be novelties to the majority of our readers.

The screw-driver illustrated in the accompanying engraving, Fig. 1, is claimed to combine greater strength, convenience and durability than has ever been obtained in a common driver.

Novelties.—Fig. 1.—Gay's Ratchet Screw-Driver.

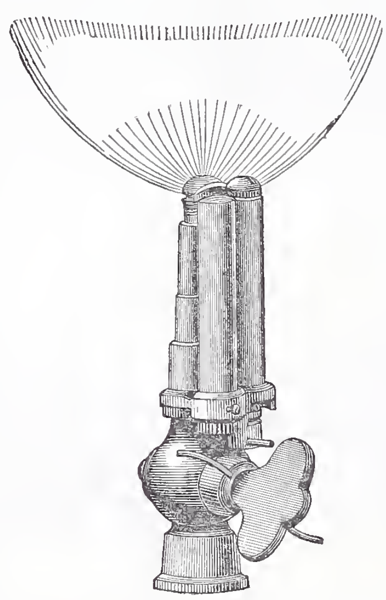
It may be described as a double-action ratchet screw-driver. By sliding the button, which is shown in the face of the handle in the engraving, from one side of the plate to the other, one part is thrown out and another let into the teeth of the ratchet, thus changing from a right-hand to a left-hand action instantly. By leaving the button midway, the blade remains stationary, like that of a common screw-driver. By this direct action of the ratchet, the pressure against the screw is maintained as firmly while turning the hand back as when turning the screw head. By retaining the pressure in this manner, it is, of course, possible to carry the hand much steadier than when the driver is used in the usual way. The blade is far less liable to slip out of the slot and mar the wood into which the screw is being driven than with the ordinary tool. Strength is secured in the construction of this tool by the employment of steel in the place of iron. The diameter of the ratchet, which is of steel, is larger than the diameter of the wood at the ferrule, which is the weakest point in the common screw-drivers. For certain purposes this tool is invaluable —as, for example, hanging doors and blinds, putting up curtain fixtures, and all other kinds of work where a common driver is found unhandy or inconvenient on account of its liability to slip out of the slot in the screw head. The manufacturers are Messrs. Gay & Parsons, Augusta, Me. The tool is gotten up in very neat shape, with ebonized handle, and is something quite desirable for any carpenter to possess.



Elevation. Section.

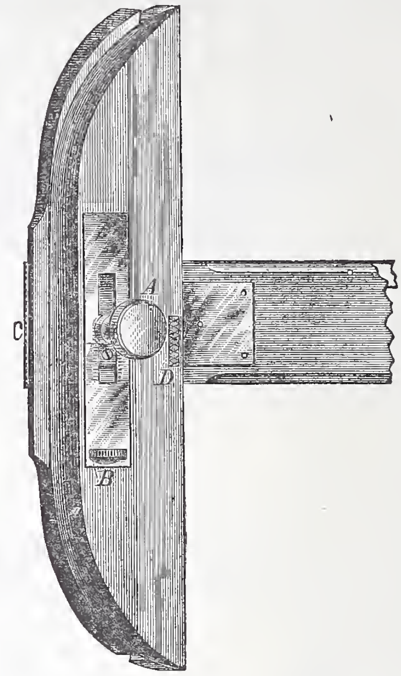
Novelties.—Fig. 2.—Wilder's Gas Regulator.

In Fig. 2 is shown a section and elevation of a new gas regulator. The importance of burning gas under a low and constant pressure is not generally understood by gas consumers, and gas bills are frequently extravagantly large because, in order to obtain the light needed, gas under high pressure, to double or treble the necessary quantity, has been used. It is a well-known fact that by increasing the pressure in the pipes an almost unlimited amount of gas may be passed through a burner. Contrary to what might be expected, as the amount of gas is increased the quantity of light, instead of increasing, gradually diminishes, and we can have a pressure so great that the gas blows through and no light whatever is given, the flame becoming dark-blue and practically non-luminous. The Wilder regulator is applied in the base of the burner, and controls the supply at the point of consumption. The regulator consists of a cylindrical metal cup and float, fitted in the gas pipe at any suitable point where the gas must pass through the regulator on its way to the burner. The float fits loosely in the cup, and is lifted and held poised in the current of gas as it flows. The holes *o o*, Fig. 2, in the float are of a size to pass the required volume of gas at a pressure which will sustain the float. If the gas in the supply pipe has a pressure greater than will sustain the float, the float rises and covers so much of the gasways *g g* as represents the excess of pressure. It operates automatically, therefore, to maintain a flow of gas through the holes *o o* and gasways *g g*, which will sustain it and hold it poised in the current. The flow of gas in a given time is dependent upon the size of holes *o o* and the weight of the float. These factors being constant, the delivery of gas will be constant also. The regulator is made in various sizes, suitable for all the ordinary burners. The manufacturers are the New York Gas Controller Company, 55 Boerum Place, Brooklyn, N. Y.



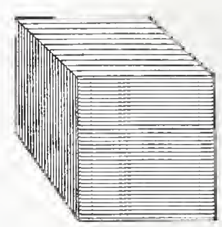
Novelties.—Fig. 3.—Self-Lighting Gas Burner.

Fig. 3 represents what is known to the trade as the scintillating gas burner, which is now being introduced by the Municipal Manufacturing Company, No. 695 Broadway, New York City. This burner is self-lighting. By turning the thumb screw, plainly shown in the engraving, the gas is let on and lighted in one operation. A stick of lighting material is contained in the tube alongside of the burner, which at every turn of the screw is forced upward. The thumb screw, in turning, moves back a small knife, shown at the top of the tube,

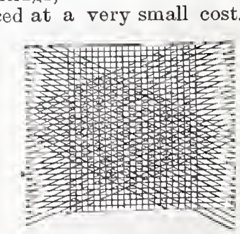


Novelties.—Fig. 4.—Day's Spacing T-Square.

which, when a spring that is contained in the second tube is released, flies forward, cutting off enough of the lighting material in doing so to produce a solid flash, which ignites the gas. There is no trouble from sparks in the use of this burner, or anything of that kind. After the lighting material in the tube, which is said to contain enough for 2500 or more lightings, has been exhausted it may be replaced at a very small cost. From a trial of one of these burners, extending over a period of several weeks, we are confident that they are likely to fill a long-felt want.

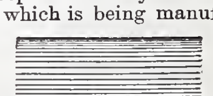


Novelties.—Fig. 5.—Specimen of Work done with Day's Spacing T-Square.



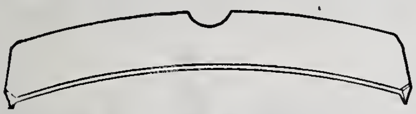
Novelties.—Fig. 6.—Specimen of Work done with Day's Spacing T-Square.

Fig. 4 represents Day's Patent Spacing T-Square, which is being manufactured by Prof. Daniel T. Ames, the penman, of No. 205 Broadway, New York City. The usefulness of this article is best illustrated by referring to some specimens of work executed with it, which are shown in Figs. 5, 6 and 7. The space between lines is regulated by turning the nut B, shown in Fig. 4. to the left, and moving the upper section of the head downward until the space desired is indicated on the graduated plate, which will



Novelties —Fig. 7.—Specimen of Work done with Day's Spacing T-Square.

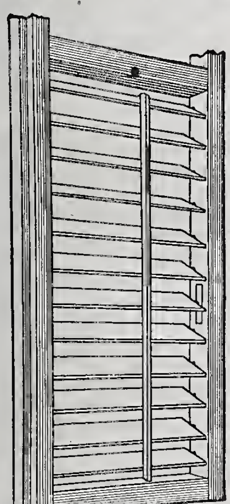
be seen by examining the surface shown immediately below the set-screw. The square, after being set in this manner, as required, is operated with the thumb upon the metal D and the fingers upon the similar metal C. The head of the square is pressed closely against the board. The lower section is drawn forward by the fingers until it strikes the stop, when the line is ruled. Then the top section of the head is drawn forward with the thumb, and the lower section is again moved in the way just described.



Novelties.—Fig. 8.—Bentley's Blind Slat Holder. (Two-third Size.)

When the second line is drawn, this operation is repeated as may be required. The blade is swiveled, so that it may be set to any angle. Shading may be graduated by turning the nut B either to the right or the left between each ruling, as may be necessary. A little practice enables the operator to perform work with this tool with great rapidity and certainty.

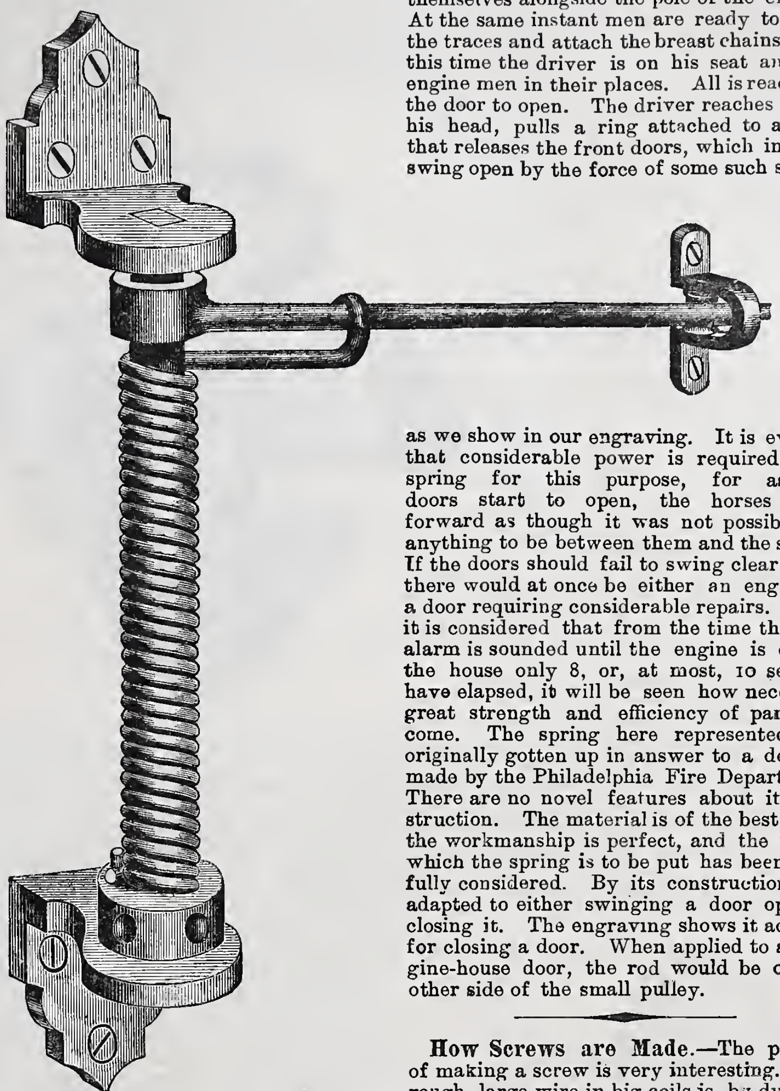
A new blind slat holder, which is being introduced by R. W. Bentley, 41 Fourth street, Brooklyn, E. D., is shown in Fig. 8. This cut represents the article about two-thirds full size. As may be seen by the engraving, it consists of a narrow strip of brass somewhat bowed, so as to give it sufficient spring, and having a semicircular notch cut in the middle to allow it to fit over the pin of the slat. Each of the corners is bent down to answer the purpose of fastening the holder in position, thus obviating the necessity for nails or screws. The slat is held by the



Novelties.—Fig. 9.—Application of Bentley's Blind Slat Holder.

spring of the brass. Fig. 9 shows the application of this article to a blind of ordinary construction. It is very simple, very easy of application, very efficient and, withal, very cheap.

