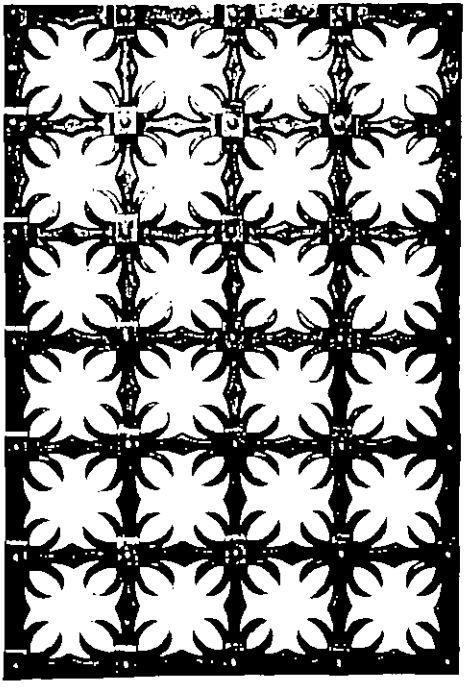


Design 4

A design similar in general character to No. 3, constructed in precisely the same manner: but differing from it in the way the decorative features are disposed.

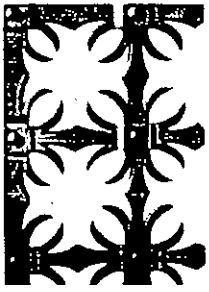
In this case the spurs chiselled from the bars are not lengthened by forging, but are pulled away from the parent metal in gentle curves. The direction of the cuts have been reversed. They are started at a point midway between intersections and thus the curved spurs cluster around the intersection points when the grille is assembled, forming narrow petalled flowerlike motifs.

Since the main principles of construction are the same, it will be appreciated that the special tools used for the preceding grille (No. 3) will, to a great extent, be used in the present case.

Forging time is saved by the acceptance of the shape of spur left by the chisel cut, with little or no further dressing.

When designing work making use of this technique, it must be remembered that the shape of the remaining section of the parent metal is dependent on the original shapes of the portions cut from it. Thus the finished work will largely depend on a just balance between these two elements for its visual effect.

It is unnecessary either to describe or to illustrate the initial stage of construction, the offsetting process, as it is identical with that used in the case of Design No. 3, and it is similar in size, measuring 2′ $4\frac{1}{2}$″ × 1′ $7\frac{1}{2}$″.



DESIGN 4

Fig 67 The work is marked out for cutting (see drawing, Fig 73, page 47). The essential points determining the chisel positions are centre punched.

Left and right-handed chisels are not required as was the case in the previous example; one pattern of specially forged chisel with a curved cutting edge suffices. (See drawing, Fig 74, page 48.) The breadth of the soft iron or copper cutting plate should fit freely between the offset sections to support the bar when being cut, when the offsets are in a downward position, as well as to afford protection to the chisel edge.

Fig 68 Careful positioning of the chisel is particularly necessary so that the end of the cut which severs the edge of the bar just leaves the centre punch mark untouched. If this is not done, no accurate guide mark for making the corresponding cut on the same side of the bar is available. (For guidance on other points refer to design 3, Fig *52*.)

Fig 69 Using round-nosed pliers the spurs are curved away from the bar at a red heat, with the work between suitable anvil horns. Care must be taken when using the horns not to lever the bar laterally more than is necessary. Excessive leverage will distort the alignment of the centre portion of the bar.

The eye will soon become accustomed to judging the amount of curve required to achieve uniform setting, an advantage when the final shaping is done.

Fig 70 To give the spurs the correct smooth curve the multi-purpose stake held in the vice is used in a manner somewhat similar to that employed in fashioning the quatrefoil sections of design No. 3. This time, however, the fuller ended special hammer is not used to lengthen the spur but is lightly applied to induce the metal to assume the form required: Care is taken to avoid mutilating the natural bevel of the chisel cut. In this design the bevel is not forged away but is retained to add its quota to the overall decorative effect.

