

the same straight line, as any defect in this respect will produce a considerable strain upon the hinges every time the hanging part is moved, will prevent it from moving freely, and is injurious to the hinges. In hanging doors, centres are often used instead of hinges; but, on account of the small quantity of friction in centres, a door moves too easily, so that a slight draught of air accelerates it so much in falling to, that it shakes the building, and is disagreeable. This may be in some degree remedied by placing a small spring to receive the shock of the door.

The greatest difficulty, in hanging doors, is to make them to clear a carpet, and be close at the bottom when shut. To do this, that part of the floor which is under the door when shut, or the width of the jambs, may have a piece of wood about a quarter of an inch thick above the general level of the floor, which, with placing the hinges so as to cause the door to rise as it opens, will be sufficient unless the carpet should be a very thick one. Several mechanical contrivances have been used for either raising the door, or adding a part to spring close to a floor as the door shuts. The best method now in use, and the simplest, is the invention of the rising or skew-butt hinge. The parts of this which bear on each other are made with a double bevel, so that, if more than half opened, the door falls against the wall by its own weight; if less than half open, it closes itself.

Various kinds of hinges are in use. Sometimes they are concealed, as in the kinds of joints called rule joints; others project, and are intended to let a door fold back over projecting mouldings, as on pulpit doors and outside folding shutters. When hinges project, the weight of the door acts with an increased leverage upon them, and they soon get out of order, unless they be strong and well fixed. The door of a room should be hung so that, in opening the door, the interior of the room cannot be seen through the joint. This may be done by making the joint according to fig. 84. The bead should be continued round the door, and a common butt-hinge answers for it.



Fig. 84.—Door-Joint.



Fig. 85.—Bevel for Edge of Door.

The proper bevel for the edge of a door or sash may be found by drawing a line from the centre of motion C (fig. 85) to e, the interior angle of the rebate; e d drawn perpendicular to C e gives the bevel required. In practice the bevel is usually made less, leaving an open space in the joint when the door is shut; this is done on account of the interior angle of the rebate often being filled with paint.

The extension of the principle of ploughing and tonguing work together is one of the most important of the improvements that have been introduced by modern joiners. It is an easy, simple, and effectual method of combination, and one that provides against the greatest defect of timber-work, its shrinkage. By means of this method, the bold mouldings of mediæval architecture can be executed with a comparatively small quantity of material; and even in the mouldings of modern architecture it saves much labour. For example, the moulded part of an architrave may be joined with the plain part, as shown by fig. 86. If this method be compared with the old method of gluing one piece upon another, its advantage will be more evident.



Fig. 86.—Joining of Architrave.

Architraves and pilasters are variously sunk and moulded according to the fancy of the designer. They are fixed to the grounds with their internal edges exactly fitting to the rebates in the jambs, and they form the enriched margin or moulding of the frame in which the door is set. Architraves are mitred at the upper angle, but pilasters have generally a console or an enriched block or cap resting on them, to which they fit with a square joint; both the one and the other either run down and are scribed to the floor, or rest on squared blocks or bases, which may be the height of the skirting board, or of the whole base.

The architraves, skirtings, and surbase mouldings, are fixed to pieces of wood called grounds, as A, fig. 86; and as the straightness and accuracy of these mouldings depend upon the care that has been taken to fix the grounds truly, it will appear that fixing grounds, which is a part often left to inferior workmen, in reality requires skill and attention; besides, they are almost always the guide for the plasterer. Where the plasterer's work joins the grounds, they should have a small groove ploughed in the edge to form a key for the plaster. In old work the ground was generally hidden, but in modern work it is frequently shown, which is a saving of stuff; thus, instead of architraves being prepared

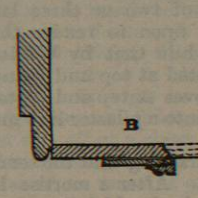


Fig. 87.—Door-Jamb and Ground.