A laundry tub that should be seamless and imperishable, clean, sweet, and almost as durable as time itself, and yet cheap beyond anything else when its merits are considered, is an article desired by every housewife and every house-owner. Many attempts have been made to accomplish this result, and as a consequence there may be found in use tubs of all sorts of material and of various styles of construction. Our readers know of the objections to wood and cast-iron, and of the merits of slate and of soapstone. A really good article has in the past been almost prohibitory in price. The tub represented by the engraving (Fig. 11), which is being manufactured by A. G. Myers, 94 Beekman street, New York, is put forward by the manufacturer as being more satisfactory than anything which has preceded it. It is, in fact, a stone tub. It is made from cement, somewhat after the manner in which artificial stone is produced. This, perhaps, does not fully describe the operation, for the maker claims that a lost art peculiar to the ancient Romans in the production of vessels from cement has been restored and successfully applied in the production of these tubs. They are constructed in one piece, and accordingly there



Novelties.—Fig. 10.—Door Spring Adapted to use in Steam Fire Engine Houses.—Scale, about ⅓ Full Size.

are no joints to leak, no soaking and no giving forth of bad smells. As may be seen in part by the engraving, the inside corners are rounded and the bottom is curved. It is also pitched to the point of discharge, thus allowing all water to quickly drain off. In the mounting of these tubs only the simplest frame is necessary. They require no bracing or binding, their own weight being sufficient to secure them in position.

Fig. 10 represents a heavy door spring, the special features of which are strength and durability. It is manufactured by J. B. Shannon & Sons, 1009 Market street, Philadelphia, and has been specially devised to fill a want long felt in connection with the doors of steam fire-engine houses. To any one who has seen the rapid preparations made for getting an engine to the scene of a fire after an alarm has been sounded, it will be plain that the efficiency of the department in some measure depends upon how suddenly the doors can be opened automatically. Systems vary somewhat as between different cities, although in the main they agree. The original alarm moves a lever, which releases the horses and opens the stable doors. The horses rush out, and place themselves alongside the pole of the engine. At the same instant men are ready to hook the traces and attach the breast chains. By this time the driver is on his seat and the engine men in their places. All is ready for the door to open. The driver reaches above his head, pulls a ring attached to a rope that releases the front doors, which in turn swing open by the force of some such spring as we show in our engraving. It is evident that considerable power is required in a spring for this purpose, for as the doors start to open, the horses rush forward as though it was not possible for anything to be between them and the street. If the doors should fail to swing clear back, there would at once be either an engine or a door requiring considerable repairs. When it is considered that from the time that the alarm is sounded until the engine is out of the house only 8, or, at most, 10 seconds have elapsed, it will be seen how necessary great strength and efficiency of parts become. The spring here represented was originally gotten up in answer to a demand made by the Philadelphia Fire Department. There are no novel features about its construction. The material is of the best kind, the workmanship is perfect, and the use to which the spring is to be put has been carefully considered. By its construction it is adapted to either swinging a door open or closing it. The engraving shows it adapted for closing a door. When applied to an engine-house door, the rod would be on the other side of the small pulley.

How Screws are Made.—The process of making a screw is very interesting. The rough, large wire in big coils is, by drawing through a hole smaller than itself, made the size needed. Then it goes into a machine that at one moment cuts it a proper length and makes a head on it. Then it is put into sawdust and "rattled," and thus brightened. Then the head is shaped down smoothly to the proper size, and the nick put in at the same time. After rattling again in sawdust, the thread is cut by another machine, and after another rattling and thorough drying the screws are assorted by hand (the fingers of those who do this move almost literally like lightning), grossed by weight and packed for shipping. That which renders it possible for machines to do all this is a little thing that looks and opens and shuts like a goose's bill, which picks up a single screw at a time, carries it where needed, holds it till grasped by something else and returns for another. This is about the most wonderful piece of automatic skill and usefulness ever seen, and it has done its distinctive work at the rate of 31 screws a minute, although this rate is only experimental as yet; 93 gross per day, however, has been the regular work of one machine.

Novelties.—Fig. 11.—Improved Laundry Tub.

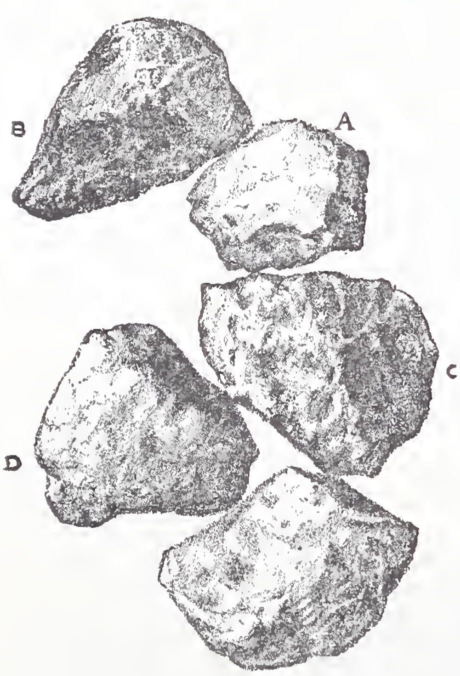
"Sharp" Sand and Quicksand.

BY W. E. PARTRIDGE.

Some time since a correspondent of *Carpentry and Building* propounded the following apparently very simple question, which was referred to the writer: "How can I tell when quicksand is mixed with building sand?" The first mental comment as the letter was laid down was something as follows: "Anybody who is not a fool ought to be able to answer that question." Then there was a little pause to think. It took only a short deliberation, however, to come to the conclusion that I must be among the fools—there was no answer forthcoming. The question then put itself in another shape: What is quicksand? Looking in the dictionary did not help me, nor did the encyclopædias. One of the latter says quicksand is "loose sand, abounding with water." Yet if we take the case of some sea beaches we find them hard and solid, even under the water line, while there are other portions which are as light and as easily moved as so much molasses. Evidently quicksand would not be fit for building, even though the "abounding" water were to be taken out. Careful questioning of builders and engineers did not bring any facts to light.

Finding it necessary to begin at the beginning, I procured a number of samples of the best building sand, as well as several lots of quicksand, one of the latter of which came from Italy. All of these were very carefully labeled, in order that during the examinations I proposed to give there might be no mistake in regard to them.

Examined by the unaided senses I found that all the building sand was clean and free from loam and fine particles. When rubbed



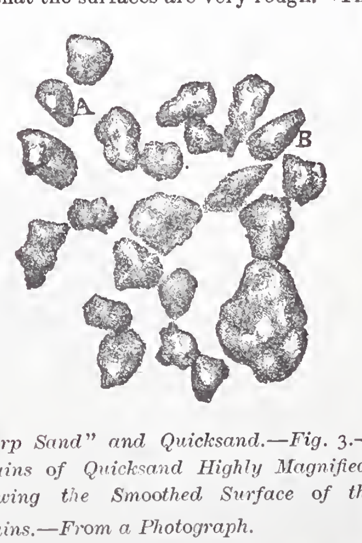
"Sharp" Sand and Quicksand.—Fig. 1.—Grains of Good Building Sand Highly Magnified.—From a Photograph.

under the finger it felt gritty, even to the last particle, and was quite coarse as compared with most of the quicksand samples. The quicksands were generally very fine, full of dirt, and when rubbed between the fingers did not feel in the least gritty. In fact, they seemed soft and smooth, some of them appearing almost like flour to the touch. In the bottles many samples of the quicksand appeared somewhat dirty, and when spread out on a piece of glass there were fine particles which seemed to be loam.

Having gone as far in these investigations as was possible without some other means of supplementing the senses, samples were prepared for examination under the microscope. To do this I coated a small spot in the center of a glass slide with varnish and poured a little of the sand upon it, spreading it about and taking care that none of the particles fell off. By holding the glass over the lamp for a moment the varnish melted and each grain was secure in its place. I then placed the samples under the microscope and examined them under a great variety of conditions. The first peculiarity

"Sharp" Sand and Quicksand.—Fig. 2.—Grains of Good Building Sand Highly Magnified.—From a Photograph.

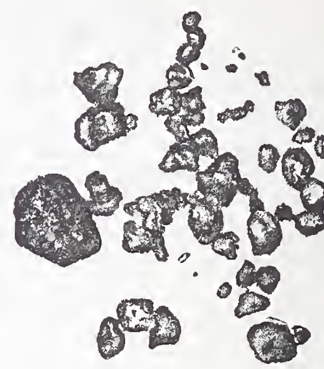
that showed itself was the fact that all the different samples appeared to be very much alike in substance. They were all semi-transparent, but were tinged with various colors. Those from the immediate neighborhood of New York had a reddish or yellowish shade, while others were more nearly white. Some of the Eastern sand appeared to be without color. With the color the resemblance ceased. Nothing could be more striking than the appearance of good building sand when seen through the instrument. In order to give the readers of *Carpentry and Building* the clearest idea possible of the actual differences of the sand, I have photographed several of the samples as they appeared under the microscope. These photographs have been very carefully engraved, and the cuts present accurately the sand as seen through the instrument. Fig. 1 shows five grains of ordinary building sand. The grains are irregular, and although the angles are not sharp, it will be seen that the surfaces are very rough. The



"Sharp Sand" and Quicksand.—Fig. 3.—Grains of Quicksand Highly Magnified, showing the Smoothed Surface of the Grains.—From a Photograph.

grain lettered D, although it has a somewhat rounded form and angles, is by no means smooth. In the under side there is a hollow which cannot be shown in an engraving, making it somewhat resemble a cup-sponge. The whole outer surface is roughened. The grain A is somewhat smaller than the average, yet its surface is very decidedly rough. B was not only rough, but of an impure material. It was formed by flaking off of small particles.

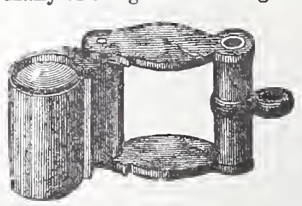
These numerous projections evidently interlock, and prevent the free motion of the particles which is found in quicksand. Fig. 2 shows five other grains from a different sample of sand. While the main angles are not particularly sharp, it will be seen that the surfaces, as in the former case, are rough, and the sides formed by flaking off of pieces. Some of the grains appear to



"Sharp" Sand and Quicksand.—Fig. 4.—Grains of Quicksand Highly Magnified.—From a Photograph.

be small crystals. Grains shaped like these not only afford lime or cement a firm hold, but by the great amount of surface they present, give ample opportunity for the action of the lime upon the silica of which they are formed. From an examination of these engravings it is easy to see why sand of this kind is called "sharp." It is not, as might at first be supposed, because it has many sharp angles, but on account of its very rough surface, which makes it feel rough to the touch.

Fig. 3 presents a very decided contrast to those which we have just examined. The grains are magnified to the same extent as those in the first samples, yet not a single grain approaches in size the smallest of the grains of the building sand. The largest grains at the bottom of the engraving, when measured, are less than half the size of the smallest grains of the building sand, and the largest only about 1-6th of the bulk by actual computation. Here then is one very marked difference. Fig. 4 is from a photograph of another sample of quicksand. Here the particles are still finer than in the last case, many of them, even under the same magnifying power, appearing as dust or very small dots. Many of the grains are angular, some



"Sharp" Sand and Quicksand.—Fig. 5.—A Coddington Magnifying Glass.

of them having very sharp points, and at first sight might seem to deserve the name of "sharp," which is applied to the building sand. A little closer investigation shows that there is another marked and radical difference between the two kinds. The grains of quicksand are, without exception, smooth upon the surface. This is especially true of the larger grains in both Figs. 3 and 4. There is also a very general tendency in the grains toward globular and pyramidal forms. Thus, while many grains have very sharp points, they also have the other end round or nearly hemispherical. Examples of this may be seen at A and B in Fig. 3. These grains, although having sharp points, seem to be circular in section and are highly polished upon their whole surfaces. Many of the grains roll as easily as so many marbles. Quicksand, whether from Hunter's Point, Long Island, where there are large deposits of varying colors, or from Italy, as above mentioned, seems to the naked eye, and even under the glass, to contain a great deal of dirt. A large proportion of this is simply grains of sand still smaller than those which go to make up the general mass. So far as can be seen, their shape is the same as those of larger size. All of them appear to be water-worn, like the pebbles upon our beaches which are exposed to the full sweep of the ocean waves.

