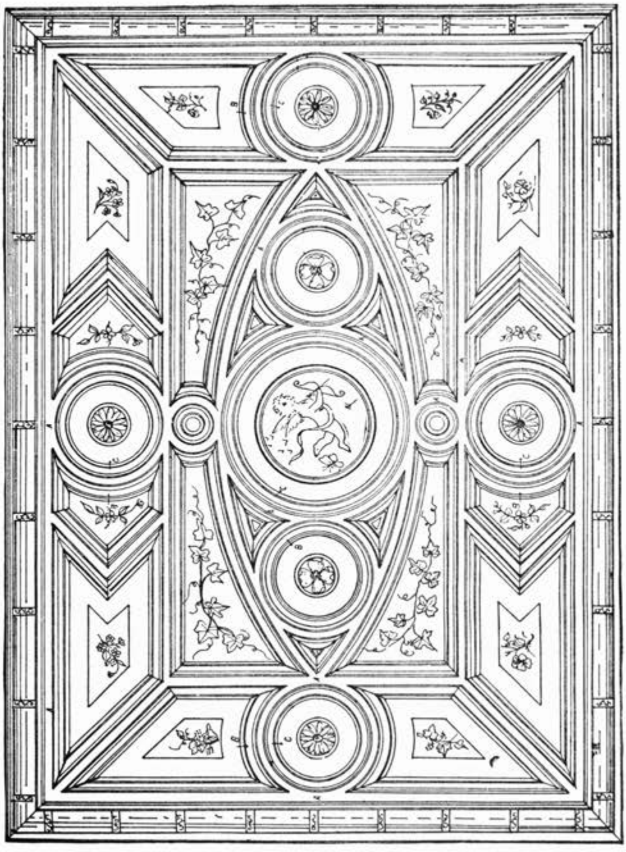


PLAN OF A GEOMETRICAL WOODEN CEILING.

OWEN B. MAGINNIS, DESIGNER.

HOW TO JOIN MOULDINGS;

OR,

The Arts of Mitring and Coping.

A complete treatise on the proper modern methods to apply practically in joining mouldings. A book for working carpenters, joiners, cabinet-makers, picture frame makers and wood-workers. Clearly and simply explained by over 40 engravings, with full directive text.

BY OWEN B. MAGINNIS,

AUTHOR OF "PRACTICAL CENTRING," "THE CARPENTER'S HANDOOK" (LONDON), ETC.

NEW YORK:

WILLIAM T. COMSTOCK,

23 WARREN ST.

1892.

INTRODUCTION.

THERE is no carpenter, cabinet-maker, or other artisan, who will not find it a benefit to be thoroughly familiar with the proper methods to follow in joining mouldings together, or, as it is technically termed, "mitring" them, etc. As there has never been any book printed treating at length on this important art, I have carefully prepared this little work, and feel confident that it will be found of great service in and out of the shop, both by practical men and amateurs. The contents are all gathered from practical experience, and can therefore be followed in actual work without any doubt as to their accuracy.

I beg to acknowledge the kindness of the publisher of the *Manufacturer and Builder*, who has permitted me to reproduce the "Art of Coping."

THE AUTHOR.

CONTENTS.

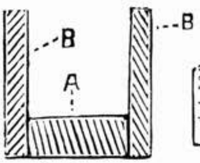
CHAPTER I.

THE DEFINITION OF A MITRE.—MITRE BOXES: HOW TO MAKE AND LAY THEM OUT.

"MITRE" is defined architecturally by Webster as the "joint formed by two pieces of moulding each cut at an angle and matching together; to meet and match together on a line bisecting the angle of junction, especially when at a right angle; to cut the ends of two pieces obliquely and join them at an angle."

The above definition of the great lexicographer is really in substance the full definition of the term and the way it is employed, so we will at once proceed to describe the different forms of mitres, from the simplest to the most difficult, giving each in detail and illustrating all methods in full, with the appliances necessary for accurate cutting, etc.

THE MITRE BOX.—This indispensable adjunct for the purpose of cutting mouldings on an angle is well known, yet so important is it that it must be perfectly and accurately constructed so as to insure the perfection of the mitre. Fig. 1 represents a mitre box as it ought to be made by carpenters in the shops or building, and, as will be seen, consists simply of three pieces of wood joined together, the size of the pieces being as near the following dimensions as possible for ordinary mouldings up to $3\frac{1}{2}$ inches wide and using a 20 or 22-inch panel saw. The length of the box



END VIEW.

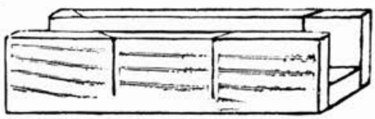


FIG. 1.—THE MITRE BOX.

should not be less than 18 inches nor more than 2 feet six inches long. The bottom should be 2 inches thick by 4 inches wide inside so as to insure the sides being firmly and strongly fastened to its edges; sides, $1\frac{1}{4}$-inch stuff by 6 inches wide. Either pine, oak or soft ash may be used for the material. I cannot by any means recommend any of the other woods for this purpose, as they are entirely too subject to atmospheric changes. Experience has proven that pine is preferable to any other wood, even though the cuts may wear out sooner through the friction of the saw sideways. If the box be made long enough new cuts can be put in in a few minutes, while the oak box is heavy and unwieldy, though it has the virtues of wearing well.

To construct a mitre box properly the bottom piece, A (see section), must be placed upon the bench and taken out of wind with the fore plane by using straight edges or winding sticks and placing one across each end of the surface to sight across them until they show parallel. If one corner should be higher than the other it must be planed down perfectly level; this being done one edge is straightened with the try-square, after which it is gauged to a parallel width, and the other edge squared. The sides, B B, must also be taken out of wind and one edge straightened. For very good work the sides should also be gauged and planed to a thickness of say $1\frac{1}{8}$ inch when $1\frac{1}{4}$-inch stuff. This planing and gauging must be very well done to gain a perfect box. Before fastening the sides on the bottom they must be carefully gauged with a line 4 inches down on the face side, or on the side which was taken out of wind, which must be done on both sides of the box. A small wire nail can now be driven close to each end exactly on this line and the side can be placed on the edge of the bottom, keeping the wire nails close down on the face of the bottom, or rather the gauged line fair with the face of the bottom, and the side can be nailed fast to the edges of the bottom, keeping the fastening nails about the centre of the edge. Should the above work be properly done the inside of the box will measure 4 inches deep, 4 inches wide and be perfectly parallel from end to end, top and bottom at 4 inches, and the sides will stand square to the bottom. On looking across the top edges of the sides they will be out of wind and show as one. If a box be made in this way it will cut a mitre exactly to a square mitre.

There are two or more ways by which the box can be marked for sawing, but only two which will be accurate. The first consists in taking a drawing board or clean piece of stuff with a straight edge, as Fig. 2, and laying off on it a square whose side is equal to 8 inches, and drawing two diagonals from corner to corner, as shown, then setting a long bevel to one of the diagonals and screwing the blade

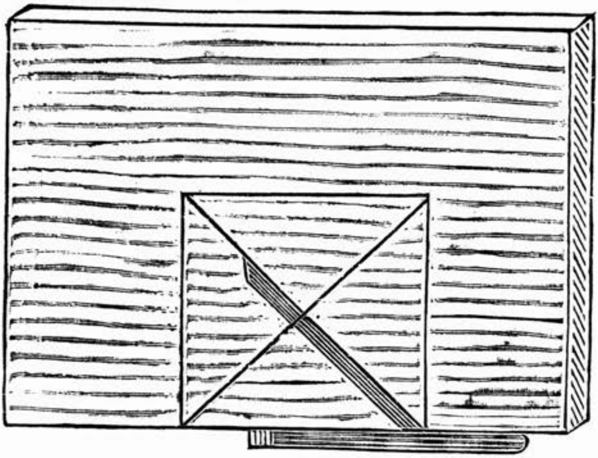


FIG. 2.—SETTING THE BEVEL.

fast in the stock; now take the bevel and lay it across the edges of the sides of the box, and, applying it from the outside of the box, holding the blade firmly down with the left hand, mark the cut with a sharp pen-knife on the edge with the right hand. Next, reverse the bevel for the left hand cut, as Fig. 3, and mark it similarly, which, being done, take the try-square and square down from the edges on the outside of the sides to the level of the bottom, also with a knife, watching that the square does not move and that the line is perfectly straight. This is one way to lay out the cuts.

Another method by which it can be

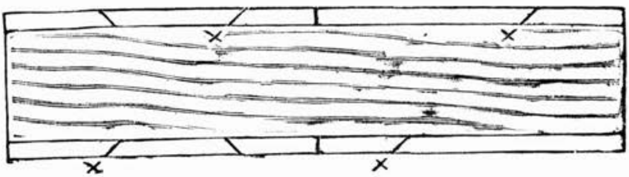


FIG. 3.—TOP VIEW OF MITRE BOX.

done is to take the width of the box inside, 4 inches, and lay it off on the inside arrises of the sides, square, and with the straight edge and knife, to mark the direction of the angle of 45°, which is now being treated, and square down as before. I would scarcely recommend that the box be marked by taking two equal numbers from the heel of the steel square, because it is difficult to hold it firmly in position and there is always the likelihood of the squares being out of true or worn, which will, of course, affect the direction of the cut, though it can be done when the bevel is not available. The reverse cut can either be marked across the right or at the opposite end, but the first has the advantage of leaving the remainder of the box sound for making new cuts when the first ones are worn too wide to be accurate in sawing the moulding.