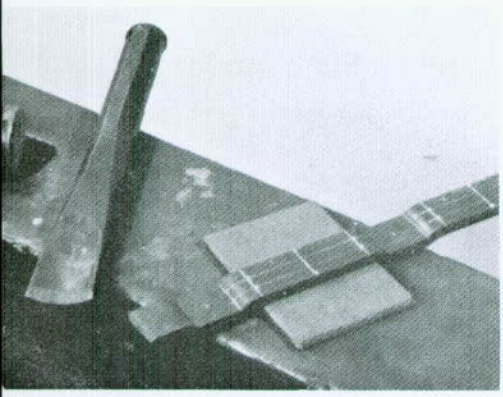


Fig. 67

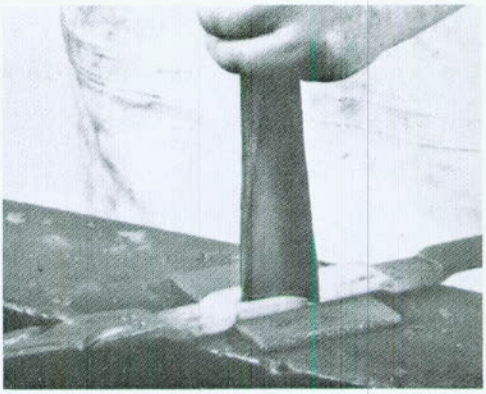


Fig. 68

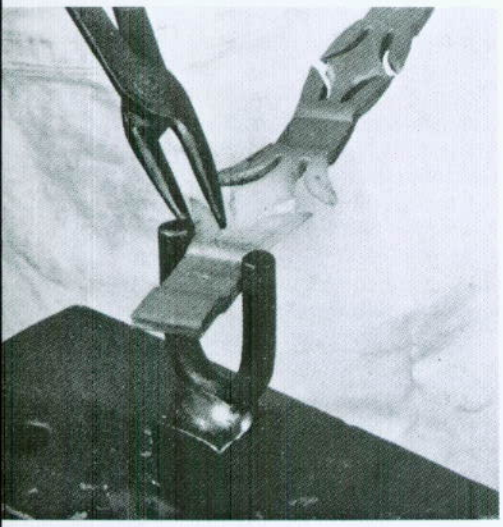


Fig. 69

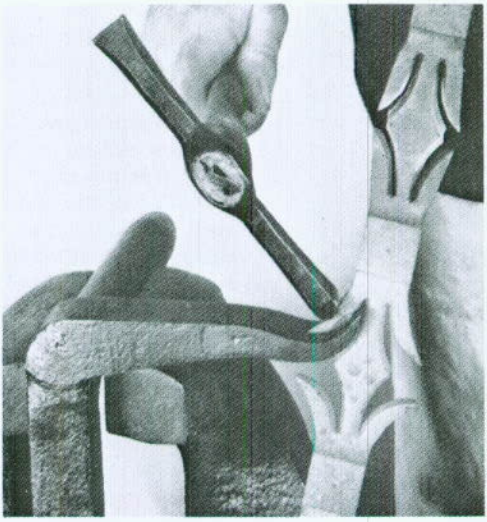
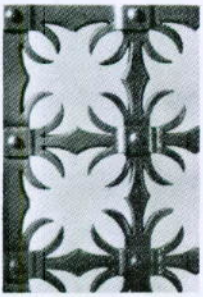


Fig. 70



DESIGN 4

Fig 71 Using the anvil section of the multiple tool the work is lightly hammered into a true plane.

It is necessary to check the work from time to time against a chalk tracing of the full size drawing on steel plate, in order to ensure that uniformity in setting has been achieved.

In view of the relative simplicity of the operations a special former is superfluous.

Fig 72 The assembling of this grille takes a similar course to the previous example, except that little or no time is absorbed in adjusting the spurs forming the decorative features.

It will be appreciated that the methods used for this and the previous example are flexible within certain limits and lend themselves to the creation of a range of designs. For instance, in the present case the spurs could have been shaped to bring the tips rather closer together, so forming flower forms of a different character. Furthermore, it is obviously possible to alternate flower forms of the two patterns, or even to embody both the quatrefoil motif of the previous example and one of the flower forms in the same grille.

There is also limited scope for the use of chisel cuts of differing profiles, but care must be taken to ensure that sufficient strength is left in the body of the bar.

Changes should not be made merely for the sake of novelty, as this approach might easily destroy character and produce nondescript results.

It is always very risky to accept ideas that have been worked out on the drawing-board only; a small section of the modified design should be made so that the decision whether or not to proceed may be based on observation of the effect in the solid.