We now come to the question asked by the correspondent in regard to finding out whether quicksand is mixed with the building sand. Under an ordinary magnifying glass, costing from one dollar to one dollar and a half or two dollars, it is possible to do this. The observer must not expect that he can see all that is shown under the high magnifying power used when these photographs were taken, but he can see enough to be able to recognize the general shape of the sharp sand, and the glass will also show him the smaller and more nearly globular grains of the quicksand. The glass will be a sufficient aid to the eyesight if it is properly managed and is of fairly good quality. All things considered, a little "Coddington," such as is represented in Fig. 5, is the cheapest and most powerful glass that can be got, and in some respects it is the easiest to manage. Almost any of the pocket magnifiers will answer, however. A linen prover can be made to show the difference in the various kinds of sand in a fairly satisfactory manner.

To examine the sand so as to see its character to the best advantage, it is necessary to to take some care. First obtain a piece of looking glass, and place it in such a position that upon looking down the reflection of the sky can be seen. Then take a bit of window glass and pour a little of the sand upon it. Shake about a little, until each grain seems separate from its neighbor, and then apply the magnifier, holding the slip with the sand in such a position that the reflection of the sky from the looking glass is seen through the sand. This insures good light, and, as the grains of sand are partly transparent, gives them a bright illumination. If a linen prover is used, it should be placed upon the glass and the sand sprinkled into the opening under it. It is also desirable, especially in the case of white sand, to look at it in a strong light with a black background. The clean, pure sand is then easily distinguished from that which is dirty and the amount of the dirt detected. It would be well to read the article on "Hand Magnifiers," which was published in the August number of *Carpentry and Building*, in order to get some idea of the best methods of adjusting them.

I do not wish to be understood as saying that an original investigation into the characteristics of sand and quicksand could be made by the means just described, or that I could have discovered even a small proportion of the facts which have been presented by the aid of a pocket magnifying glass. Having once seen with a high power certain appearances and understanding what the structure actually is, it becomes very easy to recognize them with a small glass. The engravings, together with the description, will be enough to enable any reader of *Carpentry and Building* to recognize both sand and quicksand, and to detect many of the peculiarities described, as well as to tell whether quicksand is mingled with the building sand.

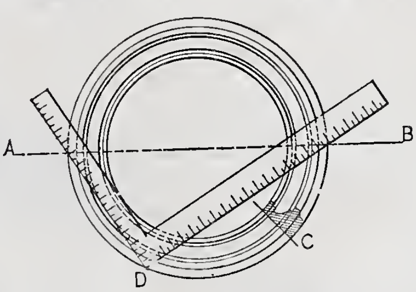
NEW PUBLICATIONS.

Modern Architectural Designs and Details, containing 80 lithograph plates showing new and original designs of dwellings of moderate cost in the Queen Anne, Eastlake, Elizabethan and other modern styles. Complete in 10 parts. Part second. New York : Bicknell & Comstock.

The second part of the above work, an announcement of which was contained in the last issue of *Carpentry and Building*, is before us, and fully sustains the favorable opinion we had formed of it from inspection of the first part. The contents of the present number are as follows : Details of store finish, both exterior and interior, including shelving, &c. ; a plate of brackets ; a plate of fences and gates ; a plate showing modern caps and hoods suitable for windows and doors ; a plate of architraves and bases with two designs of wainscoting ; a plate of balconies containing both elevations and details. The last plate of this number contains three designs, shown by elevations and floor plans, of cheap cottages. As mentioned in our former notice, the price of this work is placed at $1 per part.

CORRESPONDENCE.

No doubt many of our readers—including some who are neither architects nor designers—noticed the announcement of three design competitions among the advertising pages of last month's *Carpentry and Building*, although no mention was made of it in our reading columns. The same notice is



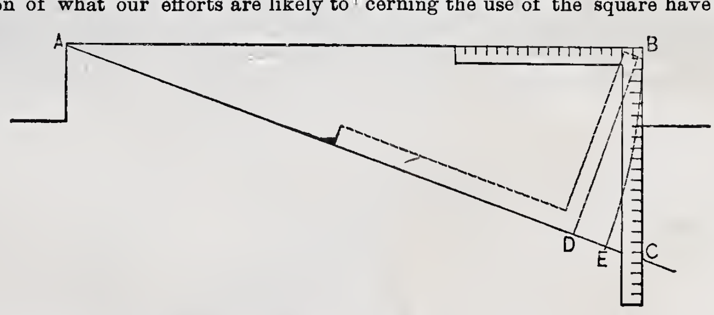
How to Use the Square.—Fig. 1.—Bisecting a Circular Molding.

repeated in the present issue. We desire that this matter shall be brought to the attention of every architect in the country, and, therefore, any of our subscribers who may mention it to such of their architectural friends as are not regular readers of the paper, will be conferring a favor. The subjects which we have chosen for the competitions are such, we believe, as will afford our readers the greatest benefit when the designs come to be published in this paper. While we are not in the habit of making promises with regard to the future, the fact that we have offered liberal cash prizes for designs of a popular character may be taken as an indication of what our efforts are likely to be in the way of interesting and benefiting our readers during the coming year. The end of a volume is a station at which a number of subscribers usually leave the train. In this matter of competitive designs to be published in the new volume, we have entered upon something which we trust will be of sufficient interest to those who may have been thinking of stopping, to warrant their continuing along with us. We think, further, that the character of the paper itself, the large amount of practical information contained in each number, and the general usefulness of the publ cation to all in the building trades, are such that many among the friends and acquaintances of those who are at present going with us may be induced to go along also, if the matter is properly placed before them. Those who think as we do in this respect are invited to send to this office for club rates and sample copies.

At this particular season very little is done in the matter of house building beyond finishing off those structures which have been commenced during the summer, therefore designs, plans and details of houses have probably less interest for our readers at this time than at any other period of the year. For these reasons, in part, we have omitted the usual house plan in this number. This course has afforded us sufficient space to give attention to some other matters of general interest, questions concerning which have been raised by our correspondents. The initial article of this month touches upon a subject which is of special interest to builders, decorators and the occupants of houses generally. Those who have written to us upon the subject of wall papers will find their questions answered in this article, even though their letters have not been incorporated therein. In the same way the article entitled "Eastlake Principles and Eastlake Fashion" answers questions which have been propounded by correspondents. The article on "Sharp sand and Quicksand," as stated therein, was called out by the letter of a correspondent. We feel under obligations to him for asking what at first seemed a foolish question. Had he not done so the opportunity would not have been presented for giving the subject such careful attention as it has now received.

Our papers on stair-building have now reached the consideration of practical work, and accordingly criticisms, suggestions, questions, &c., are in order. It is not to be supposed that unaided we can present such an important subject, and one of such general application, altogether exhaustively. There are several ways of performing almost every operation that can be mentioned, and at most we can hardly present more than a view from a single point of observation. As we said in the outset, we shall fail of accomplishing the greatest possible good in this matter unless the correspondence department supplements our efforts. A thorough discussion of principles, a comparison of methods and a statement of reasons why one method is preferred over another, contributed by the practical men among our readers, and questions from the beginners and learners, are very desirable. Such communications will supply parts which cannot be obtained in any other way, and will have the effect of showing up the entire subject in a more thorough manner than has ever been accomplished in any of the large number of books written on stair-building.

Responses to our invitation for letters concerning the use of the square have reached us in time for publication in this number from only G. H. H , W. B. and W. S. We had hoped for a larger number of letters, although had we received them, it would hardly have been possible for us to have made any better showing of the subject in this number than we have been able to present. We want to keep this good work moving. Let all contribute until the square has been treated exhaustively. There is abundant opportunity yet remaining for all who are willing to assist.

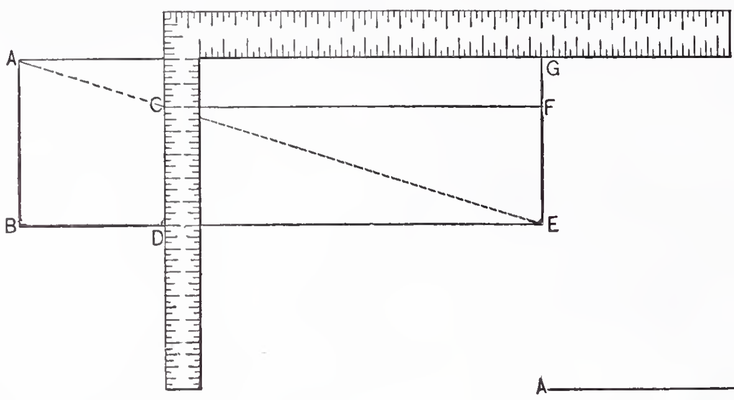


How to Use the Square.—Fig. 2.—Finding the Length of a Piece to Fit in a Recess.

How to Use the Square.

From G. H. H., *Philadelphia.*—The steel square may be used to cut a circular molding into semicircular pieces, as shown by the accompanying drawing (Fig. 1). Place the heel of the square to the outer edge of the molding, as shown at D. Mark the intersection of the blade and tongue with the molding, and through these points draw a line, as shown by A B, which will pass through the center of the circle, and will, therefore, divide the molding into two equal segments.

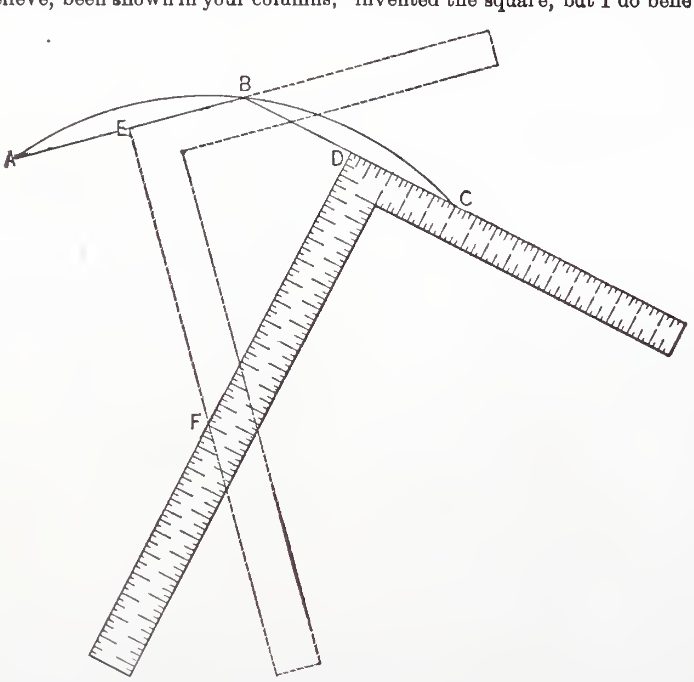
To find the length of any piece to fit into a recess by the use of a steel square, the operator may proceed as indicated in the accompanying sketch (Fig. 2.) Lay the piece to be cut with one end in angle, as shown at A. Take the square, and, placing it against the piece to be cut, move it until the tongue or blade sights straight for the other angle B. Then put the square into the angle, setting it at just the point to be fitted, letting the blade intersect the piece to be cut, as shown at C. Then a point marked midway between the position



How to Use the Square.—Fig. 3.—Proportional Reduction.

of the square in the first place, as shown by D, to the point C, as indicated by E, will be the place at which the piece is to be out.

From W. S., *Waterville, N. Y.*—From the last number of *Carpentry and Building* I discover that rules for using the steel square will be acceptable. I therefore send rules for obtaining the side bevels of hip and jack rafters which are old, but which have the merit of being correct. Much has already been written by your correspondents in regard to the use of the square for obtaining the bevels for backing hip rafters. The square is equally applicable for obtaining all the bevels required in a hip roof, thus obviating the necessity of a drawing. The bevels required in the construction of a hip roof are seven in number, viz., the upper and lower end bevels of common rafters, the upper and lower end bevels of hip rafters, the backing of hip rafters and the side bevel of hip and jack rafters. Rules for obtaining all these bevels by the use of the square have, I believe, been shown in your columns,



How to Use the Square.—Fig. 4.—Finding the Center from which a Given Arc is Struck.

with the exception of the last two. These I don't remember seeing in the paper.