CHAPTER II.

SAWING THE MITRE BOX, MITRING SIMPLE MOULDINGS AND PROVING THE CUTS IN THE MITRE BOX.

WHEN the box has been properly marked the next thing to be done is to saw it, or rather to saw into the sides exactly to the knife mark. The saw should not be run down the centre of the mark, but to one side of it, so that the operator may see that it moves down in sawing just to the line. It is therefore best to keep the thickness of the saw blade to the right of the line both across the top edges and on the sides, kerfing both edges simultaneously and reversing the box at intervals to make sure that the saw is not running from the mark, which would throw the cut out of square and spoil the box for good mitring. It is, of course, necessary that the teeth of the saw be sharp and well set and not coarse, so that the cut on the mouldings may be clean enough to obviate planning. Another point I would also strongly recommend is that the saw with which the box is cut, be used in cutting the mitres, because, as it fits best into the kerfs, it will run steadier and more accurately than one which is thinner and has less set. Again, by using a saw with more set the kerfs in the sides are liable to be thrown out of true when placing it in the box. I would decidedly prefer a long saw in preference to a tenon or panel saw, still a 22-inch panel saw is very handy for the box described, as the longer the stroke the better for accurate cutting. Some carpenters prefer to insert a square cut in the box to make butt joints, especially when fixing mouldings in buildings, and it is a judicious and economical practice, when necessary, though, as we are now dealing with the elements of the science, we will proceed with the methods of obtaining ordinary mitres.

Supposing Fig. 4 to be a fillet of wood of any length and it is desired to saw it into such a shape that two or more pieces will be joined at right angles, or square, so as to show a continuous grain and be a close joint, how is it to be done? With the aid of the box just described, very simply. Make the piece long enough to be handily placed in the mitre box, which we will presume is placed upon a bench or table, or even a saw bench, and there fastened by a nail driven diagonally through the ends of the bottom into the bench to

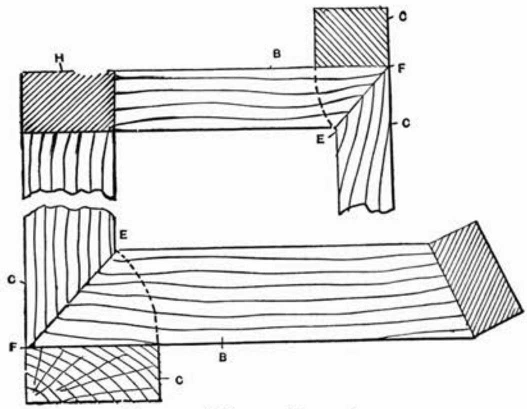


FIG. 4.—A SIMPLE MITRE JOINT.

hold it firmly in one position, then place one piece in the box in the bottom corner against the farthest side, as at A, Fig. 5, and hold it fast there with the thumb of the left hand, the fingers spanning the top edge of the side. Now lift the saw with the right hand, and, inserting it in the kerfs of the box, move it back and forth lightly until it touches the bottom and the end of the mitred piece drops off. We are now presumably making the right hand cut, as B, Fig. 4. Care must be taken to hold the piece immovable in one place until the saw has gone entirely through, as the slightest movement will destroy the shape of the cut and render it inaccurate. The saw will point from left to right in making this

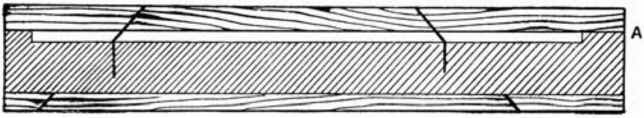


FIG. 5.—TOP VIEW OF BOX WITH SADDLE.

cut, and be placed in the left hand kerfs of the box. To make the left piece that will fit against this, as C, Fig. 4, it will only be necessary to place and hold it in the box as before and saw in the right hand cuts from right to left. When the two are placed together on a level board or surface they will be as represented in Fig. 4, and the mitre joint will be as E F. The inside and outside angles will be 90° and the pieces will be square to each other, giving a continuous grain on all sides and a perfect, if not invisible, joint on the mitre. G, Fig. 4, is the section of the mitred ends which will, of course, be longer than the cross section of the fillet, H. The accuracy of the cuts in the box can now be practically proven by placing the mitred pieces together and holding them with one hand or a hand screw while inserting a true try-square in the angle. If the stock and blade of the square touch every part, then the box is correct; if not, then the box is out of true and there is no remedy but making new exact cuts or kerfs in the sides, using more care in doing so. T is the section of the fillet when sawn at an octagon, or on the angle of $22\frac{1}{4}$ degrees, below which is seen the fillet mitred on the edge and the section of the mitre cut.

The process of mitring, just described, is applicable to all fillets and simple mouldings. For example, the quarter-round, Fig. 6, the half-rounds or beads, Figs. 7 and 8, the round or torus, Figs. 9 and 10,

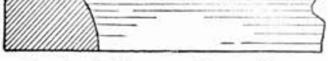


FIG. 6.—A QUARTER-ROUND MITRED.

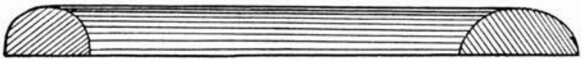


Fig. 7

Fig. 8

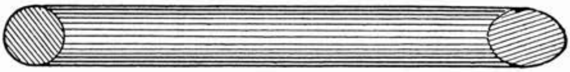


Fig. 9

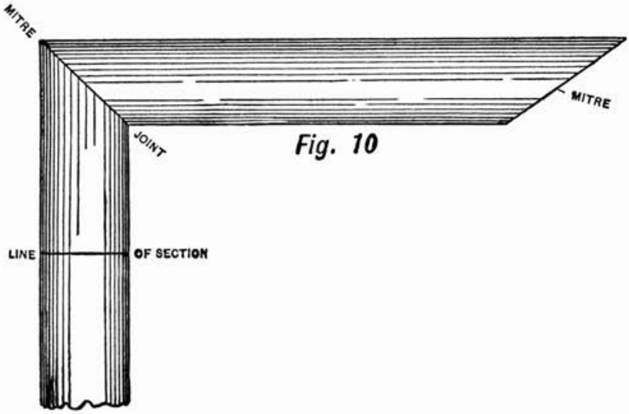


Fig. 10

are all similarly mitred, as are also the "scotias" or "cavettæ," Figs. 11 and 12, which are shown mitred and in projection.

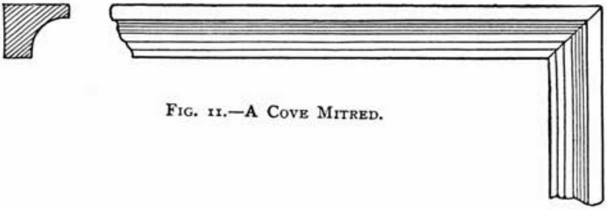


FIG. 11.—A COVE MITRED.

When a fillet or moulding is to be mitred to a fixed length a regular method must be followed to insure its being, when mitred, the exact length required. It is usual to mitre the left hand corner and end first, and then having marked the measurement on the top arris of the piece, as E, to place it in the box, keeping the mark to the side of the saw kerf in the box, because, when it is sawn, the mark must just be on and nothing more. It would leave the piece short by the thickness of the saw blade were this precaution not taken and the mark placed carelessly at the kerf.

FIG. 12.—BACK VIEW OF COVE.

It will be seen from the above that extreme care is always requisite for proper mitring, in order that the beveled ends formed by sawing in the box may fit to form the angle required *without planing*, which is rarely done neatly enough to make a close joint and causes much waste of time.

A good mechanic will never plane his mitres, but saw them so accurately that they will fit to a hair when placed together.

FIG 13.

Fig. 13 shows the right hand mitre of a compound raised moulding mitred in the box, A being its cross section and B its mitred section. In order to acquire practice I would advise a beginner to mitre four pieces of wood, fillets, or mouldings, like Fig. 4, together, forming a picture frame, as it were. This can be done by first mitring them, say, two 8″ and two 12″ long, and tacking each one as it is mitred round on a flat board till they form a border or frame and the joints come close. There are many who claim that it is impossible to cut four pieces or eight mitres so precisely as to fit all round. This is a fallacy, and after doing it several times the beginner will see that if his mitre box be true they will all fit and the frame

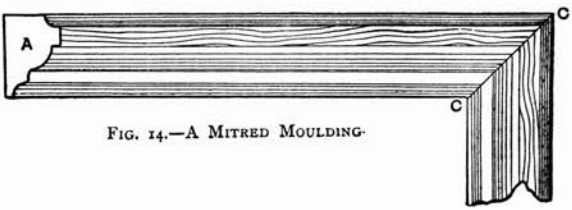


FIG. 14.—A MITRED MOULDING.

will be square. The latter he can determine either by placing a rod across from corner to corner inside till the diagonals are equal, or by the method before described with the try-square. Fig. 14 is a panel mould mitred for a picture frame, A being the cross section and C C the joint of the mitre.