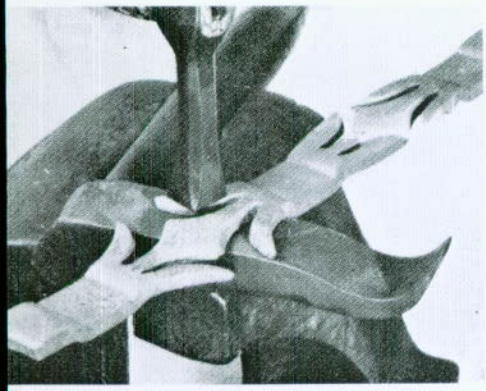


Fig. 71

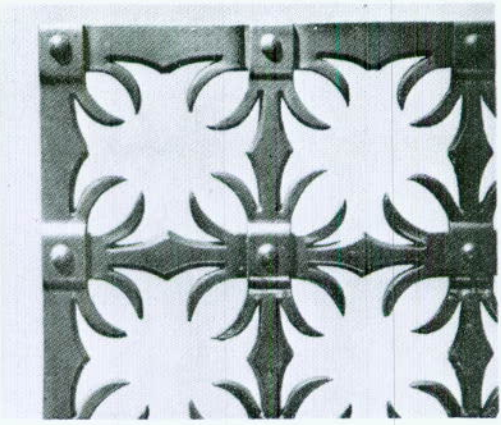


Fig. 72

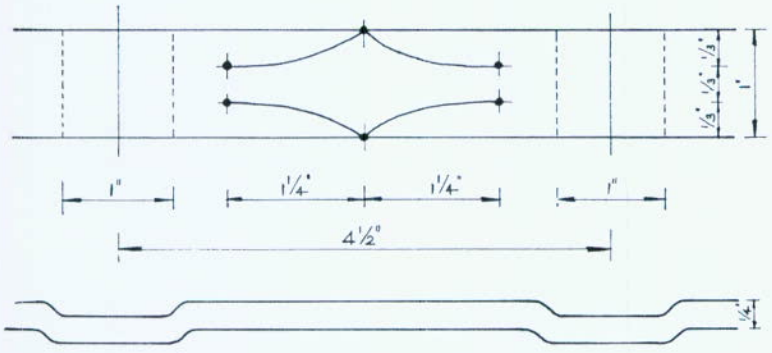


Fig. 73 Marking out diagram

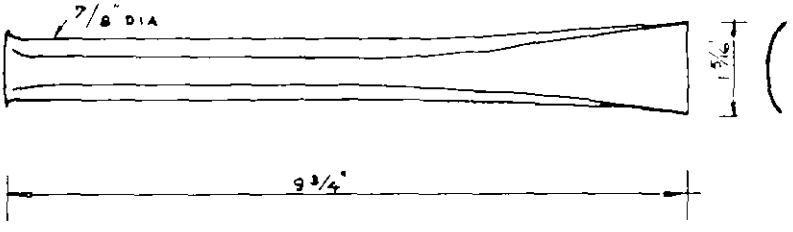
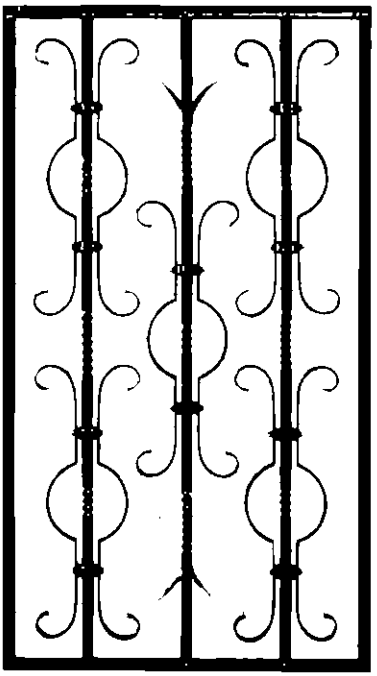


Fig. 74 Curved chisel



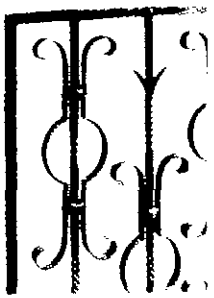
Design 5

In contrast to the other designs described in this book, the present example is, to a greater extent, built up from component parts applied to the bars, rather than fashioned from them.

The style of the decorative motifs also differs, since as the edge rather than the face of the metal is presented when the grille is viewed from the front. A delicate contrast is thus produced between curved forms and strong perpendiculars.

This design is particularly adaptable to settings of widely differing areas, a point which will become clear as the details of its construction are assimilated. It is not suggested that either the size of motifs, or the spaces between them, should be enlarged, which would produce an attenuated impression. A decrease or increase may be very desirable, but it is essential that a working drawing should first be made to ensure that the density of pattern is maintained and is appropriate to the setting.

The frame of the example illustrated is 3′ 4″ × 1′ 10½″, and is made from ¾″ × ½″ bar. The decorative motifs are of ¾″ × ⅜″ and the vertical bars of ½″ square material.



DESIGN 5

Fig 75 Work is started by taking a piece of $\frac{3}{4}$" × $\frac{3}{16}$" bar of ample length to make one section of a decorative motif and bending the first corner to 110° using a hand lever bending machine.