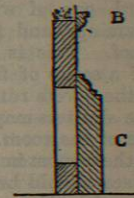


Fig. 88.—Ground and Mouldings.

as in fig. 86, they are made as shown in fig. 87, where A is the rebated and beaded door-jamb, and B the ground, which is generally splayed at the back as a key to the plastering instead of being grooved. On this a thin piece of stuff is bradded to form the double-faced architrave, instead of sinking out of the solid, and on this the ogee or ovolo moulding is nailed. Again with base mouldings, A (fig. 88) is the ground fixed against the wall, on the top of which is nailed the upper moulding B, and C shows the skirting and lower moulding, fixed against a fillet on the floor.

We have thus far spoken chiefly of joinery as performed at the bench; but by far the most important part remains to be considered; for, however well a piece of work may have been prepared, if it be not properly fixed, it cannot fulfil its intended purpose. As in the preceding part, the general principles will be stated that ought to be made the basis of practice; and these illustrated by particular examples. When the carcass of a building is ready for the joiner, the first thing to be done is to cut the bond timber out of the openings, set the sash frames, and fill them with old sashes or with oiled paper on frames, to exclude the weather, but admit light. The flooring joists are then proved with straight-edges, and any inequalities in them are removed with the adze; the flooring boards are next cut down to their places, and are turned with their faces downwards until the ceilings are done. First, however, the pugging is done, if any be intended. This is to prevent sound passing through the floor when finished, and is sometimes called deafening sound-boarding. It is effected by nailing fillets to each side of the joists, near the bottom, and laying on these pieces of rough boards across

Fixing
joists
work.

and close together; then there is put a layer of mortar mixed with chopped straw, or sometimes clay, sawdust, or small shells.

The preparation given to flooring boards in superior work is planing the face, shooting the edges, and gauging to a thickness,—the common fillister or stop rebate plane being used to work down to the gauge mark, from the back of every board, and about half an inch in on each edge. When a board is to be laid, it is turned on its face in the place it is to occupy, and the workman with his adze cuts away from the back over every joist down to the gauge rebate, so that on being turned over it falls exactly into its place, and takes the same level with all its fellows, which have been brought to the same gauge; then follows the process of laying, and the result must, if the work be done well, be a perfectly even and level surface. The slight inequalities of surface which may occur are reduced with a smoothing-plane, the brads being previously punched below the surface if the floor be face-nailed. Floors are in ordinary cases either laid straight joint or folding, and are edge-nailed, as fig. 89, or face-nailed. According to the folding method, two boards are laid, their heading joints all on the same joist, and of course in the same straight line, and nailed at such a distance apart that the space is a little less than the aggregate width of the three, four, or five boards intended for it; these boards are then put to their places, and, on account of the narrowness of the space left for them, they rise like an arch between its abutments. The workmen force them down by jumping upon them. Accordingly, the boards are never soundly fixed to the joists, nor can the floor be laid with any kind of evenness or accuracy. This method should be avoided in all good work. Straight joint flooring is when every board is laid separately, or one at a time, the heading joint or joints being broken or covered regularly in every case. Dowelling is the driving-pins of wood or iron half their length, into the edge of the last laid board, the outer edge of which has been skew-nailed, their other ends running into holes prepared for them in the inner edge of the next board, in the way the head of a cask is held together, and then its outer edge is skew-nailed in the same manner, and so on. Tonguing is effected by grooving both edges of every board, and fitting thin slips and tongues into them. The boards are usually forced together by pressure as with a clamp applied to the outer edge. The nail used in face-nailing floors is called a flooring brad; it has no head, but a mere tongue projecting on one side of the top of the nail, which is put in the direction of the grain, that it may admit of being punched in below the surface level, otherwise the superficial inequalities could not be reduced when the floor was completed, because of the projecting heads of the nails. For side or edge nailing, however, clasp-nails, nails whose heads extend across on two of the opposite sides, are used.

As boards can seldom be got long enough to do without joints, it is usual, except in very inferior work, to join the ends with a tongued joint, as shown in fig. 89, where B

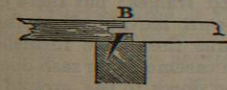


Fig. 89.—Tongued Joint.