CHAPTER III.

MITRING PANEL AND RAISED MOULDINGS.

HAVING considered the simplest form of the science, I will now describe how a raised or rebated moulding can be inserted in a

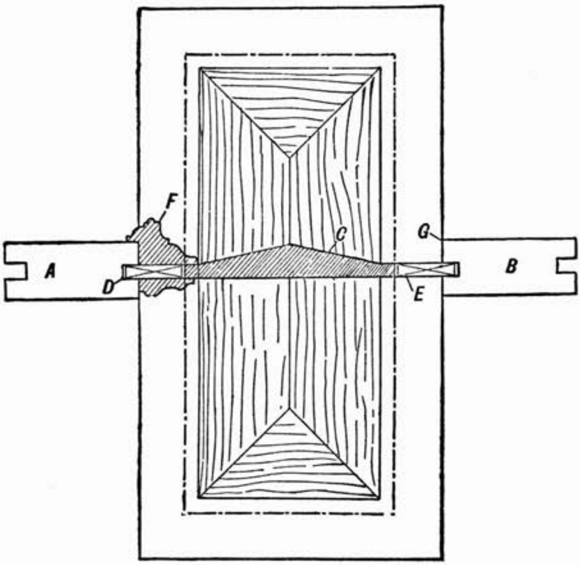


FIG. 15.—PANEL AND MOULDINGS.

panel. Supposing the panel at Fig. 15 to be a panel in a door of any kind, either for a room or wardrobe, A B being the section showing the two stiles of the frame A and B, C the panel, D E the fillets and F the panel moulding, which has to be mitred round the inside edges of the frame and to cover the joint at the arrises, as G, by the rebate or lips on the moulding F.

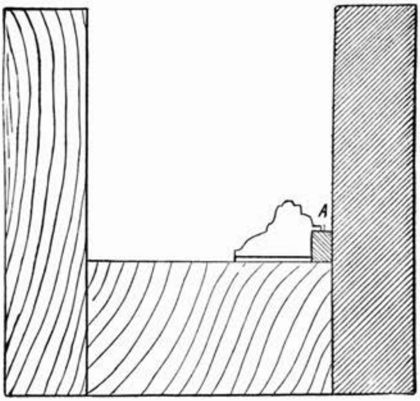


FIG. 16.—BOX WITH SADDLE.

Should the frame be so carefully made and planed off that the sinkage of the panel be equal all around, then all that is necessary is to make a saddle as A, Fig. 16, equal in width to the depth of the sinkage, which is here $\frac{1}{2}''$, about $\frac{1}{4}$ or $\frac{3}{8}''$ thick, and place it in the mitre box in the position shown in the drawing, so that the lips of the moulding may rest upon it. Fig. 5, being a plan of the box, illustrates this more clearly, also how the marks for determining the length are scratched with a knife on the bottom by squaring out from the mitre point where the saw intersects it. Should there be any difference in the sinkage between each corner or angle, then a saddle, the width of which is equal to the neat depth, must be used when cutting the mitres at each individual corner. This must be strictly adhered to when there is a marked difference in order to make the mitres fit closely, the rebate to come closely down to a joint on the frame and the inside edge of the moulding close down on the panel, thereby making a good job. When the latter is being done the best method to follow is to place the pieces round in the panel, just feeling, making the profiles of the moulding intersect equally, commencing at the left and working round, and when the four are in to tap them gently down, using a block, so as not to bruise the moulding, and a hammer, making sure that they all fit snugly in their places.

The usual way to mark the length of this description of rebated moulding is to place it in the sinkage of the frame, keeping the left hand mitred end closely into the corner, and then marking it with a pocket knife. This mark is placed to the square line at Fig. 5 in the mitre box and when it is sawn it will be just the exact length required.

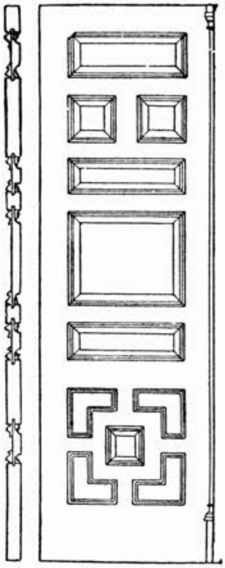


FIG. 17.—DOOR WITH RAISED MOULDINGS.

The front door illustrated in Fig. 17 has both flush and raised panels, but a raised inch moulding on one, the face side, and a common o-gee chamfer moulding on the other. The full size section, Fig. 18, gives the full profile of each. This door is a very good example of mouldings cut in the way I have just described, with the addition of having a central panel with L panels grouped around,

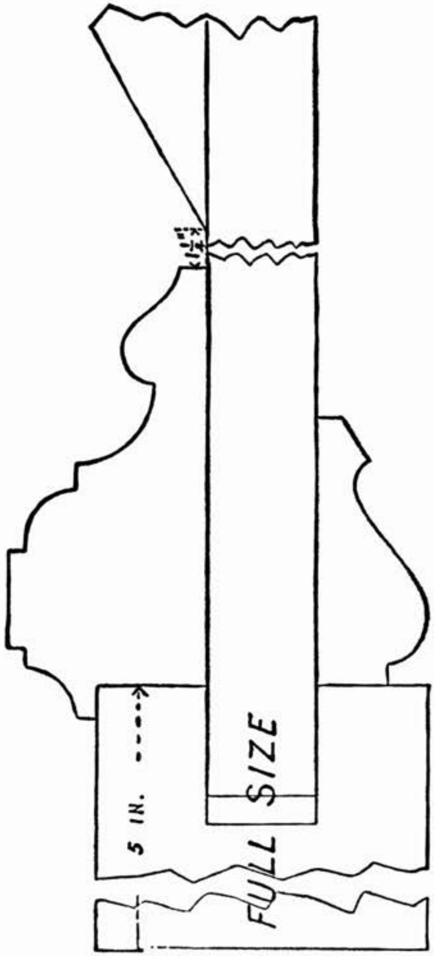


FIG. 18.—SECTION OF FIG. 17.

which gives four outside mitres. Here the difference between outside and inside mitres must be explained. An inside mitre is one in which the profile of the moulding is contained, or the outside line and highest part is contained within the angle, and an outside mitre is one which is directly its opposite, or the whole of the moulding is cut round outside the angle. The mitres are similarly sawn in the box, with the exception that the direction of the cut is changed, and instead of being an inside angle the profiles of the moulding intersect on an outside, as shown on the door. As it often happens from faulty construction that the rails and stiles of a door are slightly out of square, it is advisable to place a try or set square over or in the angles, to make sure that they are correct, or the mitres will show an open joint according as they vary. When this is the case the best way is to place a thin shaving or strip of cardboard, when mitring, behind one end. of the moulding to make it vary likewise to suit the framing.

CHAPTER IV.

TO MITRE ON OCTAGON AND POLYGONAL FIGURES.—THE MITRES FORMED BY STRAIGHT MOULDINGS INTERSECTING WITH CIRCULAR MOULDINGS, ALSO MITRES OF CIRCULAR MOULDINGS INTERSECTING.

THE moulding should also be carefully examined to see that it is stuck the full thickness, that the rebate is square and fully fit for the purpose for which it is intended, and it is best to plane the back off a little on a bevel so that it will fit easily into its place and tighten as it goes down. When the moulding is too thick for the sinkage then it must be backed off until the distance from the lips to the bottom is slightly less than the depth from the face of the frame to the fillet or panel. Machine-made mouldings often vary in their outline and thickness, and the operator will find that when the pieces are driven into their places one piece may rise over its fellow and require trimming off to make the joint exact and the profiles of the members continuous. As just stated, when the character of the work is high, as in cabinet work or the construction of hardwood finish for or in buildings, it is best to take precautions to prevent the occurrence of faults which will necessitate remedies likely to mar the finished appearance of the workmanship.