Fig 76 The slight radius left on the corner by the bending machine is now converted into a sharp corner by forging. To do this a short heat is taken, which must be a balanced heat, that is equal in each leg of the angle. To ensure this result a brick is positioned near the fire on which one end of the piece is rested at the correct angle.

Fig 77 The corner is defined by working alternately on each of the outside faces. During this operation the work is kept clear of the anvil to avoid thinning.

Fig 78 When the hammer is applied in the second position, one leg of the angle is rested on the anvil against the step, where no slipping can take place.

Fig 79 A second corner is bent at 110°, at a distance from the first corner, found by measuring round the curve on the full size working drawing. This distance, once determined, remains constant throughout the work. To ensure complete control when defining the second corner, tongs of the correct pattern must be used.

Fig 80 The length of metal between the two corners is now formed into the correct curve. No heat is used; the operation is carried out solely with the aid of anvil horns and scroll wrench.

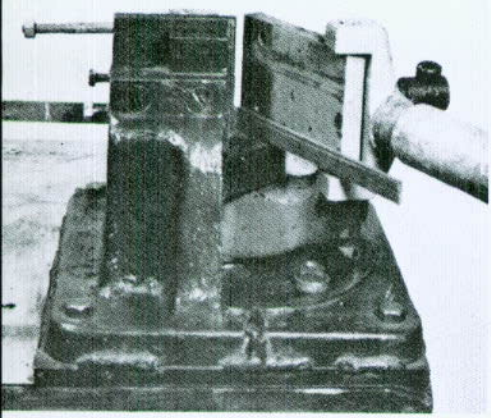


Fig. 75

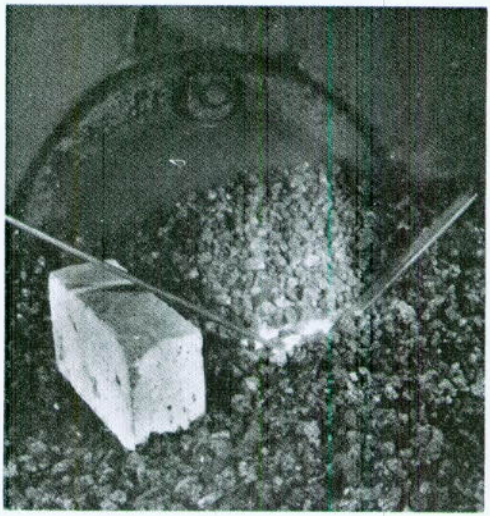


Fig. 76

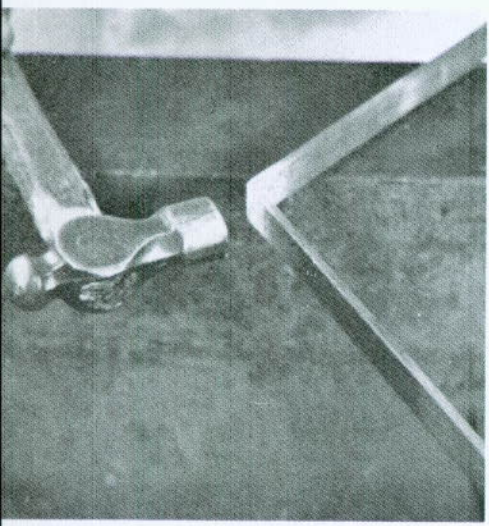


Fig. 77

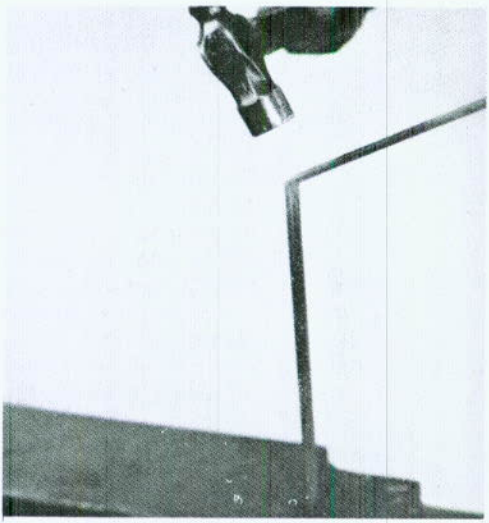


Fig. 78

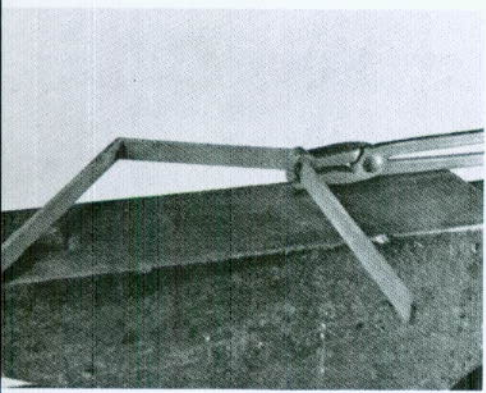


Fig. 79

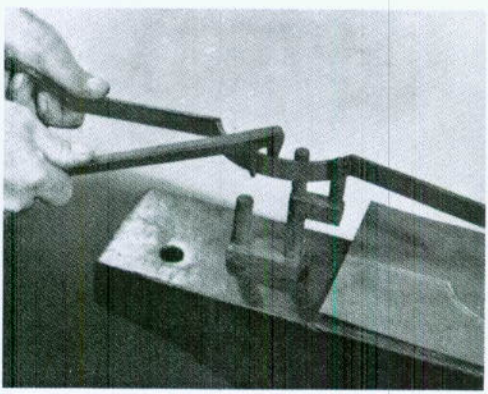


Fig. 80

DESIGN 5

Fig 81 The curve, and set of the angles are checked against the drawing to ensure that both legs of the piece are in one true line.

Fig 82 The length of metal required for each leg, from one corner to the tip of the curled end, is now obtained from the full size drawing.