To obtain the side bevel of hip rafters, take the length of the hip rafter on the blade of the square and its run on the tongue (or proportional parts of each); mark by the side of the blade, which will give the required bevel.

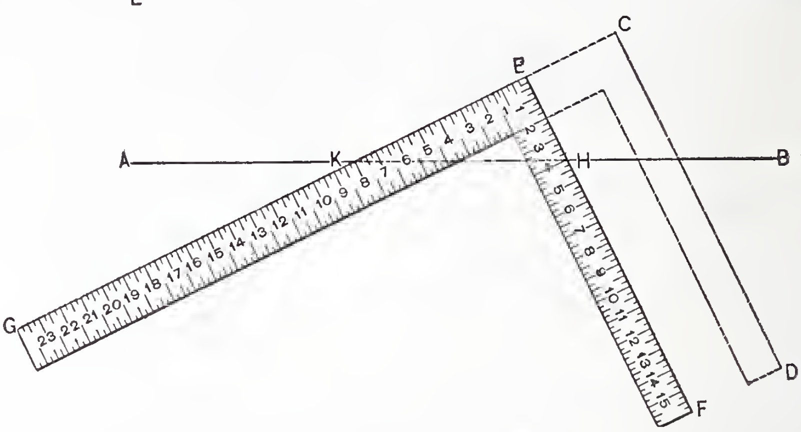
To obtain the side bevel of jack rafters, take the length of a common rafter on the blade and its run on the tongue, the bevel on the blade will give the side bevel required.

From W. B., *Springfield, Mass.*—Making a practical quotation from one of the English poets, I would say that

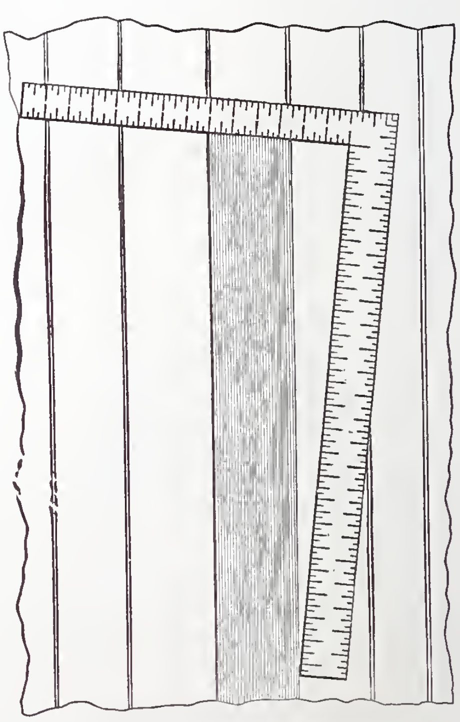
"A *square* man's the noblest work of God."

I have known many such men—men who worked with the square, by the square and on the square. Now, lest your Paterson, N. J., correspondent shall spend his valuable time in hunting up authors to find from whom I have "prigged" what follows, and from whom he borrowed, and in turn who suggested it to the man at the third remove, and so on back to the time of the boss ship-carpenter, Noah, I will say at the outset that I did not invent the square, nor the man who first used the square, and I do not claim any of the combinations that may hereafter appear. Nor do I believe that those two ancient worthies, the Hirams, invented the square, but I do believe that if they (the Hirams) never had been born a horizontal and a perpendicular would have still produced a square, and that certain divisions of the square so formed, placed in a given way, would have produced the same results as now. Though I was not the original discoverer of the square and its uses, I have had to discover for myself to what extent it is adapted to my needs. In this respect every one should be a discoverer in everything, though, perhaps of necessity, it may be only in a small way.

In answer to your request at the head of the "Correspondence" column in the November number, I will contribute my mite by sending you diagrams of some of the applications of the steel square that I have found very useful in my practice, and which you can publish if you think they will be of value to the readers of *Carpentry and Building*. These are what occur to me on the spur of the moment after reading your request. There are a great many other uses to which the square may be put, some of which will doubtless present themselves to my mind for another occasion. These problems may be objected to because, so far as I know, at least, they were not published, or even indorsed, by Peter Nicholson. It would seem that there is a Peter in other things than theology by whose standard our orthodoxy is to be tried. If Peter Nicholson teaches us that the proper place to apply a bevel is at the center of the stick instead of on the side, no doubt we ought to follow it unquestioningly, because to him have been intrusted the keys to the mechanical kingdom so far as concerns carpentry. On the other hand, if old Peter Parley, the geography man, had announced that the best route to China was through the center of the earth, because it is some 4000 miles nearer, due respect to him as an authority should have started travelers on that route. I suppose one of the proofs that I and others are degenerate sinners is because we don't in all things practically follow the Peters.



How to Use the Square.—Fig. 5.—Simple Rule of Three.



How to Use the Square.—Fig. 6.—The Square as a Bevel.

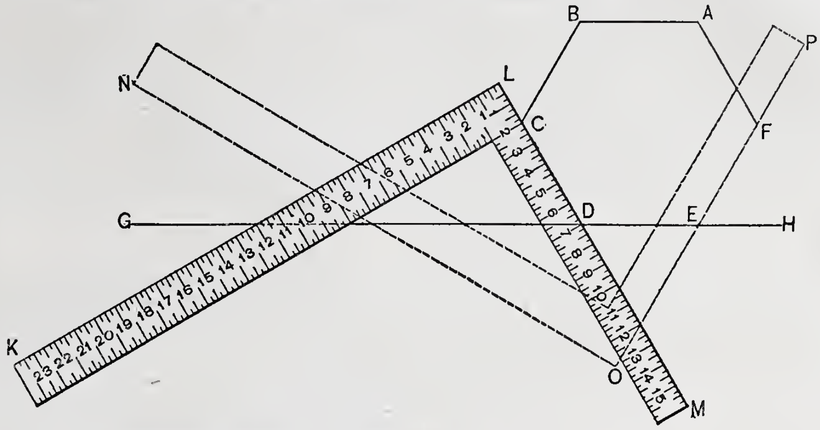
Allow me to express the wish that these diagrams may not be referred to as "W.

B.'s rules," as has been done in other cases. I have never sent you a rule. I have stated the fact that certain things would produce certain results. I have never liked rules, but rather principles.

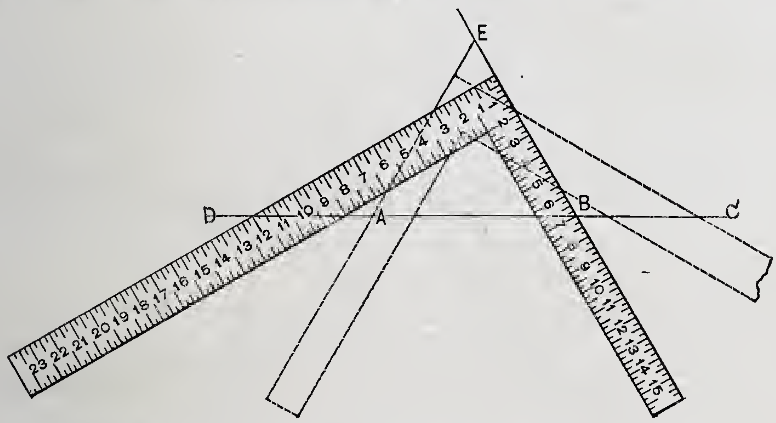
Before describing the inclosed sketches, I will improve this opportunity of saying that as G. H. H. has cut out the shaky portions of his system of applying the bevel to a hip rafter, I now pronounce it, as given by him in the September number, sound.

My first sketch (Fig. 3) represents something which I have found very useful. It shows the method of reducing a given plan or surface in exact proportion. I have found it very advantageous for employment in making models to some proportional pait of full size. Let B A G E be a plan or surface to be reduced. Draw the diagonal line A E, as shown. Take the required amount of reduction, B D, from one end, thus obtaining the point D, from which square up, cutting the diagonal line at C. Then a line drawn from C parallel to A G, as shown by C F, will be the amount to take off the side.

Fig. 4 shows the manner of obtaining the center of a circle which shall pass through three different points, as A B C. Connect the points A B and B C by lines as shown. From the center of these lines square down and scribe along the square, producing the lines until they intersect, as shown at F. Then F will be the center of a circle which will pass through the three given points A B C.



How to Use the Square.—Fig. 8.—Laying Out a Hexagon.



How to Use the Square.—Fig. 7.—Laying Out an Equilateral Triangle.

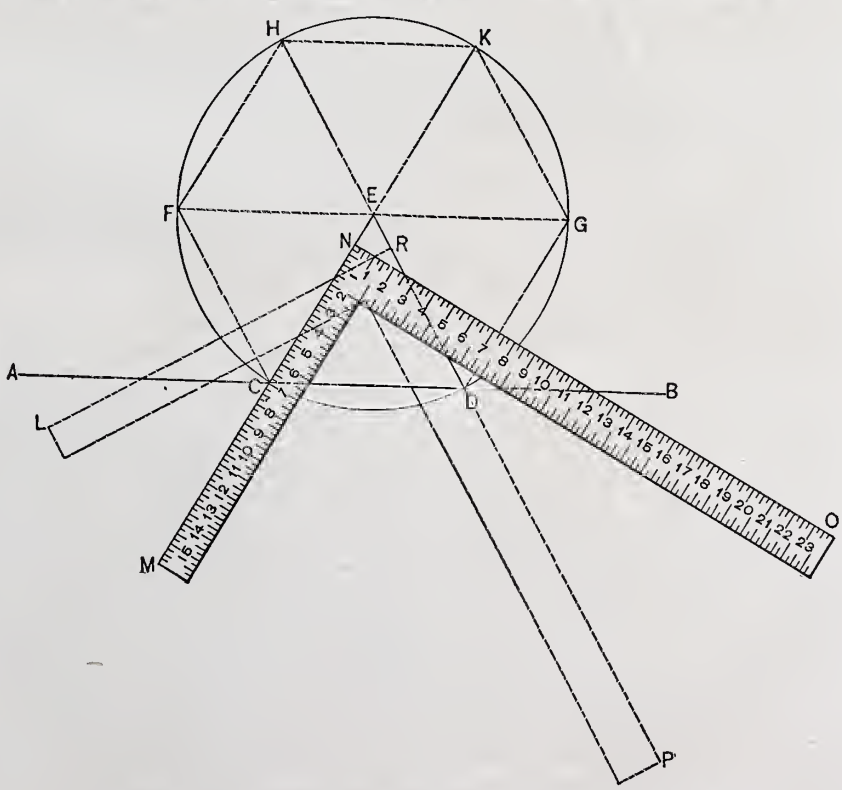
Fig. 5 shows how examples in simple proportion may be worked by the square. Take, for instance, the following—6 : 12 : : 4 : is to what number. Place the square with 6 of the tongue and 12 of the blade upon the line A B, as shown by K C D. Scribe along the blade, then move the square down on the line until 4 of the tongue comes against the line A B; then the answer will be that figure on the blade which falls upon the line A B—in this case 8. When the answer is to be a number greater than the three known terms, this process will be reversed. For example, take the following—8 : 4 : : 6 : is to what number? Place the square as shown by G E F; scribe along the blade as before. Move the square up on this line until 6 of the tongue falls directly over the line A B; the result will then be found on the blade at K as before, which, in this instance, is 12. The square used in this general manner will also multiply one number by another and divide by a third. For example, what is the result of 6 multiplied by 8 and divided by 4? Take 8 on the blade, and 4, which is the divisor, on the tongue; scribe along the blade as in the previous instances. Move the square up this line until 6 of the tongue falls over the line A B; then the answer will be found on the blade where it crosses the line A B, which, in this case, is 12. The practical application of this principle may be seen in such calculations as are involved in measuring boards, painting and plastering. Take, for example, a case in plastering. Suppose a room is 12 feet long and 12 feet high, and it is necessary to reduce the surface of one of its sides to yards. Take 9, the number of feet to divide by, on the tongue and 12 on the blade; scribe along the blade as before directed. Then move the square up until 12 of the tongue cuts the line A B. Then look on the blade for the result, which, in this case, is 16. It will be readily seen that a bevel, or, in the absence of a large bevel, a couple of laths, properly adjusted, may be carried up and down on the blade of the square according to the lengths of different rooms, by which the number of square yards in each will be readily determined. The bevel should be set with the divisor 9 and the hight of the room as fixed points.