Concerning the subject of mitring on all other angles besides that of 45°, it is to be said that for this purpose the mitre box is also requisite, the method of kerfing for the octagon cut being similar excepting that the direction of the cut across the box is only 22½° instead of 45°. All octagons on different designs are of different sizes, and a fixed method should be followed for this and all other sided figures to determine the direction of the line which will exactly bisect the angle formed by the junction of the sides, or, technically speaking, the mitre. In Fig. 19 the methods of finding this line will be seen, embracing the pentagon or five-sided

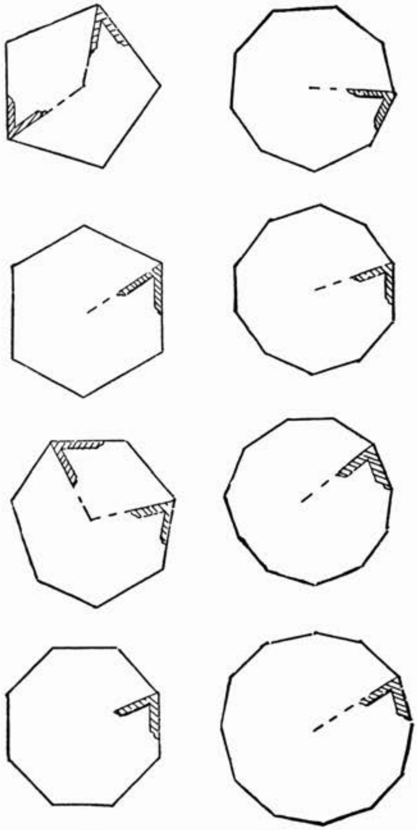


FIG 19.—POLYGONAL FIGURES.

figure, the hexagon or six-sided, the heptagon or seven-sided, the octagon or eight-sided, the enneagon or nine-sided, the decagon or ten-sided, the undecagon or eleven-sided and the dodecagon or twelve-sided. Therefore, all that is required to find the angles by which the box must be marked for the mitre is to set a bevel to the lines laid down as here shown and to the size desired and to line across the box for the kerfs.

Fig. 20 shows a moulding mitred together on the outside and inside cuts of an octagon, also the mitre of a straight piece with a piece on the octagonal cut of $22\frac{1}{2}°$, which often occurs in practical joinery and demands care in making. In connection with this it might be mentioned that a very simple method to find the bisection or mitre of any angle is shown at Fig. 20*a*, which consists of taking any two points equi-distant from the apex of the angle, as A and B, and with a pair of compasses, set to any radius, to strike two intersecting arcs. By joining the points of intersection with the apex by a line, this line will be the exact mitre. This method can be applied here with perfect

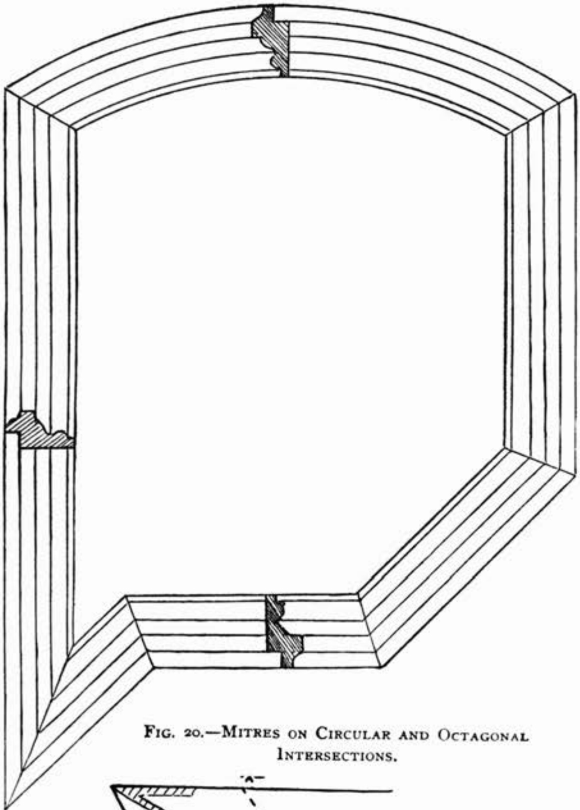


FIG. 20.—MITRES ON CIRCULAR AND OCTAGONAL INTERSECTIONS.

FIG 20*a*.—TO FIND ANY MITRE.

success. At the opposite end of Fig. 20 is illustrated the mitring of a straight piece of moulding with a curved or circular piece. As the moulding embraces a part or arc of a circle, it follows that, being cut by the circle inside the circumference, the mitre will be a straight cut.

The feature noticed is amply illustrated in Fig. 21, which is the junction of a circular and straight moulding, the straight piece being tangent to the circular and each having similar members they mitre perfectly and show good workmanship. This sketch also shows the joint of a circular moulding with a straight one when the sweep is a semi-circle, and the sections, as drawn, will give the reader a clearer explanation of the manner in which the various members lapse into each other in passing. The writer considers this subject of circles in mitre of so much importance in the construction of decorative joinery that he would strongly recommend all those interested to closely examine and study all existing examples of work already executed. It is capable of

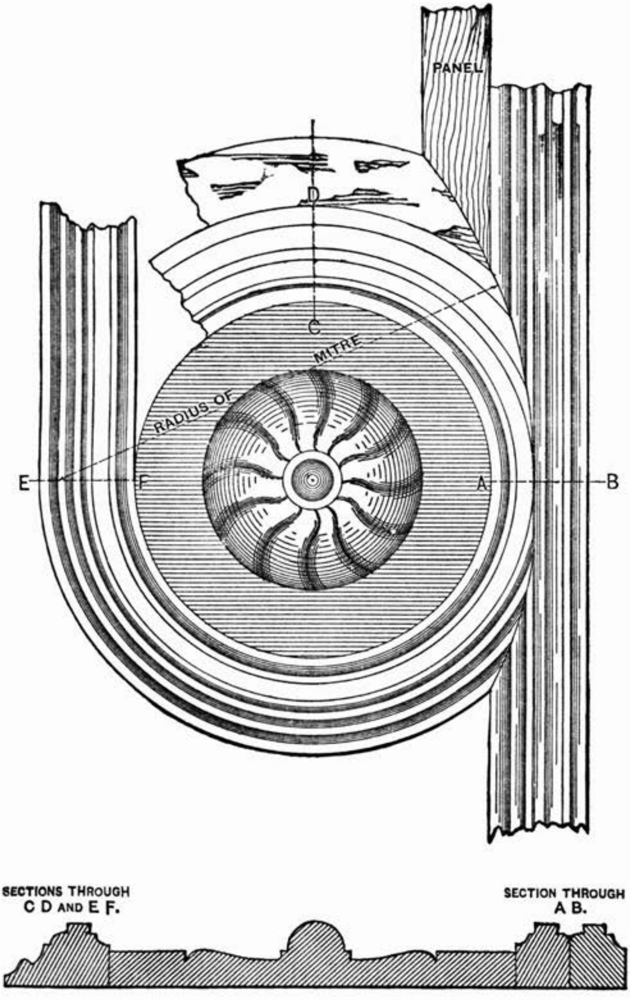


FIG. 21.—CIRCULAR AND STRAIGHT MOULDINGS.

much variation, involving very careful study in working out in practice.

Fig. 21*a* is the mitre formed by tangent circles, which is also a curve. In connection with this subject it must always be remembered that all curved mouldings should be turned to a like profile to intersect properly. This I show at the section on the line of the mitre.

The drawing, Fig. 22, gives the reader

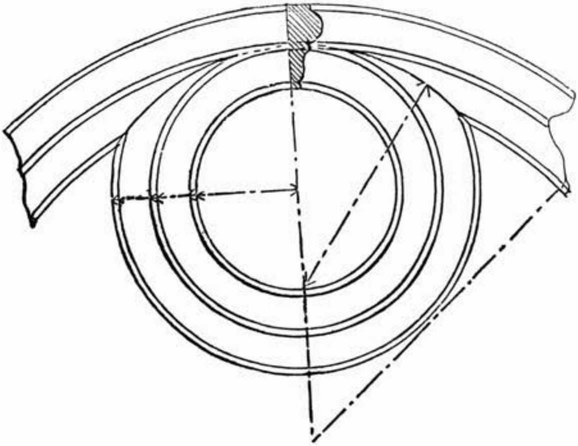


FIG. 21*a*.—MITRE FORMED BY CONCENTRIC MOULDINGS.

a description of how two circular contiguous mouldings of the same radius and profiles must necessarily form a mitre whose direction will be a straight line, but if two circles intersect which are contiguous and radii of different lengths, then the mitre joint will be a curve.