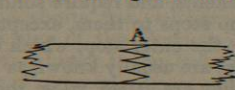


Fig. 90.—Forked Boards.

is the joint. The etched board is first laid, and edge-nailed to the joist. In oak floors the ends are forked together sometimes, as shown at A (fig. 90), in order to render the joints less conspicuous. The joints should be kept as distant from one another as possible.

In laying floors the advice of Evelyn only to tack the boards down the first year, and nail them down for good the next, is certainly the best method when it is convenient

to adopt it; but, as this is very seldom the case, we must expect the joints to open more or less as the wood has been more or less seasoned. Now, these joints always admit a considerable current of cold air; and also, in an upper room, unless there be a counter floor, or pugging, the ceiling below may be spoiled by spilling water, or even by washing the floor. To avoid these disagreeable results, the boards should be ploughed and a tongue inserted into each joint, according to the old practice. When the boards are narrow, they might be laid without any appearance of nails, in the same way as a dowelled floor is laid, the tongue serving the same purpose as the dowels. In this case the cross or feather tongues for the joints should be used. A new system of flooring has for some years been used in London, to which the name of "Victoria floors" has been given. A rough floor of boards, three-quarters of an inch thick, is first laid, and the rest of the joiners' work fixed, and the plastering finished. When all is done, a floor formed of inch or inch and quarter plank, ripped down the middle, and consequently very little more than 5 inches wide, is laid; the rough boarding being first covered with a layer of shavings, or old newspapers, or other waste paper. These boards are dowelled on one edge and nailed on the other, and a very sound floor is thus formed, which neither springs nor creaks. A wainscot floor can be laid well on this principle.

Another early operation in joinery is the fixing of the framed grounds for the doors and windows, and for the skirting (Plate XXVI. fig. 5, and woodcuts, figs. 86, 87, and 88) to which the plasterers may float their work. The skirting grounds are generally dovetailed at the angles, and are well blocked out, so that they may not vibrate on being struck, or yield to pressure when the plasterer's straight-edge passes roughly over the surface; they must also be set with the utmost truth and precision. When the floors are cut down and the grounds fixed, the joiner's operations in a building should be suspended until the plasterers have finished, or nearly so, and then the floors may be laid. By deferring this operation until that period, the workmen of the two different trades are prevented from interrupting each other, and indeed injuring each other's work; and joiners always find employment in the shop preparing, as before intimated.

If the part to be fixed consists of boards jointed together, but not framed, it should be fixed so that it may shrink or swell without splitting or winding. The nature of the work will generally determine how this may be effected. Let us suppose that a plain back of a window is to be fixed. Fig. 91 is a section showing B the back of the window, A the window-sill, D the floor, C the skirting, and E the wall of the house. The back is supposed to be prepared as previously stated, and is kept straight by a dovetailed key a. Now, let the back be firmly nailed to the window-sill A, and let a narrow piece d, with a groove and cross tongue in its upper edge, be fixed to bond timbers or plugs in the wall, the tongue being inserted also into a corresponding groove in the lower edge of the back B. It is obvious, that the tongue being loose, the back B may contract or expand, as a panel in a frame.

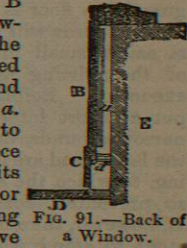


Fig. 91.—Back of a Window.

In getting out skirtings, if the work be of a superior description, the boards should be tried up as for framing in every way except bringing to a width, which need not be done. The face edges, however, must be worked with great precision, and moulded or rebated as the case may require. Rebating or tonguing will be perhaps necessary when the skirting consists of more than one piece, that the different