Fig. 6 shows how the square may be used as a bevel, for example, for cutting a board to fit any opening, as in a floor or wall. Place the end of the square on one side of the opening and carry the heel out until the line of the tongue is parallel with the head of the opening; observe the figure on the tongue and place it in the same manner upon the board to be cut.

Fig. 7 shows the manner of laying out an equilateral triangle by means of the square. Draw the line B C; take 12 on the blade and 7 on the tongue; mark on the tongue for one side of the figure. Make the distance from B to A equal to the desired length of one side of the figure. Reverse the square, placing it as shown by the dotted lines in the sketch, bringing 7 of the tongue against the point A. Scribe along the tongue, producing the line until it intersects the first line drawn in the point E, then A E B will be an equilateral triangle.

Fig. 8 shows the application of the same principles to the construction of hexagons. Draw the line G H; lay off the required length of one side on this line, as D E. Place the square as before, with 12 of the blade and 7 of the tongue against the line G H; placing 7 of the tongue against the point D, scribe along the tongue for the side D C. Place the square as shown by the dotted lines; bring 7 of the tongue against the point E and scribe the side E F. Continue in this way until the other half of the figure is drawn, all as shown by F A B C.

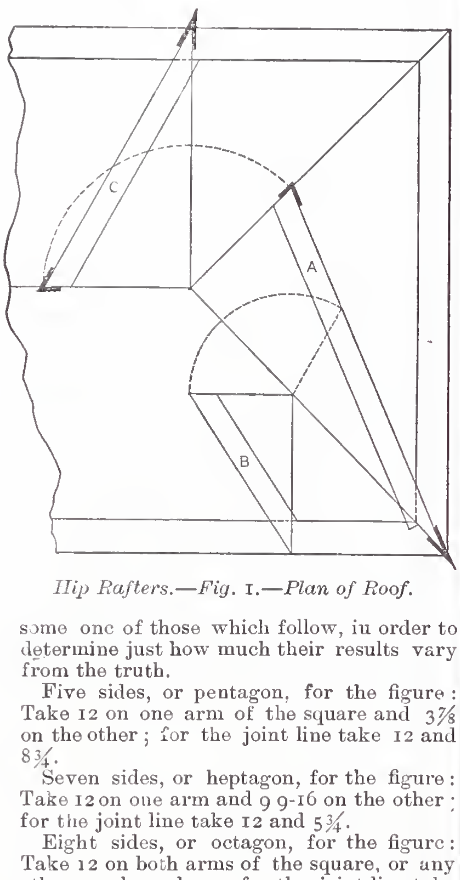
The capenter more frequently requires the joint line of this figure than he does the full outline; accordingly, it is well to proceed as shown in Fig. 9. Since the hexagon is composed of six equilateral triangles, it follows that the same operation as shown in Fig. 7 is all that is required in this case. Draw the line A B (Fig. 9), or suppose the line A B to represent the edge of a piece of timber; place



How to Use the Square.—Fig. 9.—Finding the Joint Line in a Hexagon Miter.

he square with 7 of the tongue and 12 of he blade upon this line, as shown in the engraving; scribe along the tongue, which will be the joint line. To find the center, a circle struck from which will circumscribe a given hexagon, set the length of one side on the line A B, as shown by C D. Produce C N indefinitely in the direction of L; reverse the square, or place it as shown in the engraving, with 7 of the blade and 12 of the tongue on the line A B, and from D draw D R, producing it until it meets C N in the point E; then E will be the center, a circle struck from which will circumscribe the hexagon, as shown in the engraving.

All other regular polygons may be constructed with the square, and their joint lines drawn by the same general principles as illustrated above, formulæ for doing which I send you herewith. I do not claim mathematical accuracy for these several operations, with the exception of the octagon, but they so closely approximate the real result that they are sufficient for all practical purposes. Any one who is well up in mathematics can test either the above or



Hip Rafters.—Fig. 1.—Plan of Roof.

some one of those which follow, in order to determine just how much their results vary from the truth.

Five sides, or pentagon, for the figure: Take 12 on one arm of the square and 3⅞ on the other; for the joint line take 12 and 8¾.

Seven sides, or heptagon, for the figure: Take 12 on one arm and 9 9-16 on the other; for the joint line take 12 and 5¾.

Eight sides, or octagon, for the figure: Take 12 on both arms of the square, or any other equal numbers; for the joint line take 12 on one arm and five on the other.

I recommend taking 12 as a basis in all cases, more because it can be easily remembered than for any other reason. Other numbers than those above mentioned, bearing the same relations, will, of course, produce the same results.

In conclusion, allow me to extend a cordial invitation to you, Mr. Editor, and to all who have contributed to *Carpentry and Building*, especially G. H. H., A. S. L., and H. McG., to a Christmas oyster supper at my house, Christmas day, 4 p. m. sharp. Have W. C. M. bring his onions along, for we can make use of them; but he had better retain the leather spectacles until he is able to see that there was at least a "slight variation" between my way and that of G. H. H. of applying a bevel to a stick of timber. When you leave the cars at the depot (for I suppose you will all come by the modern means of travel) ask the first man you meet with a tool box on his shoulder where old "Nosey," who knows everything, lives, and he will direct you to the humble dwelling of W. B.

Note.—Our friend "Wood Butcher" may have intended the above invitation as a joke; if so, we are just the one to take a joke, especially when an oyster supper is mentioned, and act upon it. We happen to be somewhat acquainted in Springfield, and expect to have no trouble in following directions. If nothing happens, we shall be on hand and shall endeavor to take with us enough representatives from our staff of contributors to insure a full table. We hope all those specially mentioned in the invitation, and as many others as may feel disposed to accept the hospitality of our venerable friend, will put themselves in communication with us at once, so that we may all go together. It will be a fine way to spend Christmas evening. Letters of regret will be in order from those who are unable to leave home. Our readers may look for a report of what takes place, if anything transpires worthy of special mention.

How Do They Do It?

From ANDREW DOREMUS, *New Jersey.*—MR. EDDITUR: Sum men r jest tu smart fur ennything. I red sum time ago about 1 of them that knu al ther wuz in 4 yeers. He wuz smart. Hear's anuther last munth (October) who kno's it al and mor. I meen the fello down in the pine rejuns of Virginy. I wud like tu kno how tha find it al out in sech a short time. that's wat bothirs me. This last feller cood'nt find out eunything frum the bilding jurnels or frum buks on arketectur, so he must hev evvolootted it al out of hisself. Our fourman in the crib I wurk is an old un about sixtty yeers old, that in my opinyun duz kno it al, but he sez he duz'nt, but I think he lize. I wud jest like to se him takkle sum uv these 4 an 6 yeer fellers til he sho them the size ov a buk that wat tha did'nt kno about Carpentirs wurk wud maik. He is the bos. hes bin at it over fourty yeers. He tuk the starch wun day cleen out of a York ir that wuz 1st class, at leest he sed he wuz. Knode it al until that old chap shode him wat he knu wuz'nt mor than the law'dalow, and wuz'nt eggsakly much, and it wuz onny about fraiming un of them cussed hip and vally ruffs, and wich I never coo'd see thru how it wuz dun. The Nu Yorkir he tuk water he did. he likered, that is he set em up, because he fond out it tuk sum branes tu maik a Carpenter. Then he dug for Nu York and sed he diddent know it al yit, and the man that sed he did wuz a——(I'm not profain). Menny of them smart uns cum out hear and the ares tha swing is a site to se; tha kuo it al fur a wile, til the old man sets up a job on em sum nice mornin, and then tha kraul doun a litle hoal and bring it with em. but wen tha find out how much tha dont kno tha git to be desent fellers, unles tha hav mor conseat than'd bust a ox, n'sum of em hev. I wurked at the trai'd sevven yeers and I can't du al them things them fellers kin, blode if I kin, and blieve thare mistaken wen tha think tha kin. Kan't yu koxe them to rite a buk 'n sho us the results of thare eggsperanc how tha dun it. we shud hev it fur the traid at larg. I aint much on riten or spelin, but thems my vews. Pleeze saw, plain, sanpaper, shelack and pollish this leter so as to rede rite.

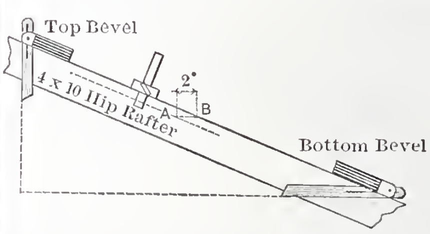
Hip Rafters.

From PHIL.—I propose to call the attention of the readers of *Carpentry and Building* to a plan for getting the shape of backing of cove hip rafters. It will require but little thinking, I believe, to fully understand it. I submit some sketches herewith, which practical men will understand without much explanation. Fig. 1 represents the plan of a hip roof, with the shape of rafter, hip rafter and jack rafter indicated. The application of the several bevels noted is self-evident. Fig. 2 shows the application of the bevels to the hip rafter. Working from the top edge, measuring along the upper edge of the rafter from where the bevels cut the top line, is the length of the hip. For the backing, measure back from the top edge on a level line, as shown at A B, one-half the thickness of the rafter; thus, if the hip is 4 inches thick, measure back 2 inches, as indicated in Fig. 2. Make a point at A and gauge, as indicated in the sketch. Fig. 3 shows the jack rafter set back 3 inches on line, the same as thickness of the hip; or, instead, apply the bevel to the square, as shown in Fig. 4, or, in case no bevel is at hand, use the square and a pocket rule, as shown in Fig. 5. Place the rule against the upright part of the square and measure out the whole thickness of the jack—3 inches—and draw the lines, as shown in the sketch. These same rules apply to cove hip rafters, as illustrated in Fig. 6. Set back half the thickness, as there shown. The best way I know of backing cove hip rafters is to cut a hip from a pattern, then slide the pattern back from the front edge on the horizontal or bevel lines indicated in Fig. 6, and mark as shown.

Young Men vs. Old Fogies.

From J. M. J., *Maysville, Ky.*—I am in receipt of the September number of *Carpentry and Building*. I did not suppose I was stealing any of W. B.'s thunder when I wrote the letter which appeared in the August number. I care very little for any controversy in which carpenters may indulge. While I believe that both G. H. H.'s and W. B.'s rules concerning hip roofs are good, I confess that I have not read either article. Every carpenter has his own rule for framing, and every town in the country has its own celebrated framer. I suppose Springfield, Mass., has one as well as other places. Our town did employ one a year or two ago. Nothing could be done in the framing line but that this man had to be boss of the job. One day lately, however, a friend meeting him asked how he was getting along at present at the carpentry business. "Oh," said he, "the young men have got away with me. Old fogies must step aside and let the young boys take their places. If they have any particular hobby which they wish to transfer to their grandchildren, it is necessary nowadays for them to secure letters patent."

Carpentry and Building is good, and to keep it good you require letters from practical men. I don't believe there is one carpenter in a hundred who knows anything



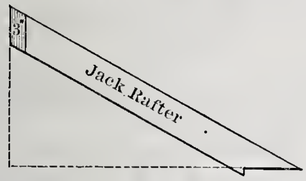
Hip Rafters.—Fig. 2.—Application of Bevels to Hip Rafter.

about the problem of equal areas or understands the communications concerning the strength of materials. Carpenters, as a general thing, are not educated men; if they were they would get clear of driving nails for a living. The fact is, we are compelled to work for the lack of education, and if you wish us to understand the articles in *Carpentry and Building*, don't come at us with geometry and other sciences as if we were all professor W. B.'s, or had grandchildren able to instruct us in those parts of which we know nothing. I wish the paper every success.