By referring to the geometrical design for a ceiling, Fig. 23, the student will see

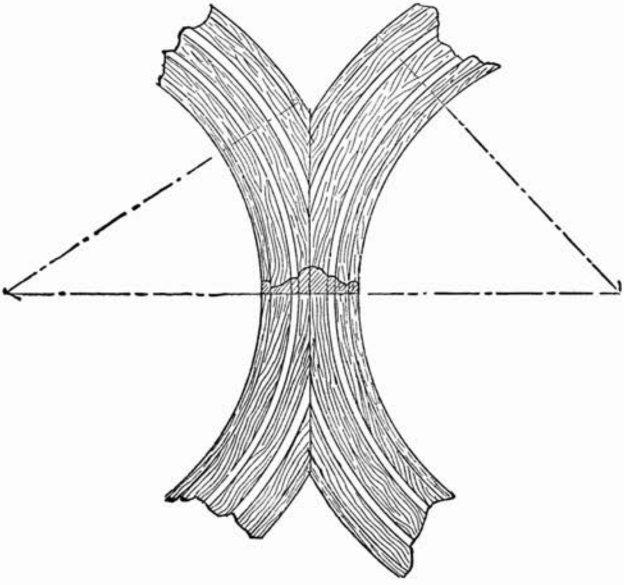


FIG. 22.—MITRE OF TWO ECCENTRIC MOULDINGS.

another and more advanced feature, namely, in the mitring of a straight moulding into one whose peripheral is a circle, the direction of the straight one being through the diameter, which makes a straight joint when mitring, also another

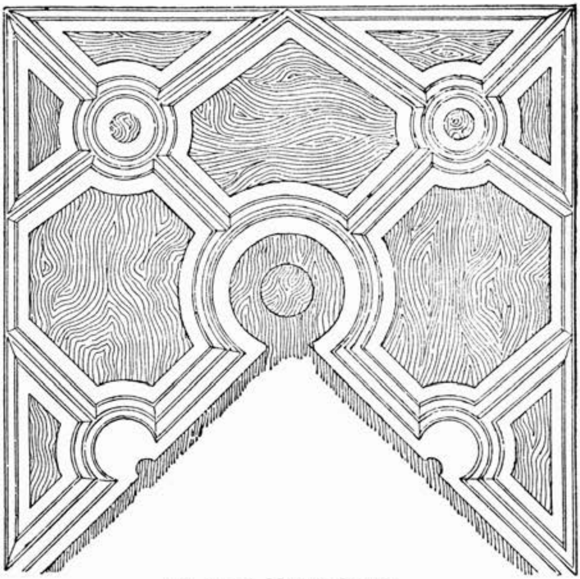


FIG. 23.—A MITRED CEILING.

circle cut toward the centre by another which does not pass to it at right angles but on an acute angle.

CHAPTER V.

MITRING CROWN OR SPRUNG MOULDINGS. BASE AND WALL MOULDINGS, OR DOOR-TRIM.

CONCERNING the subject of mitring crown mouldings I would state that there is only one way to mitre a sprung moulding properly, whether it be a crown mould or any kind, and that is to place it in the mitre box against the further side with the side that is to stand perpendicular as on the side of the wall. The two most common kinds of mitre cuts usually made on crown moulds are those on the inside and outside mitres, as A and B, Fig. 24, where the mitred pieces are shown as they will appear from above. When a piece has to be cut on an outside mitre, as on the corner of a building, it is mitred from the corner, or as B, Fig. 24; that is, the direction of the cut will be outside the right angle made by the building; but if it be an inside mitre the mitre joint will be contained within the angle of the building and it will bisect it. It is to be said, how-

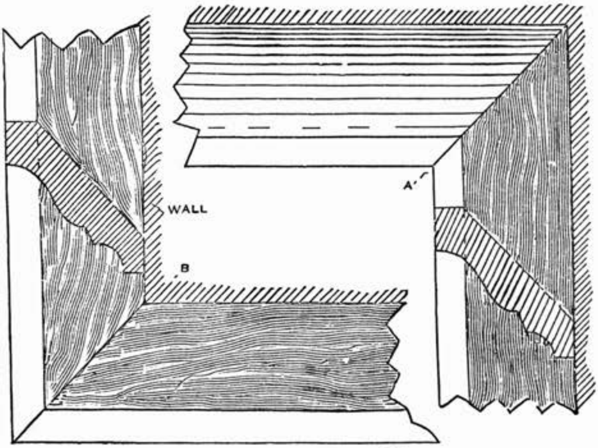


FIG. 24.—A CROWN MOULD MITRED.

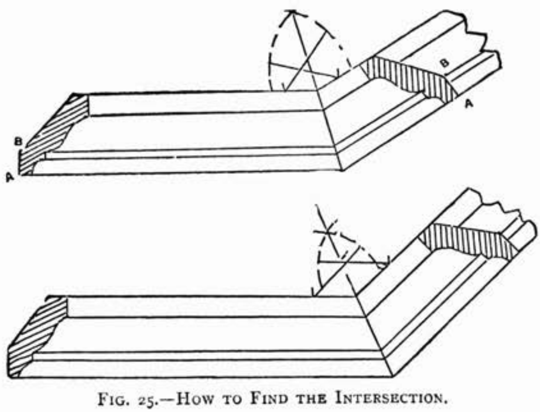


FIG. 25.—HOW TO FIND THE INTERSECTION.

ever, that inside angles, like A, are usually coped, and the method of doing this will be explained hereafter. Fig. 25 illustrates the manner of mitring a level moulding with one on the pitch on the same surface. Some carpenters maintain that the same conditions prevail here as in the case of a moulding on a pediment mitring and with one on a level, namely, that they won't intersect. This is an error, as the sketch clearly proves, because each moulding has the same profile, and the only thing essential to insure a perfect intersection is to determine the exact line of the mitre. It can be done as shown by taking any two points and striking arcs cutting each other, and the point of section being joined with the apex of the angle will give the direction of the mitre joint. As it often happens that there may be only one gable or pediment on a building, or two of a different pitch, it would scarcely be necessary to make a box for the four or eight cuts, and a very rapid and simple way which I have found to work well is to lay out the direction of the cut on the plumb side which nails against the wall or fascia and square across the bottom edge.

A carpenter with a well filed saw and steady hand can cut this joint clean and straight from the back. Another way which some prefer is to lay the running directions of the moulding out on a board and set each piece up on the laid out lines, then to place the moulding to the lines and square up with a try-square from the line of the mitre as laid out. This method saves more time than by making a box.

To prove that the angle does not regulate and alter the intersection I illustrate at Fig. 26 a large 5-inch crown moulding of ten members which will intersect and be continuous, each to each, provided the profiles run on each piece in the sticker and be entirely alike. I find from experience that by reason of the peculiarity of some stickers there is a variance of some mouldings, and it is therefore wise in the carpenter to measure each piece carefully to insure their intersection and save time in trimming them off to a like profile.

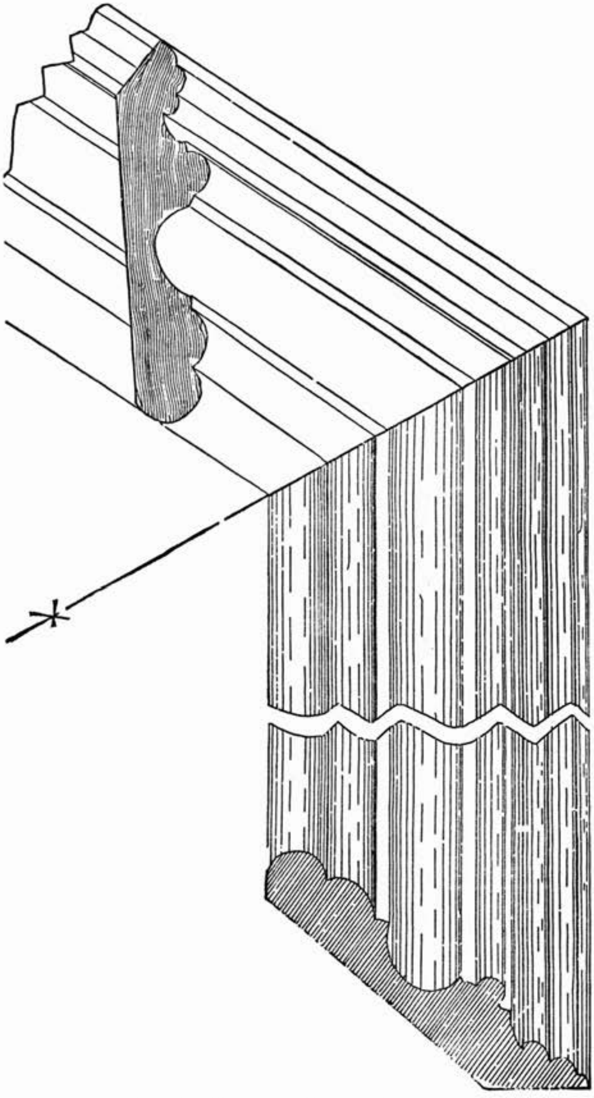


FIG. 26.—LEVEL AND PITCHED MOULDING.

This is rarely done neatly enough to make a clean job because it is necessary to trim as far back as 8 or 9 inches from the mitre to prevent each member appearing round.