When the ends of the motif are fish-tailed by drawing down, lengthening of the metal will take place. This must be taken into account and an allowance made when the legs are cut to length prior to forging. The required allowance must be determined by trial for any given size of motif. After forging, the fish-tail is both trimmed to length and squared off in one and the same operation. The tip is curled over the front edge of the anvil by means of a stroking action with the hand hammer, in readiness for engaging on to a former which is specially made for this job. (Drawing, *Fig 100, page 60.*)

The engaged portion is held in place on the jig by gripping it with a pair of round-nosed pliers. The tip of the work must accurately coincide with the end of the jig before the operation of pulling the work round it is attempted.

Fig 83 **The work is pulled into shape and if it has been correctly carried** out the corner will coincide with the end of the straight part of the *jig within close limits.*

All measurements and details are checked during the process of making this first section to ensure that subsequent repetition work may go smoothly.

Fig 84 The decorative motifs are carried on collars made from round bar. In the present example they are of $1\frac{1}{8}$" diameter. These may be made by cutting them from the bar with a power hacksaw and *drilling them individually. Alternatively a lathe may be used, when* the stock bar can be bored to a depth of several inches and the collars parted off.

A collar has been produced $1\frac{1}{8}$" in diameter and $\frac{3}{4}$" in thickness with a $\frac{7}{16}$" hole drilled centrally.

The collar is heated and a $\frac{7}{16}$" square drift is driven through the hole, over a bolster.