Note.—Without stopping to argue with our correspondent whether or not men of intelligence and education follow carpentry as a business, we would remind him that the particular mission of this paper is to throw light in dark places—to help along those who are striving to acquire knowledge. There is no reason why beginners at the trade of carpentry, by improving their opportunities, should not acquire such a knowledge of and familiarity with the principles of mathematics and the natural sciences which underlie their trade as to be able to take positions in the front rank before they are many years older. We are sorry that our correspondent has not read the articles on backing hip rafters, since he has already ventured to criticise them. We have no doubt that he would have understood every point which the letters attempted to make, although it is barely possible, according to his estimate, that there are some who would fail to comprehend them in all particulars. However, we have yet to meet with the first response to the broad invitation extended in our September issue, for any one to write us who still failed to understand the underlying principle of backing hip rafters.

Inlaying.

From Old Mahogany, *Chicago.*—I desire to add a word or two to what has been said about inlaying on page 145 of the August number, lest some young mechanic may be misled. All that was published at that time is very good so far as it goes, but it does not go quite far enough. The workman there was told to be careful to move his work "sun about." Now, it will depend on which side up he tilts the saw table whether the work must move with the sun or against it, and this is so self evident that no one would be likely to err. Suppose we cut a monogram or even a single letter with some inside cutting in it. Say the letter B, and the tilt of the table requires the outside cut to be made with the sun. The inside cuts must be made against it in order to preserve the wedge shape of the upper



Hip Rafters.—Fig. 3.—*A Jack Rafter.*

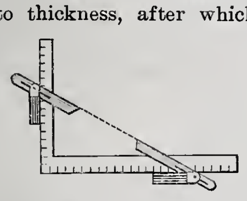
letter. If the work were a monogram it might be so involved as to require some sawing inside of the second cut. In such a case it is necessary to go through the same movement as at first.

There are other wrinkles in inlaying which I will be glad to send to the paper, if you think the subject of sufficient interest.

Note.—We have no doubt the cabinetmakers among our readers would be very glad to have this correspondent furnish further information upon this subject; accordingly, we shall welcome anything which he may see fit to send us.

Measuring Brickwork.

From C. S. P., *New Bedford, Mass.*—In *Carpentry and Building* for August, J. C. D., Vienna, Ill., asked for a rule for measuring brick walls. The rule employed by me is as follows: Take, for instance, a brick building 24 by 50 feet. I would first find the number of inches around the building, which is (on the outside) 1776 inches; this divide by 8, the number of inches in the length of a brick, and we will have 222, the number of bricks it takes to lay around the building one course high. I will now multiply this number (222) by 5, as the bricks used by us lay about five to the foot in hight, and we will have 1110 bricks in all four walls, 1 foot high and 4 inches thick; multiply this number by the number of feet in hight, which we will suppose to be 20, and we will have 22,200 bricks in the building 4 inches thick; this to be increased in the same ratio, according to thickness, after which deduct

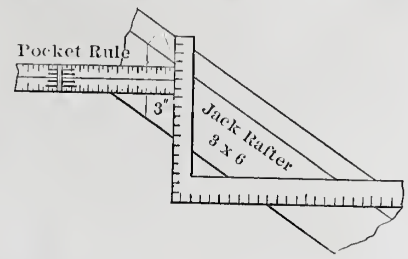


Hip Rafters.—Fig. 4.—*Setting the Bevel by the Square.*

one-half the openings and figure arches double for the labor, but add no more brick. Chimneys we figure in the same way as wall.

Cement Sidewalks.

From S. B., *London, Ontario.*—Your correspondent W. R. J., of Mechanicsville, Ohio, wants to know how to put down cement sidewalks. I have seen sidewalks of this character made in San Francisco, Sacramento, British Columbia and other places, and I will give a description of the manner of constructing them. First, lay off the width of the required walk, then put a board along on the outside, and with a suitable rammer ram the dirt well down for a depth of two or three inches below the top of the outside board. This board must be leveled to the hight of the intended walk. Lay off the space which the walk is to occupy in blocks or squares, using strips of wood for the purpose; then apply the cement. The first coat is made one of cement to five of sand, the last coat one of cement to two



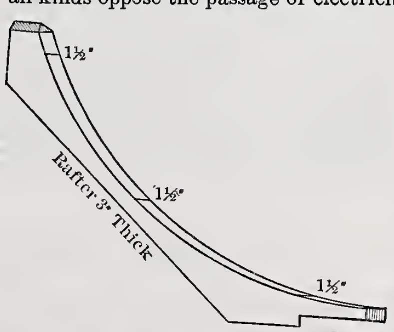
Hip Rafters.—Fig. 5.—*Use of Pocket Rule and Square instead of Bevel.*

of sand, and is to be well troweled with a plasterer's trowel.

Discovering the Position of Breaks in Telegraph Cables.

From W. A., *Blackshear, Ga.*—When the Atlantic cables break I have been told that electricians know just where the break is. If that be so, will you please tell me how they arrive at this knowledge?

Answer.—It is true that the electricians are able to find out by means of certain tests where a fault in a cable is located. To gain a rough idea of how this is done, it must be understood that electricity can be measured. That is to say, one current can be compared with another, so as to know which is the strongest, or, to use a more correct expression, which has the greatest "intensity," and which has the greatest "quantity." Wires of all kinds oppose the passage of electricity



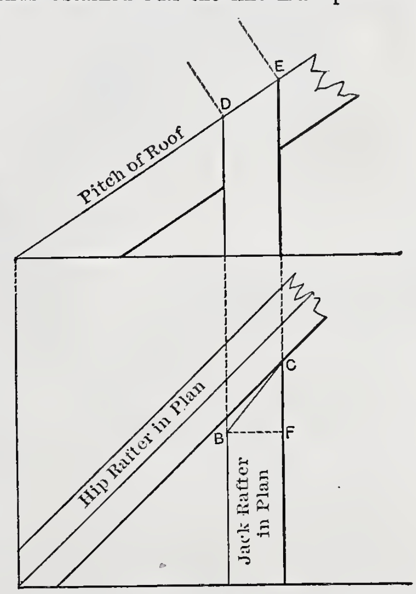
Hip Rafters.—Fig. 6.—*Application of the Rules to Cove Hip Rafters.*

to a small extent; some kinds of wire more than others. That is to say, they vary as conductors, copper being, for example, much better than iron. It is, in fact, one of the best of all conductors. It is intensity in the electrical current which is needed to overcome this resistance. As the length of a wire increases so does its resistance. The total resistance, divided by the number of miles, will, of course, give the resistance per mile. We need not trouble ourselves about the delicate and intricate methods employed for measuring intensity and resistance; it is sufficient to say that it can be done so that results in numbers are obtained. When a break occurs in any part of a cable the current at once escapes, instead of traveling the whole distance. To find the position of this break, then, it is necessary to measure the resistance of the current. This being known, if the sum obtained is divided by the resistance per mile, the length of the cable through which the current is passing is known, and of course the distance to the break.

The galvanometer, which is one of the most important instruments in electrical work, depends for its operation upon the fact that a magnetic needle is turned from its proper direction whenever it is brought near a wire or other body in which a current of electricity is passing. The amount of its deviation depends upon the strength, &c., of the current. Other instruments for increasing or diminishing the amount of resistance which a current of electricity meets are also needed. So that, strange as it may seem, it has at last become possible to apply accurate measurements to that force in nature which, of all others, seems to be the most imponderable and the least capable of measurements of any kind.

Backing Hip Rafters.

From C. O., *Canton, Miss.*—In the accompanying sketches I illustrate the method which I prefer for backing hip rafters, and also show how to find the top or horizontal cut of jack rafters, the perpendicular cut being, of course, the same as on common rafters. Thus, to find the backing on a hip rafter the base line of which lies at an angle of 45 degrees to each side, it is only necessary to take one-half the thickness and set off on foot bevel from the toe back, all as shown in Fig. 1, and square across the point thus obtained run the line E F up on both

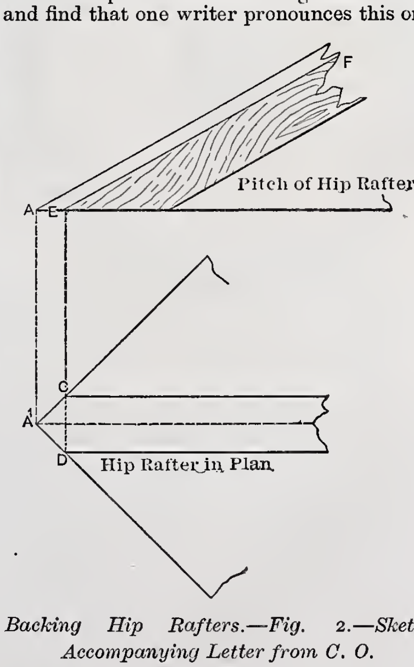


Backing Hip Rafters.—Fig. 1.—*Sketch Accompanying Letter from C. O.*

sides of the rafter. In like manner, for the top bevel of jack rafter, take the thickness of rafter and project it on line of pitch, as shown by D E in Fig. 2. The length thus found is to be put from the point back, as shown by C F, and square across, as shown by F B, draw the line B C, which will be the true bevel.

Which Rule for Backing Hip Rafters is the Best?

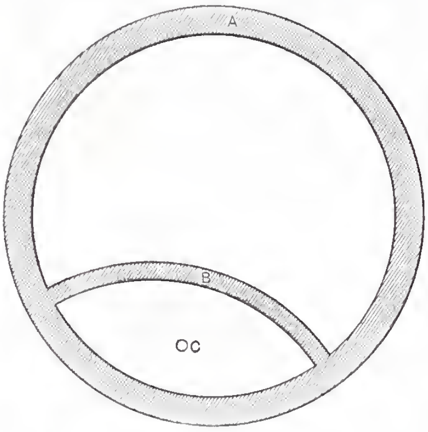
From H. A. H., *Avoca, Wis.*—Will you please inform me which of the various rules you have published for backing hip rafters you consider the most simple to follow and the best for general use? I have examined the correspondence containing these rules, and find that one writer pronounces this one



Backing Hip Rafters.—Fig. 2.—*Sketch Accompanying Letter from C. O.*

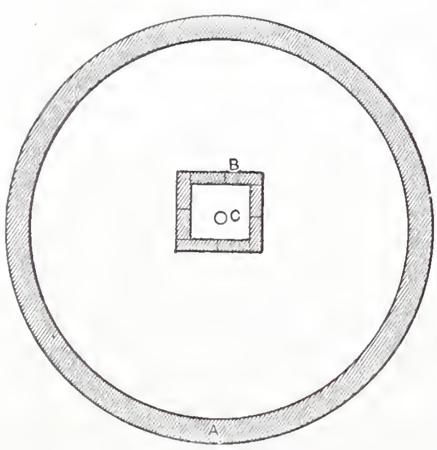
incorrect, and another brands that one as shaky, &c., and I am really doubtful which one to follow. Will you have the kindness to set me on the right track?