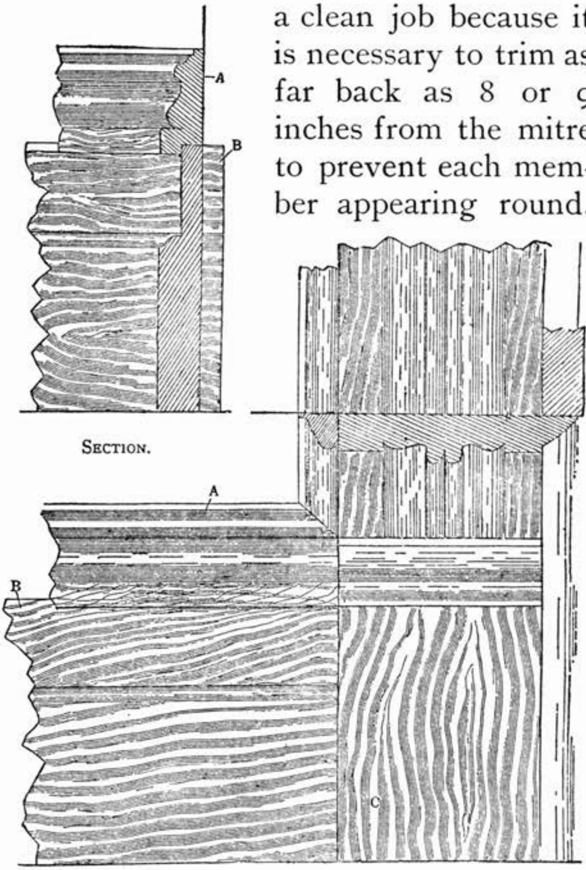


FIG. 27.—A BASE MOULDING AND CASING.

Regarding the mitring of sprung mouldings on a curve much the same conditions prevail as with those stuck flat, but should the reader desire to become thoroughly acquainted with this subject I would refer him to some of the very excellent works written by various authors treating on it. There is very little occasion for this class of work at present, and, even were it so, I should still refrain from taking and accrediting to myself those ideas which have been so clearly explained and illustrated before.

Fig. 27 will explain how the mitring on door trimming is usually done. A is the base moulding or top member of the base. As will be noticed it has three principal members, comprising the square or flat surface on the bottom, the main o-gee and the upper compound moulding. When the base mould, A, is fitted against the trim and base block, C, the two bottom members are cut square in the mitre box, and the top member is mitred to permit the wall moulding (which is really the top member, to run in separate lengths) to mitre. It is used for the purpose of covering the joint likely to open between the back side of the door casing and the wall plaster

CHAPTER VI.

MITRING CHAIR RAIL, PICTURE MOULDING. COLUMN BASES AND THE USE OF THE MITRE TEMPLET.

FIGURE 28 shows the reader an elevation and section of a piece of chair rail mitred

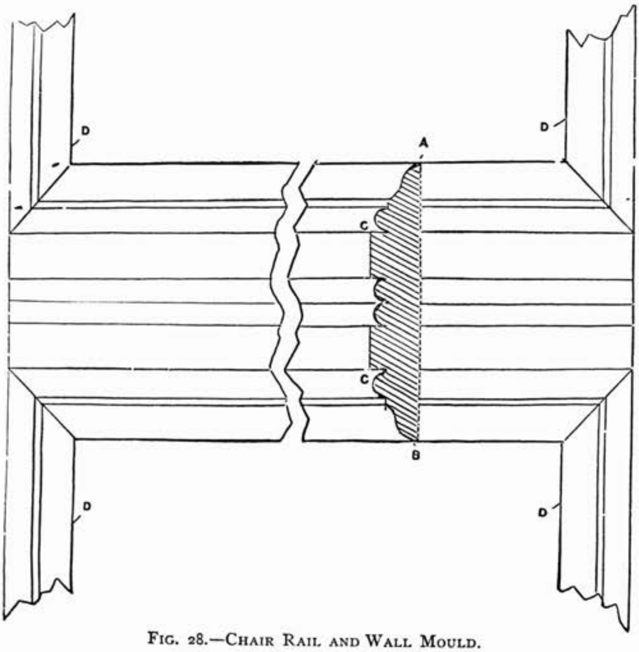


FIG. 28.—CHAIR RAIL AND WALL MOULD.

into the wall mould of a door or window trim. A B is the section of the mouldings, and it will be noticed that the two upper members, C A and C B, though they are stuck solid on and form part of the chair rail, are of the same profile and mitre with facility with the wall moulding, L. In many sections of the country this style of finish is not used, but in some of the East-

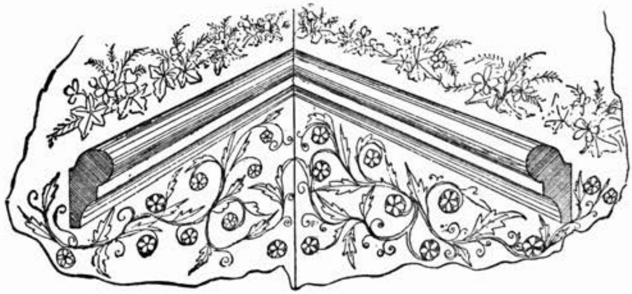


FIG. 29.—PICTURE MOULD.

ern States and in New York City it is the usual method, and has, I think, many good qualities which would recommend its adoption.

The picture mould shown in the drawing, Fig. 29, where it is represented as being nailed on a wall on which the wall paper has been pasted, conveys to the reader the way in which this moulding is placed beneath the frieze. This moulding usually is cut on square inside and outside angles. There is very little to be said explanatory of how it should be mitred, excepting that when gilt moulding is being mitred a very fine tooth saw should be employed in order to avoid breaking the plaster of Paris composition which covers the profiles of the members. Another thing is that the inside angle should never be coped but should invariably be mitred, for the reason that it is almost impossible to cope it with the pen-knife without injuring the gilding.

Fig. 30 represents the mitring of a base moulding round a column whose plan or section is a hexagon. It will be noticed that the base is composed of nothing more than a large moulding stuck in the machine to the design shown in the sketch. Readers will understand for the accurate mitring of such a moulding as this it would be best to construct a special mitre-box, and, after setting a bevel to the angle desired, so mark the box from it and

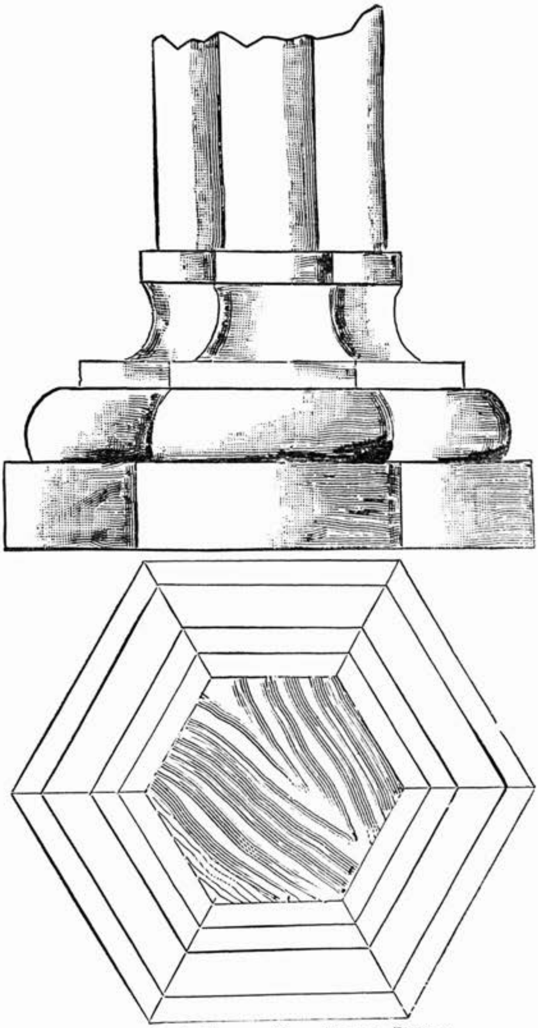


FIG. 30.—A COLUMN BASE MITRED ROUND.

thus insure the accuracy of the length of each piece. Nail or glue on each side of the hexagonal piece. I would here like to impress one thing on all readers, and that is the necessity of making sure that wide mouldings are straight or even a little hollow on the back side. This is necessary when the pieces are affixed to surfaces, and

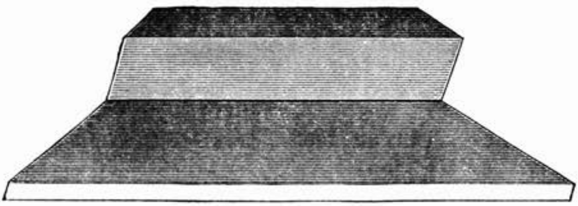


FIG. 31.—A MITRE TEMPLET.

a good plan to follow is to place the edge of a blade of a try-square across the back, and, if it be rounding, to plane it to a slightly hollow surface with a smoothing plane.

Fig. 31 represents what is commonly called by carpenters a mitre templet, and it is used for the purpose of marking all small mouldings, as beads, quarter-round, etc.

Fig. 32 shows its application to a quarter-round. The introduction of mitre squares, bevel squares and other modern tools have rendered the use of this instrument more

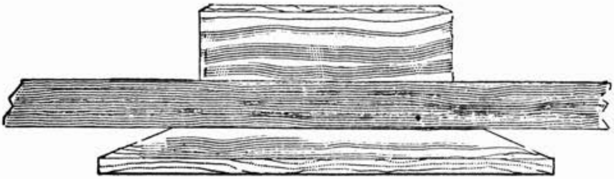


FIG. 32.

or less obsolete, but the older mechanics regard it as essential in their tool chest and use it largely in putting together beaded framing or other work where small mouldings are to be mitred.