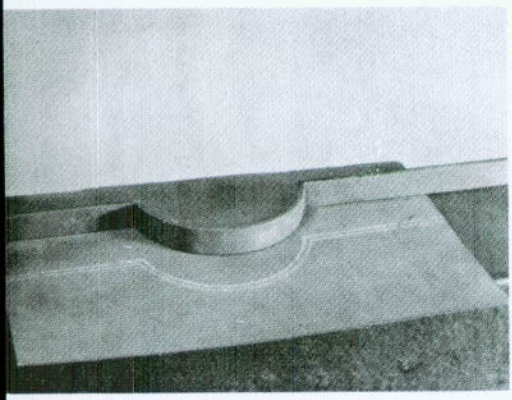


Fig. 81

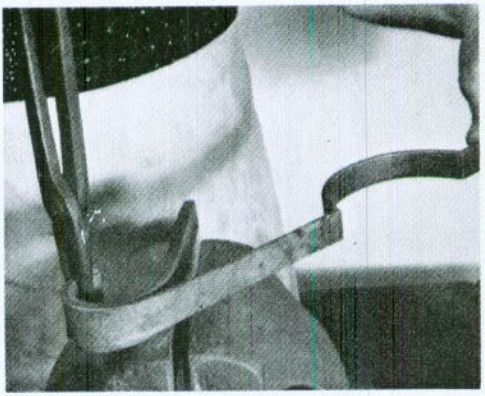


Fig. 82

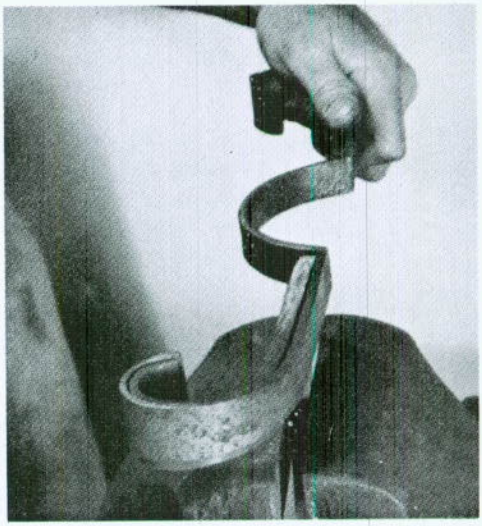


Fig. 83

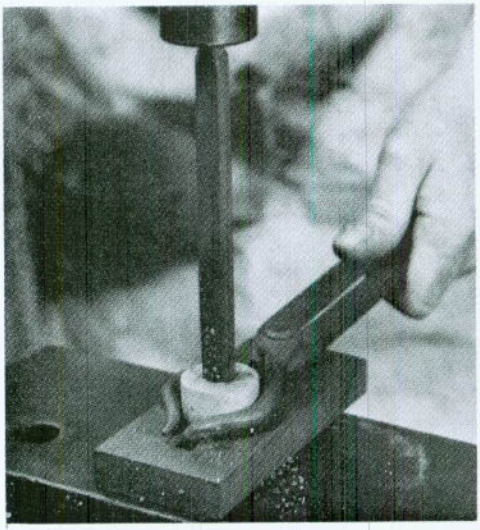


Fig. 84

DESIGN 5

Fig 85 With the $\frac{7}{16}$" square drift in the hole, two facets, wide enough to accommodate $\frac{3}{4}$" wide bar, are forged parallel to one another. The relationship between these facets and the axis of the drifted hole must be carefully observed from the illustration.

Fig 86 The drifted hole is inevitably distorted to some degree by the previous operation. This distortion is now rectified by forging the arcs of the collar employing a rolling action in a suitable bottom swage. Two purposes are served: the distortion is removed and the mechanical surface of the bar is given a hand-wrought texture.

Fig 87 The collar is now drifted with a $\frac{1}{2}$" square clearance drift to accept a $\frac{1}{2}$" square bar.

Fig 88 The faces of the collar are dressed in order to remove any irregularities left by the drifting and forging operations.

Fig 89 The vertical bars are now made. The centre bar is described here because it carries, in this case, two pairs of spurs not included in the other vertical bars. In a larger grille these features would occur on alternate verticals.

One end of a convenient handling length of $\frac{1}{2}$" square bar is forged to a round section $1\frac{1}{2}$" in length and $\frac{1}{2}$" in diameter.

This section of the centre stem is set aside and work is continued by the making of a pair of spurs to be fire welded eventually to its rounded-up end.

Fig 90 A convenient handling length of $\frac{5}{8}$" square bar is short square pointed leaving a small square flat area at the tip.