pieces may be made to fit neatly and firmly together; and all but the lowest piece must of necessity be brought to a width, as well as tried up in other particulars. A skirting in a single width is called by that term; but when it is made up of more than one part it is designated a base; the lowest board is then called the skirting board, and the upper the base moulding or mouldings (Plate XXVI. figs. 1 and 5). The skirting board is not brought to a width because the labour would be lost according to the ordinary mode of fixing it. The board is applied to its place with its lower edge touching the floor; but as the most perfectly wrought floors are found to have some slight unevenness of surface so close to the wall, a straight edge would not fit closely down to it in every part. The board is therefore propped up at one end or the other until the upper or faced edge is perfectly parallel with the average line of the floor, or rather so as to be perfectly level. A pair of strong compasses, such as are used by the carpenter, is taken, and opened to the greatest distance the lower edge of the skirting board is from the floor throughout its length; the outer edge near the point of one leg of the compasses is then drawn along the floor, whilst the point of the other, being kept vertically above it, is pressed against the face of the board, on which it marks a line exactly parallel to the surface of the floor, indicating, of course, every, even the slightest, irregularity there may be in it. If the floor be not a very uneven one, the excluded part may be ripped off with the hand or the panel saw, which may generally be made to follow the traced or inscribed line exactly; if, however, the line be a very irregular one, having quick turns in it, the hatchet must be used. This operation is called *scribing*, and the result of it is evidently to make the skirting fit down on the floor with the utmost precision. Care must be taken in performing the operation that the upper edges of the skirtings be not only level, but that all which are in immediate connection be scribed to the same height, that their upper edges may exactly correspond.

In the principal rooms of a house, the skirting C (fig. 91) is usually grooved into the floor D, and fixed only to the narrow piece *d*, called a ground. (See also Plate XXVI. fig. 5.) By fixing in this manner, the skirting covers the joint, which would otherwise soon be open by the shrinking of the back, and from the skirting being grooved into the floor, but not fastened to it, there cannot be an open joint between the skirting and floor. When it is considered that an open joint in such a situation must become a receptacle for dust and a harbour for insects, the importance of adopting this method of fixing a skirting will be apparent. As grooving a floor is attended with considerable labour, and as the boards will sometimes twist, it is more common now to nail a small fillet to the floor, against which the back of the skirting rests, and, of course, has full room for expansion. Before skirtings are fixed, vertical blocks are put at short intervals, extending from the floor to the narrow grounds, and made exactly flush with and true to the latter, and are firmly nailed. These form a sound backing, to which the skirtings may be bradded or nailed, and so prevented from warping or bending in any manner. If, however, the skirting be not very wide, and be sufficiently stout to stand without a backing, a fillet only is nailed along the floor as a stop for its lower edge; but this is rendered unnecessary if the skirting be tongued into the floor, as the tongue will answer every purpose of a stop (fig. 5, Plate XXVI.) The ends of skirtings should be tongued into each other when it is necessary to piece them in length; and on returns or angles the end of one should be tongued into the returned face of the other in the square parts, and mitred in the oblique-angled or moulded parts.

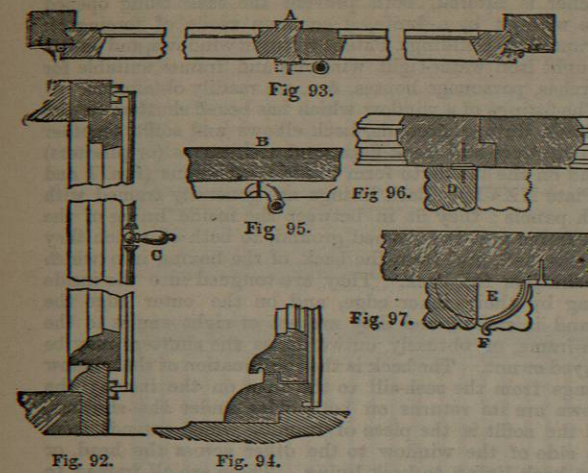
The dado of a room should be fixed in the same manner as explained above for window backs (fig. 91). When a

chair-rail or surbase is required, grounds similar to those for the base are fixed to range like them with the face of the plastering; the surbase itself must be wide enough to cover the grounds and the joints formed by them and the plastering completely; it is in effect a cornice to the stereotype (or pedestal, as the three parts may be termed of base, dado, and surbase), and the space or dado between it and the base is generally understood to be wainscoted, though it is more frequently plastered.