CHAPTER VII.

VARYING MITRES IN BOTH STRAIGHT AND CIRCULAR MOULDINGS.

IN THE ordinary routine of work pertaining to each of the different wood-working crafts, there are certain forms of joints, cuts or important details of construction and decoration which are well known and occur almost daily, and other forms of the same which are varying. As those which are most in use are more easily worked and familiar to the operator, so it must of necessity follow that unusual forms will call forth more labor of brain and manual skill to effect their successful completion. This is particularly applicable in the case of the mitre joint, which every wood-worker is in daily contact with. It is being continually employed in different parts of joinery, in all places where a continuous grain or moulding is required, but the most difficult of all its employments to execute is the mitring of mouldings, both flushed and raised, in framing. Here the intersection of the profile, especially those with many members, necessitates great care in marking the mitre box and sawing it, marking and sawing the moulding, and insuring its perfect intersection before driving the pieces to their permanent place in the panel. Concerning a simple square mitre of the angle of 45°, as it is too well known to require special comment here, we will avoid its consideration, except to recommend readers to take careful heed of three important points, essential to perfect mitring:

First—To mark the mitre box by a bevel set to the diagonal of a square about four inches wide, laid down with a knife on a clean board.

Second.—To mark the box also with the knife and saw, carefully, keeping the saw kerf to one side of the knife mark.

Third.—Saw moulding exactly to the mark made on the panel, and out of one continuous piece for each panel, round the sides, and intersect perfectly before driving down.

Care and exactness will help to perfection and save trimming off afterward.

Fig. 33 represents a piece of ash paneling designed to stand under a stair string.

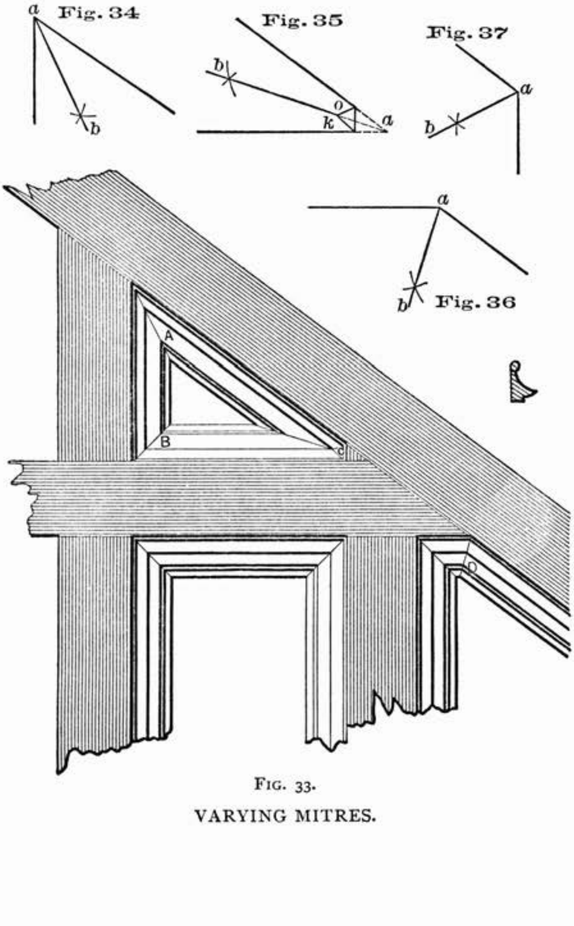


FIG. 33.

VARYING MITRES.

To find the mitre at A, strike out the angle inside the framing at A, like Fig. 34. Take any two points equi-distant from A, the apex of the angle. With the compasses strike the crossed lines shown and draw a line joining their crossing with the apex of the angle. This line will be the exact mitre, and if a level be set to it and marked on a good box, the cut can be got direct from the saw. Fig. 35 shows the compound mitre at C. It is rendered compound by the insertion of a small piece necessary to continue up the mullion below the rail show, and the mitres are found thus: The angle at the corner of the rail and raked piece, being even less than at A, B, will be longer, and this line is gained by the method used above. B being a right angle, the mitre for it is cut in an ordinary 45° box, but C must be cut differently, as its length renders it unhandy for a box. It is recommended that the moulding be marked on the bottom side and the mitre cut square to the bottom to insure a close joint above. This method will always be found suitable for very long cuts. The fifth mitre, shown in Fig. 33 at D, is obtained by the same process as before, and, being short, can be marked on Fig. 36 and cut in the mitre box. Experience has taught that the only way to obtain a perfect mitre is from the saw alone, as it is invariably the case, no matter how carefully the block plane is used, the joint can never be evenly surfaced or satisfaction gained.

Fig. 38 is a diagram of an opening for a panel in a partition or door, etc., showing two methods of ornamenting the angles. The cross sections of the mouldings X^4 are similar, but the shape of the opening would vary according to the arc used, whether internal or external. The circular mouldings B B C are similar, and are of the same section as the straight portions, but A is expanded to conform to the conditions laid down in the plan—*i.e.*, that all the intersections shall be at a true mitre (45°). B B joins the straight parts with a butt joint, C is the same section, and would intersect in the same manner as B if it were in that position; but, following the

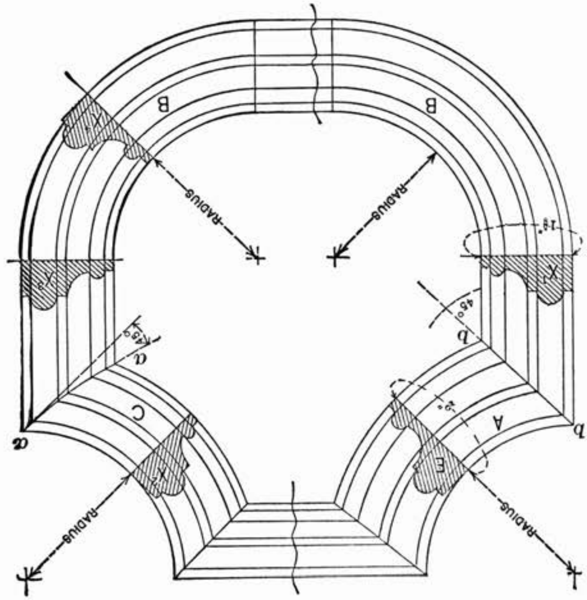


FIG. 38.—DOOR PANEL.

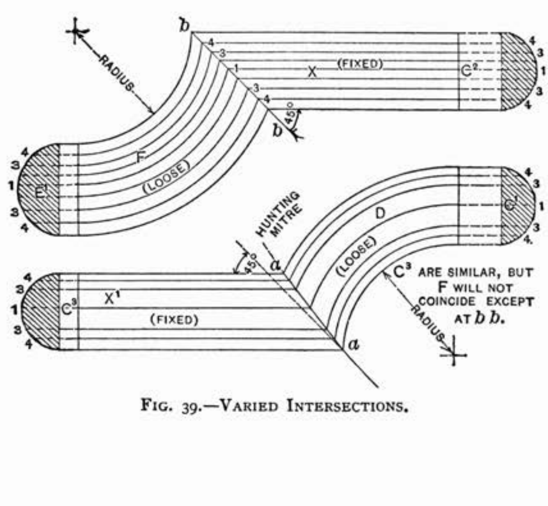


FIG. 39.—VARIED INTERSECTIONS.

plan, it will be seen that it intersects not a true mitre. But the joint is not a right line, and it is impossible to make the joint in the ordinary manner—*i.e.*, with the saw and plane (for woodwork). This joint is sometimes called a "hunting mitre," and it must be carved to its true shape. It will be noticed that it is formed of a pair of curves. This will perhaps be clearer from an inspection of Fig. 39, and to those interested in the subject (and it is a practical one) if they construct a model from that plan a curious result will be seen.

X, X′ are straight lengths of mouldings (any section—in this case semi-circular for simplicity); but the principle can be seen better if a good half-round moulding be selected.

D is a quadrant of a circle, section as X, X′, joined so that the marginal lines intersect. The form of the curved joint *a a* is found by a series of straight and curved auxiliary planes parallel to the axes of D and X′.

F is an arc similar to D internally which intersects X at *b b* at an angle of 45°. The result is that the point where the angular line cuts the horizontal line is the position where the arc must join the straight line, therefore F is expanded; its true section is shown at E′.

This explains why many workers cannot get a turned moulding and a straight one to intersect at a true mitre, when both are similar in cross section. When the model is made, alternate the positions of D and F with X and X′.

CHAPTER VIII.

A DESCRIPTION OF A COMBINATION OF MANY AND VARIOUS MITRE JOINTS ILLUSTRATED BY THE FRONTISPIECE—A GEOMETRICAL CEILING DESIGN.

THE ceiling decorated in this manner would be of the kind technically termed "planted," or the design of hardwood planted or nailed on a wooden ground or smooth ceiling surface, which would be covered with a prepared cloth capable of taking paint. The panels are, therefore, the paneled surface, and the outline of the design or woodwork.