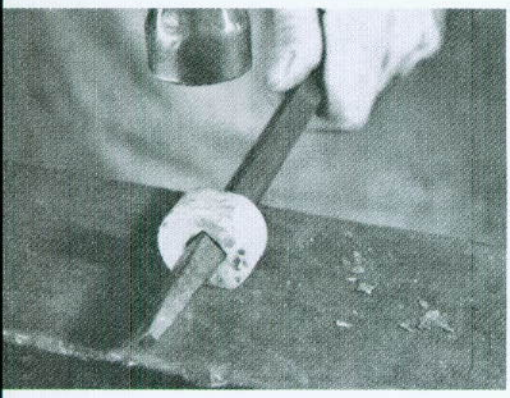


Fig. 85

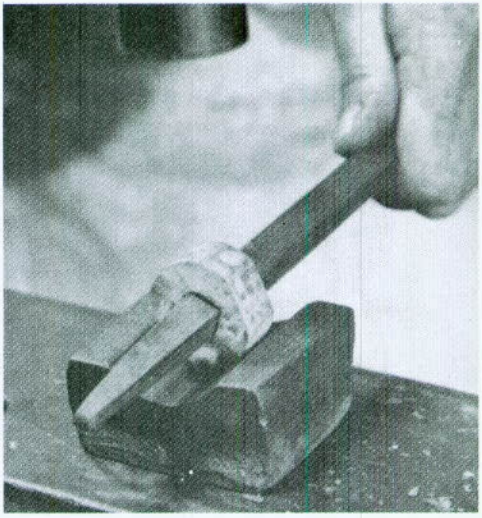


Fig. 86

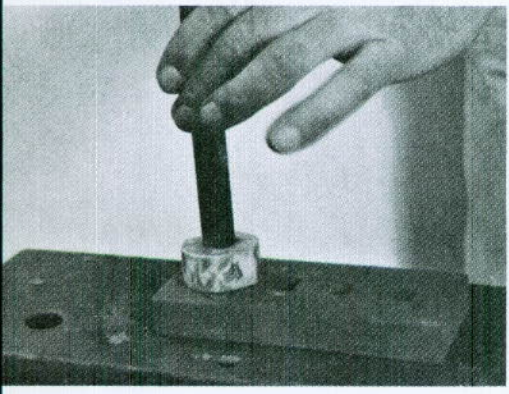


Fig. 87

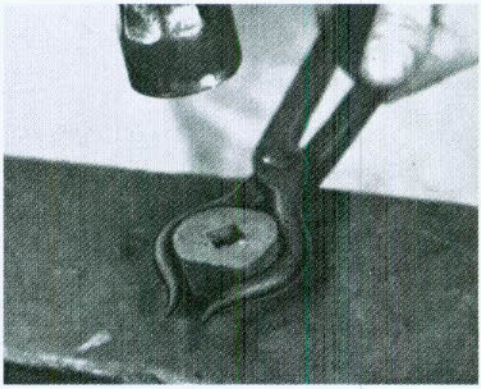


Fig. 88

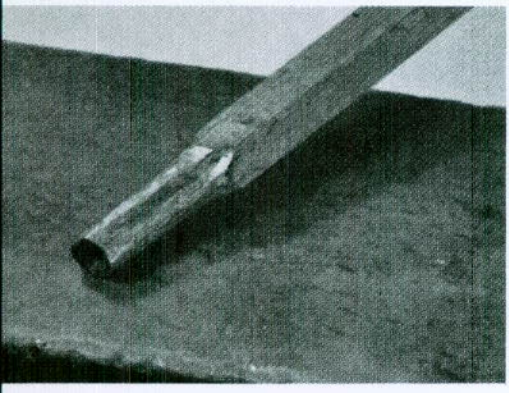


Fig. 89

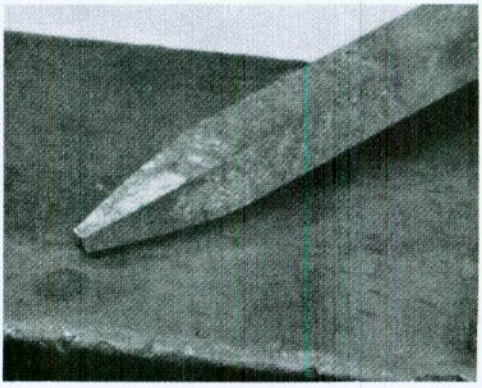
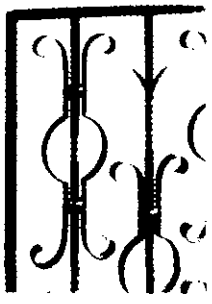


Fig. 90



DESIGN 5

Fig 91 The pointed bar is now split with the hot-set across one diagonal to produce two tapering spurs of triangular section. The small flat area referred to above renders the positioning of the hot-set easier and ensures an accurate cut. The cut must travel down coinciding with the opposite corners of the bar. This point must be particularly carefully watched at the start, and to maintain regularity a rocking action in the same axis as the diagonal must be employed.

Fig 92 Splitting is continued sufficiently far to provide an adequate length, not only for the spurs, but also for an additional $1\frac{1}{2}$" which will eventually be necessary for fire welding the spurs to the bar. When sufficient length has been split, the two spurs are cut off from the bar.

Fig 93 Before the spurs can be welded on to the prepared end of the $\frac{1}{2}$" square bar, their ends for a distance of approximately $1\frac{1}{2}$" must be hollowed on the inside to embrace the round section.

To accomplish this a combination of fuller and 'V' block is used, the former to produce the required hollow and the latter to properly support the angled underside of the spur during the forging. The innermost end of the hollow formed by the fuller must not end abruptly, but must gradually diminish in depth to blend finally into the main form.

Fig 94 The first spur is tack welded into position. The spur and the bar are raised to a welding heat. When the bar and spur are withdrawn from the fire the former is placed in a bottom swage and the spur is positioned on the bar, care being taken that its rib falls in a true line with one of the edges and not one of the faces of the bar. The spur is firmly tacked to the bar with a few correctly tempered blows delivered by the smith's mate, who uses a curved faced hammer. He uses this particular hammer to prevent a sharp nick being made in the rib of the spur when delivering his first blows, which should fall near to the branching point and not on the end of the work. The aim is both to effect a good welded junction without reducing the section on the end of the bar, which must be left full for subsequent scarfing and to preserve, as far as possible, the rib of the spur.