Answer.—To reply to our correspondent by pointing him to the page, and the column, and the paragraph, where he may find a rule for backing hip rafters which is entirely correct and quite convenient for application, would not, we are convinced be answering him in the best manner. In any case, we are certain it would not be using this opportunity to the best advantage, considering the interests of our readers at large. We take it to be the particular mission of *Carpentry and Building* not to publish arbitrary rules, but rather to show the reason for rules—to explain principles upon which rules are founded, and thus enable the mechanic to bring greater intelligence to bear upon his particular line of work than would other-



Cheap Cistern Filters.—Fig. 1.—A, Outer Wall of Cistern. B, Four-Inch Wall of Brick Laid in Cement. C, Pump Pipe.

wise be possible. Of all the rules that have been published in *Carpentry and Building*, throwing out of account, of course, any which have proved to be incorrect, there is perhaps no one which is suited alike to the requirements of every mechanic who may be in need of a rule for work of this character. To those mechanics who are well up in lines, who have had large experience in matters of this kind, more advanced rules are demanded than it would be possible for mechanics to use who are novices at the trade. We recommend our correspondent, therefore, to examine into this matter in an effort to familiarize himself with principles. After this has been accomplished, let him

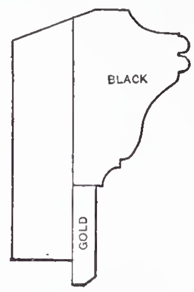


Cheap Cistern Filters.—Fig. 2.—A, Outer Wall of Cistern. B, Flue of Brick Laid in Cement. C, Pump.

select from all the rules which are laid before him that which to his mind best suits his case. In making this selection, he will have the choice of rules all the way from that which some correspondent recommended of placing the rafter on the angle of the plate after the foot bevel had been cut and scribing it, up to rules which require for their comprehension a fair degree of mathematical knowledge. The principles upon which all these rules are founded are necessarily the same, but there are various sides from which they may be approached, and there are various standpoints from which the operation may be viewed. Last, but not least, there are different grades of intelligence, different degrees of experience and different habits of mind among the men who make use of them.

Cheap Cistern Filters.

From M. D., *Galena, Kansas.*—I inclose you herewith some sketches illustrating the construction of cheap cistern filters, such as I have put in at different times and which have given satisfaction. In making a cistern, I always prefer to lay a brick wall at the outside. If the cistern is quite small, I set the brick up on the side the $2\frac{1}{2}$-inch way. If the strain is much, I make a 4 or 9-inch wall and fill behind each brick with mortar. I have at different times made cisterns by cementing directly against the earth, but have always found that they cost more to make than to employ brick. They require more cement and much more time. In constructing the filters each brick should be laid by only two strokes of the trowel. No pointing should be allowed after the brick is in position. The brick used for the purpose should be of the best hard-burnt character, and no one but a competent mechanic

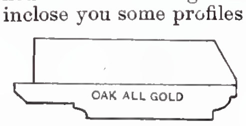


Picture Frame Moldings.—Fig. 1.—Half Size.

should attempt to do the work. The least crack in a brick or an open joint will let the water pass without filtration.

Picture Frame Moldings.

From H. A., *Jersey City Hights, N. J.*—In response to the request of a correspondent to be supplied with some designs for picture frames, I inclose you some profiles of mold-



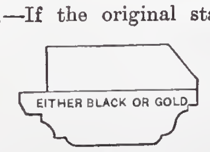
Picture Frame Moldings.—Fig. 2.—Half Size.

ings suitable for the purpose, which I have drawn. My plan of construction is to put the frame together with mortise and tenon, and to glue the moldings against the face. The small beads shown in the designs may be worked with a scratch, and can either be oiled or finished in any other way your correspondent may desire. I have marked my own taste with reference to the finish upon the designs. This is my first contribution to *Carpentry and Building*, and I trust it may be acceptable. The sketches are drawn one-half full size.

Dividing a Whole Number by a Fraction.

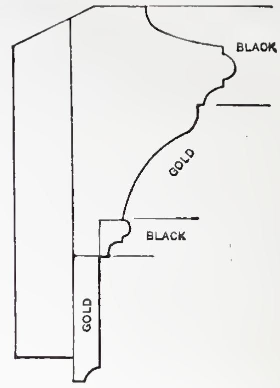
From W. R. Mc. C., *Philadelphia.*—In the October number of *Carpentry and Building*, on page 192, your correspondent C. O. gives a practical rule for finding the radius of any given arc of a circle. He gives the width of opening as being 8 feet; spring, 6 inches; and then says "Multiply half the width by itself, and divide by the hight (6 inches), which equals 32 feet." Please explain to me what equals 32 feet. What does he divide by the hight to make 32 feet?

Answer.—If the original statement had



Picture Frame Moldings.—Fig. 3.—Half Size.

been "one-half foot" in place of 6 inches (see parenthesis above), we presume our correspondent who now inquires concerning this matter would have more readily comprehended the rule. A whole number divided by a fraction which is less than the unit, gives a result larger than itself. Thus,

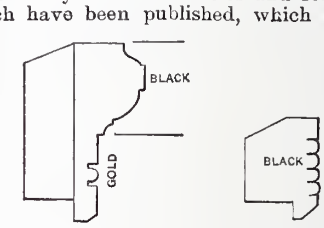


Picture Frame Moldings.—Fig. 4.—Half Size.

one-half of the opening (4) multiplied by itself gives 16; divided by one-half equals 32.

Words of Appreciation.

From W. H. C., *Geneva, Ill.*—I have carefully examined *Carpentry and Building*, so far as issued, and I can't see how it could be bettered for the mechanical fraternity. Its carefully and ably managed editorial department, and the variety of contributions from its practical correspondents, have already placed it at the head of the list of mechanical publications. I have been particularly pleased with the plain language used in the many valuable articles and formulas which have been published, which enable



A. B.

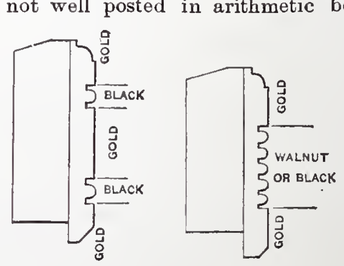
Picture Frame Moldings.—Fig. 5.—Half Size.

the average mechanic to comprehend and apply rules and principles that, as ordinarily stated, are beyond his reach.

Elementary Algebra.

From E. A. R., *West Point, N. Y.*—Is there an algebra adapted to the use of learners who have not the advantage of a teacher? I find that all elementary algebras make the four ground rules very plain, but other rules, especially fractions, are altogether too complex for one who cannot spare time to work out the problems.

Answer.—The trouble with most students in the matter of algebra is that they are not well posted in arithmetic before



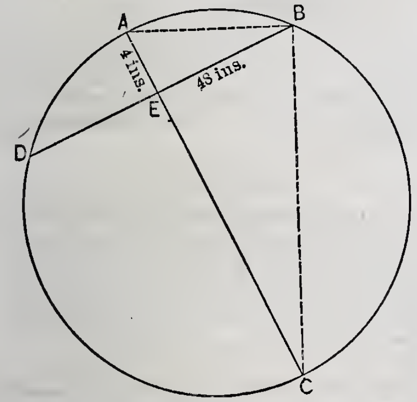
A. B.

Picture Frame Moldings.—Fig. 6.—Half Size.

they undertake the higher course. We think that any young man who thoroughly masters arithmetic as laid down in the ordinary school text books, will find but little difficulty in mastering algebra, no matter which of the elementary text books he uses. There is no royal road to a knowledge of algebra or any other branch of mathematics. The goal of proficiency in them is only reached by long-continued, persistent hard study and practice. From the last sentence in our correspondent's letter it would seem that he hopes by some means to get possession of a knowledge of algebra without paying the usual price. If so, he makes a mistake. There is only one price and that is fixed, and may be summed up in two words—*hard work*. As before intimated, we have no doubt that our correspondent can make rapid progress in the science of algebra, provided that he will first see to it that he is not deficient in the science of arithmetic. As to the choice of text books, there are so many good ones by different authors that one can scarcely go amiss in the matter of selection.

Determining the Radius of a Circle, Length of Chord and Rise being Given.

From F. M., ———. While on the circle, I will give you a method of determining the radius of a circle, the length of a chord being given and its rise. I have often



Determining the Radius of a Circle, Length of Chord and Rise being Given.

found it useful and it is as follows: Square half the chord and divide by the rise; add the rise to the quotient and we have the diameter of the circle. Dividing by two gives the radius.

To illustrate: If the chord be 4 feet and the rise 4 inches, what is the radius of the circle? Square half of 4 feet or 48 inches, which gives 576 inches, dividing this by four (the rise) the quotient obtained is 144. To this add 4 (the rise) and divide the sum by two, which will give 74, the required radius.

Note.—Our correspondent's rule is strictly accurate, and is based upon or derived from proposition xxiii, book iv, of Legendre (Davies), which says: "In a right-angled triangle, if a perpendicular is drawn from the vertex of the right angle to the hypothenuse the perpendicular is a mean proportional between the segments of the hypothenuse." The application of this principle to the question in hand will be better understood by referring to the accompanying diagram. Let D B, which is 48 inches, represent a chord of the circle A B C D, and A E the rise. Produce A E until it cuts the circumference of the circle in C. Connect the points A and B and B and C, as indicated by the dotted lines. The triangle A B C thus formed is a right-angled triangle, for the angle A B C is a right angle, being measured by half the arc A D C. (Book iii, prop. xviii, Legendre.) Then by the proposition first alluded to we have $(B E)^2 = A E \times E C$. By substituting the value of B E and A E in the above equation we get

$$576 = 4 \times E C.$$

Dividing both sides of the equation by four we have 144 = E C. That is to say, the length of the line E C is 144 inches. If to this we add the rise (4 inches) we have the length of the diameter A C, which is 148 inches. Dividing by two gives the length of radius, 74 inches.

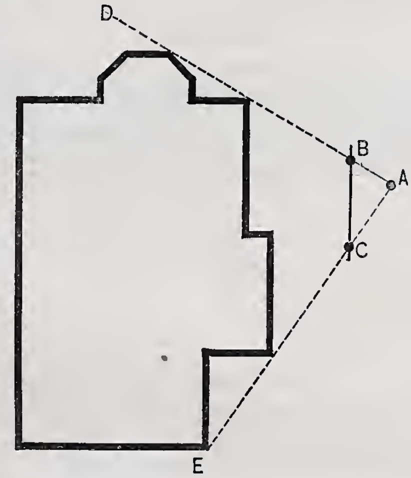
Shingling.

From W. H. J., *Canyon City, Oregon.*—The shingling correspondence has interested me very much. I learned my trade in Boston, serving four years. I have worked in New York, Chicago and San Francisco. In the latter place I first carried on business. I find that a day's work at shingling averages about 2000, although in San Francisco, where red-wood shingles are used 10 to 12 inches wide, 4000 are often laid in a day. I employed one man in San Francisco who was able to lay 7000 a day, but he shingled three courses without a line and made each nail hold three shingles. The most I have ever been able to do is to make a nail hold two shingles.

From J. W. P., *Maryland, N. Y.*—Probably there has been quite enough said on the subject of shingling, yet I would like to add a word or two on the subject. When figuring on a job I call 2000 shingles a day's work for one man. If the shingles are green, I prefer but one nail to each, whether they are wide or narrow. Twelve years ago I put up a building for a man who insisted upon two nails in every shingle, and even more than two if they were wide. The shingles were laid green. When they became seasoned they checked so that the roof looked like a sieve, and if it had not been a steep pitch it would doubtless have leaked very badly. I think a roof should be prepared with lath 1¼ inches thick by 5 inches wide, laid 5 inches apart, in order that the shingles may have opportunity for drying. Where roofs are tightly sheeted they hold dampness and the shingles rot rapidly. This I have learned by experience.

Leveling the Bottom of a Celler.

From G. H. H., *Phila., Pa.*—An easy way to level the bottom of a cellar is to drive, at some convenient place near the cellar, three stout stakes, as indicated by A B C in the accompanying sketch. First drive B and C about 3 or 4 feet apart and fasten to them a straight-edge perfectly level. Then drive the stake marked A, in such a position that a sight can be had from the top of it over the straight-edge covering the entire cellar. Then a rod cut to a length equal to the distance from the top of the straight-edge to the bottom of the cellar, placed in any point in the cellar and held in a perpendicular position, will constitute a means for detecting high and low points. Sight from the top of the stake A, over the straight-edge B C, to the rod in the cellar.



An Easy Way to Level the Bottom of a Cellar.

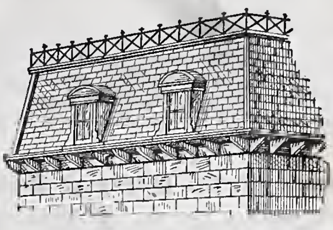
If this means be carefully used, it will answer for all leveling to the top of the first floor, the hight of the stakes being adjusted as may be required.

French or Mansard Roofs.