We will suppose then that the whole area has the canvas or cloth tacked on and that it has been given a coat of size to render it capable of receiving the paint. It is desired to work out the design in wood; how shall it be done?

First, the design must be detailed; that is to say, the main features of the construction will require to be drawn to a large scale or the actual constructed size, so that each part may be distinctly comprehended by the wood-worker and carpenter.

A very simple detail will be necessary here, and merely a section will be needed.

All mitres are simply intersections, and the mitre joint proper is the line of direction which the several and separate members form in blending into each other, each to each, in maintaining their continuity. It will then be clearly seen that if the operator place the pieces, be they either one straight or one curved piece, two curved pieces crossing or intersecting either in a tangential or eccentrical direction, or two straight pieces placed at any angle, the direction of the mitre-line or "joint" will be easily found by laying down the lines which indicate the several members.

Thus it will be readily comprehended that the main lines which form the whole geometrical part of the ceiling are the lines which indicate the members of the mouldings, and all that it will be necessary to do to determine the line of direction of the mitre joint will be to place each moulding where it belongs and mark the intersections. There are fifteen different mitres illustrated in this design, and I think I would be justified in saying that if any practical readers will go to the trouble of making a scale model, they will receive a practical lesson in the art of mitring which will give them the power to obtain any possible mitre on flat surfaces.

CHAPTER IX.

THE ART OF COPING MOULDINGS.

ONE of the means employed by cabinet-makers and carpenters in making joints in r'entrant angles is the art of coping.

The verb "to cope" is used in contradistinction to "to mitre," a method entirely used for joining pieces of joinery of a continuous grain on exterior angles. Webster gives the word as, to cover; to match against; a covering. So it is admirably adapted, and very appropriate, as when an operator copes, he really covers and matches against.

Coping is principally used for mouldings, square and flat surfaces being fitted together, one piece abutting against the other; but curved or moulded surfaces can only be coped to a successful inside joint.

Mitring interior angles is very faulty, and is rarely done by mechanics of ability, on account of the liability of one or the other joint slipping past its fellow, breaking the intersection, and showing end wood, added to the difference of the profiles of mill-run mouldings. Against plaster the inside mitre is useless, as one piece is almost certain to draw and open the joint when nailing into the studding. The best way, then, to make this joint is to cope it.

Fig. 40 represents a very simple cope, being a common shelf cleat, coped at right angles against another. As will be seen, it is the end cut to the profile of the moulding, or bevel, of the cleat, so that it will fit tight against it and look as if mitred.

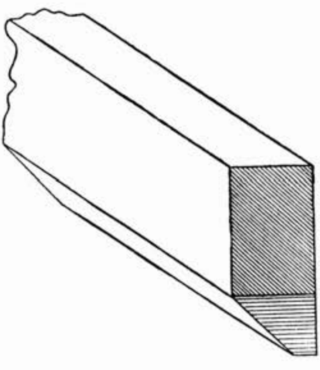


FIG. 40.—A COPED CLEAT.

In order to gain this joint, the piece is first placed in a mitre box and cut on the mitre on the side to which the joint fits; in this case, the right hand. The dotted line denotes the line of the cut. When this is done, the piece is cut through at an angle, slightly under, so that the joint may touch in every point on the face. When placed in position, if the piece be cut slightly long, the joint will come perfectly close and fit well; but the piece coped to must always be nailed well back and solid before marking the piece to be coped, as it

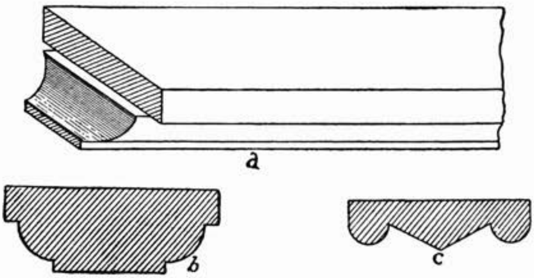


FIG. 42.—MOULDED STRIP COPED.

is certain to yield to the concussion of the hammer. This is a vertical, or plumb, cope.

A horizontal cope is drawn at Fig. 42 and shows a ceiling strip or piece of astragal coped to an ovolo, or rule-jointed edge; *a* is the coped end, done by placing the entire moulding on its back in the mitre-box and mitring each moulding on each side square across the piece, and afterward sawing or chiseling the end out to the profiles made by the saw in mitring, until it appears as in the sketch *a*, and will fit closely against the section at *b*. This cope ought to be slightly hollow, so as to press against the surface of the moulding on the arms of the cope.

The moulding shown at Fig. 42, *c*, cannot be coped, as some of its members are incapable of being so, or sink below others. This will be seen at a glance and the moulding mitred.

It is only in mouldings of this kind where the art cannot be profitably applied; but interior mitres (if they must be used) should be nailed and glued together before setting in position.

When it is found necessary to cope an architrave moulding, like Fig. 43 (a series of compound curves and squares), the mitre box is again brought into requisition and the end brought to the mitred line, always beveling it slightly under, to bring the cope close on the line of A B.

A sharp penknife is essential for good coping, to cut away the wood on the curves exactly to the mitred line, something which can scarcely be done correctly with the compass saw, gouge or chisel, as in soft wood the arris is very liable to break under the pressure of the hand, even

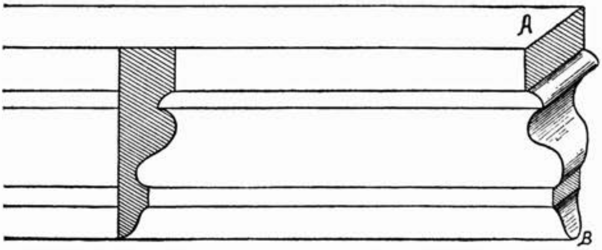


FIG. 43.—A COPED ARCHITRAVE.

though the edge be keen, whereas the small blade of a good pocket-knife, if reasonably sharp, can be very handily swept around the quick curves, and will also cut obliquely against the grain without injuring the edge of the end wood, the grain of which is often short and fragile.

A difficult cope is drawn at Fig. 44, being a section of rebated wainscot capping, with its wall moulding and another piece coped to it in a r'entrant corner, at right angles, left hand. The capping is mitred in the left hand cut in the box, and then sawn out close to the mitred line with a compass saw, and afterward being neatly

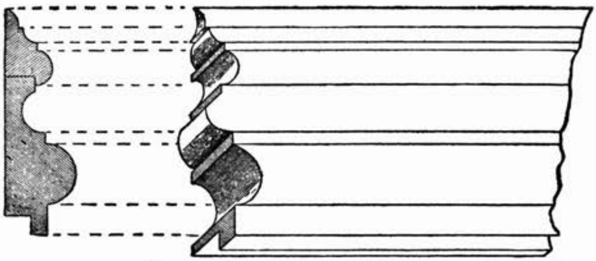


FIG. 44.—COPED WAINSCOT CAPPING.

pared exactly to the line, in order that the joint may show one line. The wall moulding is similarly treated ; but for all mouldings when coping, pieces of the same thickness and profile ought to be selected.

Obtuse angles might also be coped, taking care that the end is beveled well enough to clear the piece running behind it, otherwise the joint will be *hard* on the back and open; acute angles will cope easily.

Coping obtuse angles gives a splendid chance to bring the joint close by nailing through the cope into the piece behind, something which can never be done with an inside mitre.

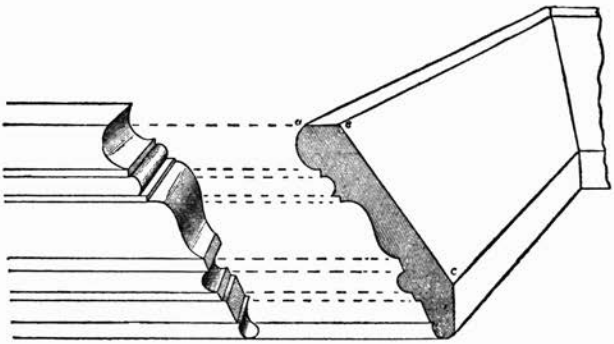


FIG. 45.—A CROWN MOULD COPED.

The crown mould is also fitted by this method when it is returned on inside corners, as on wardrobes, cases, an angle in a house cornice, etc., mitring as before, by placing the length of mould in the box upside down, the part that stands plumb, as *e c* in Fig. 45, against the side of the box, the level part, or cope *d e*, resting flat on the bottom. When cut to an inside mitre, the end is *coped*, or cut out, to cover over the profile *d b*, the coping being all level, or parallel, to *d e*, in the manner represented in the perspective sketch.

Coping on the angle, as on a gable with an eave moulding, can also be done, but the pieces must be wrought so that they will intersect, and continue true—member with member.

In conclusion, it may be said that the system is universal in its use in modern joinery for chair rail, picture mould, crown mould, base necking, wall members, etc., and is very popular among wood-workers, as they cannot, like plasterers, mitre their pieces and then close the joint with putty. It is a rapid, certain and accurate system, and when properly done, especially in the hard woods, produces a good mechanical job.