In fixing any board above 5 or 6 inches wide, similar precautions are necessary as those detailed in fig. 91, otherwise it is certain to split when the house becomes inhabited. We may, in general, either fix one edge and groove the other, so as to leave it at liberty, or fix it in the middle and leave both edges at liberty. Sometimes a wide board, or a piece consisting of several boards, may be fixed by means of buttons screwed to the back, which turn into grooves in the framing, bearers, or joists, to which it is to be fixed. If any shrinking takes place the buttons slide in the grooves. In this manner the landings of stairs are fixed, and it is much the best mode of fixing the top of a table to its frame.

The parts of the outside frame of a sash are distinguished by the terms applied to the similar parts of common framing. The upright sides are styles, and the transverse or horizontal ones, which are tenoned into the ends of the styles, are rails; but the inner framework or divisions for the panes are called merely upright and cross bars (these bars, according to the way they are moulded, are called *lamb's tongue*, *ovolo*, *beaded*, &c.),—the upright being the mortised, and the cross bars the tenoned, as with the outer framework (Plate XXVI. fig. 1). Sashes are got out like common framing; the parts are tried up, set out, and mortised and tenoned, exactly in the same manner, allowance being made in the length of the rails and all tenoned pieces in the setting out, as in common framing also, for the portions of the mortised styles and upright bars which are worked away in forming the moulding and rebate. The meeting rails of sashes which are in pairs, to be hung with lines, are made thicker than the other parts by the thickness of the parting bead, and they are bevelled or splayed off, the one from above and the other from below, that they may meet and fit closely. When the framework is completed, although it cannot be put together because of what has just been referred to, the rebate is formed by the sash fillister on the further part of the face edge, and the moulding struck on its hither angle. These things being done, the moulded edges are either mitred or scribed at the shoulders and haunches, and the sash may be put together. If sash bars are mitred at the joints, they require dowels in the cross bars to act as tenons; but if they can be scribed, dowelling is not necessary. Sashes are either hung upon hinges or hung with lines, pulleys, and weights. Fixed sashes are put into frames, of which every part may be solid but the stop, which must be put in behind the sash to detain it. Sashes hung with hinges are usually called casements, and require solid rebated frames; but there can be no stops to them, except their own movable fastenings, and the outer stop, which of course the rebate furnishes. These are usually known as French casements, or sash doors, as they are called when they open down to the ground or floor; they have now taken the place of sash windows, where they may lead from the room to garden paving, or to a balcony, or may be used for similar purposes. The ordinary arrangement for an aperture is that of two leaves working on hinges at the sides inwards or outwards, meeting in the centre of the opening. With the former, which is the usual mode, one leaf is secured to the head and sill by bolts either round or sunk in; the other leaf, when closed, is secured to the first by a handle fixed on the second and turning over a staple fixed on the first. If the casement

should be a high one, this second leaf often requires a bolt at top and bottom, to secure it against the force of the wind, which by bending it admits the cold air and wet. When it is placed towards an exposed aspect, and is thus subject to driving rains, it is necessary to take many precautions for the prevention of wet being blown through the meeting surfaces all round the casements. To effect this object, the styles, rails, and frames are sunk and beaded in various ways. Figs. 92 and 93 represent sills and



FIGS. 92-97.—French Casement fittings.