From W. S., *Tilton, N. H.*—Will you please explain what is a French roof; also what is a mansard roof, and in what respect do they differ?

Answer.—The term French roof may be regarded as the common name for designating what is called in the books and by architects a mansard roof. In other words, the two terms are synonymous. A mansard roof may be defined as one formed with an upper and under set of rafters on each side, the under set less and the upper set more inclined to the horizon. It is called a mansard roof after the celebrated architect Francois Mansard, who revived its use in France. This same style of roof is also called a curb roof, the latter term being derived from the French *courber*, to bend. The term Curb in this country is more commonly applied to a roof having two sets of rafters, of which the upper set is less inclined to the horizon than in roofs commonly designated as mansards. A very common form of the mansard roof is shown in the accompanying cut. The lower rafters are set almost vertical, while the upper rafters forming the deck are almost horizontal.

A rule for designing mansard roofs, to be found in some of the works on carpentry, directs that the lower rafters and upper rafters be equal in length, and that the two sets of rafters be placed with respect to



A French or Mansard Roof.

each other in such a manner that the profile of the roof will represent the half of a regular octagon. This rule is, however, we believe, generally disregarded in common practice.

Francois Mansard, who died in the year 1666, has been commonly regarded as the inventor of this style of roof. Research, however, shows that it was in use long before his time. It is asserted that Michael Angelo employed it in the construction of the dome of St. Peter's. According to one authority, this form of roof existed in the Louvre, built for Henri II in the year 1570. The same authority asserts that houses in lower Brittany were covered with roofs of this description as far back as the end of the 15th century. These particulars were not asked by our correspondent, but perhaps they may not be uninteresting to him and to others in this connection.

Ink Eraser.

From C. H. D., *New York City.*—Is there anything better than a sharp knife for erasing ink spots or correcting errors on books? Do the rubber ink erasers, sold under that name in the stores, really take out the ink? How can I stop the blotting after using a knife?

Answer.—Yes; there are instruments better than a penknife for making erasures in account and other books. The stationers sell a small steel blade set in a handle which is made expressly for the purpose. If kept sharpened and treated like a razor, it is much better than a knife.

The rubber ink erasers act by wearing away the surface of the paper. They contain sand or emery and grind off the ink. They are not very valuable to one who writes a heavy hand.

Dr. Phin, in his very valuable little book, "The Workshop Companion," gives the following in regard to the best and most convenient method of erasing ink:

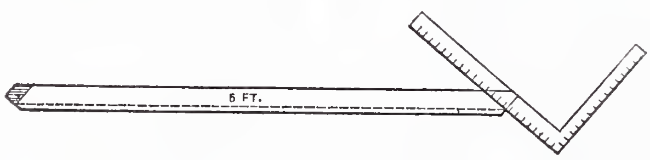
"Take of chloride of lime 1 pound, thoroughly pulverized, and 4 quarts of soft water. The above must be thoroughly shaken when first put together. It is required to stand 24 hours to dissolve the chloride of lime; then strain through a cotton cloth, after which add a teaspoonful of acetic acid to every ounce of the chloride of lime water. The eraser is used by reversing the penholder into the fluid and applying it, without rubbing, to the word, figure or blot required to be erased. When the ink has disappeared, absorb the fluid with a blotter and the paper is immediately ready to write upon again. Chloride of lime has before been used with acids for the purpose, as above proposed; but in all previous processes the chloride of lime has been mixed with acids that burn and destroy the paper."

In regard to this mixture it is necessary to say that it derives its value entirely from the chloride of lime. To be effectual it must be fresh—that is to say, the chloride of lime solution may be made in large quantity, but the acid should not be added to it. A little may be poured out into a small bottle—say as much as is likely to be used in one day's writing—and the acid added to it at the rate of one part of acid to eight of the solution, or a teaspoonful to the ounce. To work quickly, a drop must be placed on the spot that it is desired to bleach. As soon as the color is discharged the liquid must be taken up with blotting paper. The liquid will answer for bleaching almost everything. It attacks all colors powerfully. Keep the bottle stopped tight when not in use, as the smell is not agreeable. It will be noticed that some inks bleach much more readily than others, and that writing which is old is more difficult to remove than that which has just been written.

After using a knife, and before any attempt is made to smooth the spot with a burnisher or knife handle, it should be rubbed with a piece of clean rubber. It can then be smoothed down and the ink is not likely to spread.

Determining the Length of Braces.

From R. L., *Buffalo, N. Y.*—I think some of the methods which were explained in *Carpentry and Building* some months since for finding the length of braces go a long way around. If I want a brace, for example, to fit a space having a 4-foot rise and a 3-foot run, I take my pocket rule and measure across the hollow of my square from 3 inches to 4 inches and thus obtain the length, 5 inches, regarding each inch as a foot. This gives the length of my brace as



Determining the Length of Braces.—Fig. 1.—Manner of Applying the Square to Pattern for Length of Tenon.

5 feet. Any rise and run can be worked in the same manner. The rule is applicable to both braces and rafters. I next take a ⅞-inch board, long enough for the pattern and 5 inches wide. I make one edge straight and square. I then run a gauge line one-half inch from edge. On this line I put extreme length, which, in the example stated, would be 5 feet. I then take my square, with the blade in my right hand, and placing it so that eight on the blade and six on the tongue shall fall upon the gauge line just mentioned, I mark along the blade with my knife, all as shown in Fig. 1 of the accompanying sketches. I then take the square to the other end, and placing it the same way, mark along the tongue. I next square from the length spot on the gauge line to the edge cut-off, as indicated in Fig. 2. The pattern is then complete. I then place the pattern on my brace timber and don't move it until the brace is laid out. To do this I put my left knee on top of pattern to keep it from moving. I then make a scratch mark along the line of pattern, then place blade of square in front of pattern and make a mark along it 2 inches for tenon. I repeat this operation with the other end, and then square down edge and gauge with a double pointed gauge an inch and a half for face and an inch and a half for thickness of tenon. Where rise is more than run, make in pairs.

Dimensions of Doors.

From G. W. C., *Yolo Yolo, Cal.*—I desire to say, in response to criticisms from some of the correspondents with reference to my letter containing dimensions of doors, that the people in this section are of the same hight as "Melican man" in New York or any other place. My letter was printed incorrectly. I intended to state dimensions of doors as follows: Hight, 6 feet 6 inches, and width, 2 feet 6 inches. The front door should be 6 feet 8 inches high and 2 feet 8 inches wide.

REFERRED TO OUR READERS.

Dumb Waiters.

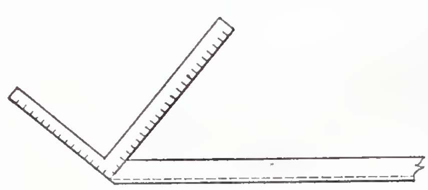
From A. M., *Baltimore, Md.*—I suggest the construction of dumb waiters for private dwellings as a good topic for discussion in the columns of *Carpentry and Building.* There is a very general demand for something of this kind to be used in passing articles from a basement kitchen to the dining-room on the first floor. I have seen a number of ideas carried out in the construction of dumb waiters, but few, if any, could be called entirely satisfactory. I am sure that a great deal can be said to advantage upon this subject, and that ideas gathered from mechanics in different parts of the country will be very valuable for consideration. Certain parts of the country have perfected one feature of the dumb waiter, while other parts of the country have given more attention to other features. By a discussion and comparison of notes, the advantages of all may possibly be combined accordingly. I think the consideration of this topic will be of great benefit to all builders. I would say, in conclusion, no patents need apply.

Best Practice in Hanging Inside Shutters.

From F. J. R., *Yorkshire Center, N. Y.*—I desire to refer a question to the readers of *Carpentry and Building.* I want to know what is the best practice in hanging inside shutters? Should the hinge of the back flap (as it is called) be gained in floor with the stile or screwed on to the face of the stile? There is a dispute upon this point and it has been referred to *Carpentry and Building* for settlement. I refer entirely to the hinges between the two flaps of the shutters, and not to those which hang the shutter to the frame or casing.

Storm Door.

From OCEAN WAVE, *New York City.*—Will some correspondent of *Carpentry and Building* please furnish for publication plan and details for a storm door or lobby, suitable for building on a stoop for protecting a front door in the winter season? I want some-



Determining the Length of Braces.—Fig. 2. —Manner of Applying the Square for Squaring Tenon out from the Shoulder.

thing to put up in sections, so that it can be taken down and stored during the summer time. The design should be appropriate for a country house, and in size about 2 feet 8 inches wide, 6 feet front and about 8 feet 6 inches high. The door should be paneled, should have head lights, and the whole finished in a workmanlike manner.

I also desire plans and details for an average-sized wash house, something which can also be used as a workshop if desired. The building to be one story in hight.

Fern Case.

From B. D., *Lowell, Mass.*—Will some reader of the paper furnish for publication working drawings for a cheap, but pretty, fern case? Size to be 27 inches square or thereabouts.

Construction of Shop Fronts.

From CARPENTER, *Manistee, Mich.*—I desire to ask of the readers of *Carpentry and Building* some practical help in the way of directions concerning the construction and fitting to the buildings of ordinary shop fronts.

Ceiling Tongs.

From T. A. T., *South Norwalk, Conn.*—In the October number of *Carpentry and Building* is a sketch of a pair of ceiling tongs, contributed by J. D. H., of Alabama. I find the engraving and description are not sufficiently explicit to enable me to make use of them, and I desire to ask your correspondent to furnish further particulars. Will he please inform the readers of the paper how long the nose of the tong is? In other words, what length is bent in at at the extreme point? Will he also inform us how long the article is made from this point to the pivot on which the tongs work? Also the length from the pivot to the bend in the handle, and the length of the handle from the bend to the end.

Mahoganizing Cherry.

From J. C. B., *Orange, N. J.*—Can any of the readers of *Carpentry and Building* furnish me a recipe for mahoganizing cherry? I want some preparation which, applied to cherry, shall give it the appearance of mahogany.

Ice House.

From SUBSCRIBER, *Boston* —Will some of your numerous correspondents give me directions for building an ice house adapted to keeping from 20 to 40 tons of ice through the summer, and suitable for erection on a farm? I want it substantial and good in all respects.

About the Trusses in the November Number.

From J. J. L., *Richmond, Va.*—I have carefully examined the specimen roof trusses published in the November number of *Carpentry and Building* in connection with the letter of M. A. W., of Tyler, Texas. I desire to ask some questions about the details of his roof truss No. 1, which please refer to him for answer. What holds the tie-beam together? I should not think that the 1½-inch rod would do the work where the pull is so great. How about the braces? They seem to be simply butted against the rafter, with nothing but a 1-inch rod passing through to hold them in place. I don't think a brace constructed in this manner would remain in position with simply the weight of roof. I desire also to inquire how he treats the braces where they come together on the tie-beams? It is details of this character, even the very simplest, that make matters of this kind interesting and valuable.

ACKNOWLEDGMENTS.

From G. H. H., Philadelphia, we have received full-sized drawings and a careful description of a graduated bevel which was made and put upon the market in that city some years since, but which, on account of its cost, failed to become saleable and is now practically obsolete. G. H. H. calls attention to this article on account of some of the questions which have been raised concerning bevels in numbers of *Carpentry and Building* already published. Briefly described, the tool consists of a brass blade and a boxwood stock. The brass blade at one end expands into a quadrant-shaped part, which, along its circumference, is graduated not only to degrees, but also to the angle corresponding to the sides of the several regular polygons up to and including that of 16 sides. One side of the stock is ruled with divisions of one-inch and a diagonal scale of fractions of the inch by tenths. On the other side are tables showing the length of the sides of polygons for each foot in diameter, both for circumscribing and inscribing circles. Taken as a whole, the tool has a great deal about it to recommend it for use; but, after all, it is doubtless too expensive an article, and probably too scientific, to be in general demand.

We acknowledge the receipt of a letter and drawing descriptive of the construction of a home made scroll saw, sent in by J. F. W., Danville, Pa., which we are unable to publish at present.