bottom rails; and fig. 94, meeting rail, styles, and frame, which last is an ordinary arrangement in France. An improvement to the mere handle for securing the leaf of the casement is that of affixing an upright metal rod, which is turned by the handle C, fig. 92, on the leaf being closed, and by hooks at top and bottom as B, fig. 95, catching into a plate fixed for them, and effectually fastening it. A simpler method has been shown where, in lieu of the rod, a reeded bar, as D, fig. 96, is moved to and fro as the leaf is required to be opened or shut, the top and bottom of the bar being rounded as shown at E, fig. 97, so as to slide into two segmental plates F, secured to the sill and lintel. Fig. 96 is a plan of the two casements, and 97 a plan of the head and sill. The metal rod, which is of brass, is called the *Espagnolette* bolt. Another mode of securing the casements has lately been introduced, whereby a flat plate, the whole height of the opening, is inserted in a groove formed in one edge of the meeting style of a leaf; and on this being closed the plate is shot forward by a handle into a groove in the other leaf, fastening the two together, the plate forming a stop against both the wind and the rain. This is a patent arrangement of Arch. Smith and Co. Fig. 98 is a plan of the usual French casement used at Paris. A shows the two leaves of the casement when shut; B is a plan of the shutters in their boxing, CC the shutters when closed, D the bolt, E the inside architrave and F the *Persiennes*, or outside blinds, shut against the stone reveals, and so provided for by the architect, instead of being an addition made by the upholsterer after the work is done, and perhaps spoiling the design. The ordinary mode is for them to be hung with projecting hinges to admit of their being folded back into the face of the wall, which is a hideous arrangement for any façade, except perhaps one of plain brickwork or plain cement. GG shows the position of the blinds when shut, and H is the outside architrave. Much difficulty arises in preventing the rain and wind from penetrating under such

doors. The French raise the doors very much to secure this, as shown in figs. 92 and 94. In England various methods have been adopted by forming second sills of metal cast into shapes to form gutters and throats; perhaps the best arrangement is the "patent sill or water bar" (fig. 99), as now manufactured by

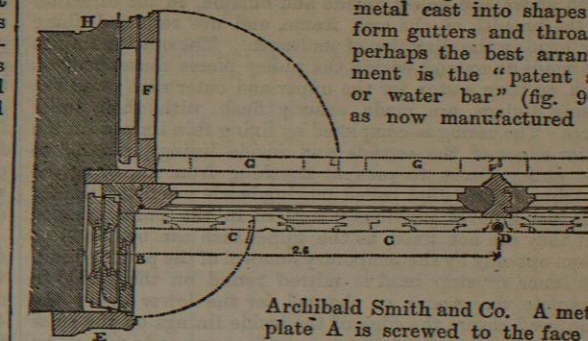


FIG. 98.—Section of French Window.

Archibald Smith and Co. A metal plate A is screwed to the face of the bottom rail. An arrangement in metal B is screwed to the upper weathering of the wood sill C, having on its outer edge a plate D hinged to it. When the door or leaf is shut, a pin E, let into the underside of the bottom rail, forces up the hinged plate D, and presses it against the first named plate A, making all tight. Fig. 100 is a section of a mediæval moulded bottom rail found in France. When the window lights are carried up over the casements, as is very often the case, the upper lights are generally fixed; but it is better that one or two of them should be rendered available for ventilating the apartment when it is not desirable to have the door itself open. This will be effected by hinging the light on the bottom rail, with the necessary means of opening and closing it, or placing it on centre hinges at the sides.

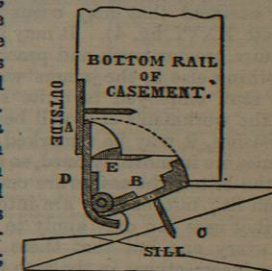


FIG. 99.—Water Bar.

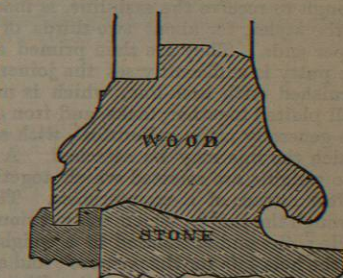


FIG. 100.—Ancient French Bottom Rail.

Sashes hung with lines require cased frames (Plate XXVI. figs. 1, 4), to receive the pulleys and weights. The sill of the frame is made, as in the former cases, solid, is sunk and weathered, and is generally made of a more durable material than the rest of the frame; the sides in the direction of the thickness of the frame are of one and a quarter or one and a half inch board, very truly tried up, and grooved to receive a parting bead; for it must be obvious that sashes hung with lines to run vertically up and down within the height of the frame must be themselves in two heights, and must pass each other in separate and distinct channels. The ends of these boards are fixed into the upper face of the solid sill below, and into a similar board parallel to the sill which forms a head above, and they are called pulley pieces, or styles, because they receive the pulleys, which are let into them near their upper ends.