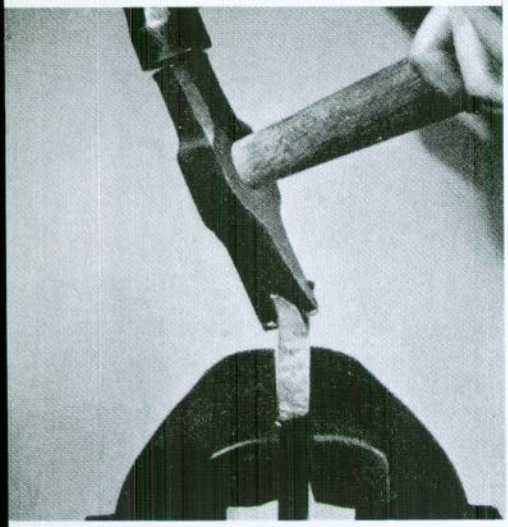


Fig. 91

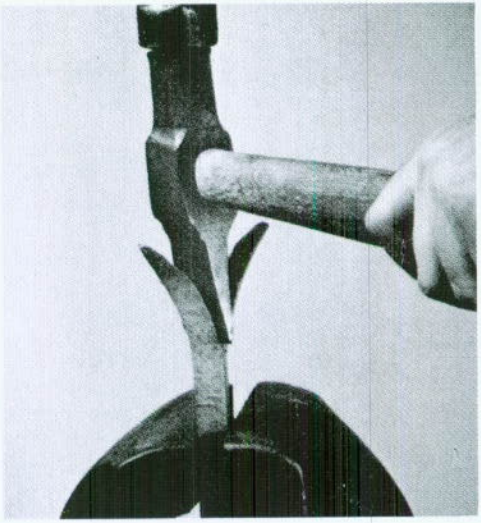
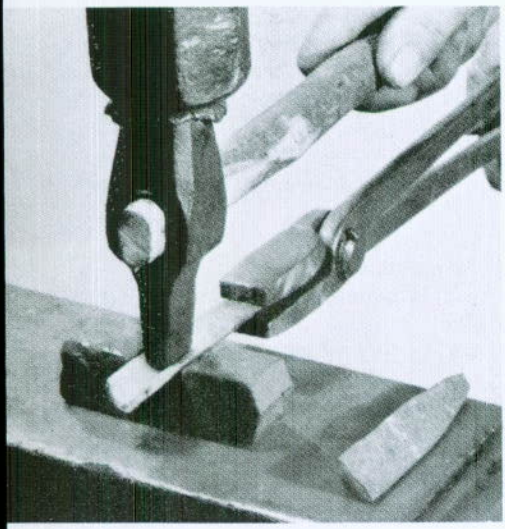


Fig. 92



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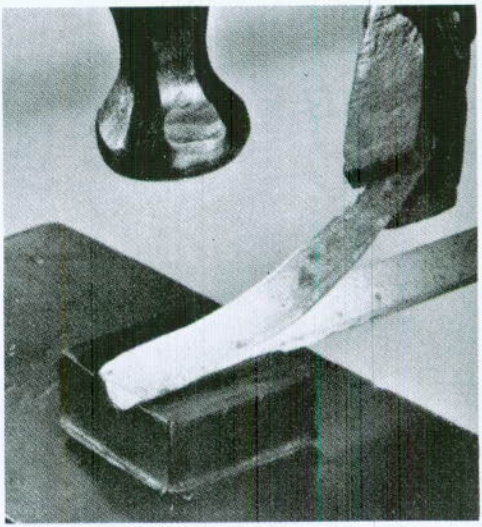

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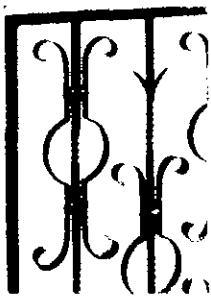


DESIGN 5

Fig 95 One of the spurs has now been tack welded on to the bar whilst the other remains to be attached. This second spur is now welded on in the manner already described.

In practice as little time as possible would be permitted to elapse between operations. A prompt return of the bar to the fire for the welding of the second spur conserves heat and reduces scaling.

Fig 96 A *full welding heat is taken and with a curved faced hammer the* tacked spurs are finally welded to the parent bar.

Full control must be maintained at this point in order to blend in the edges of the spurs left proud and unwelded after the tacking stage, and to restore the edges which were inevitably bruised at that stage.

Fig 97 The work is dressed with 'V' shaped swages to correct any remaining irregularities.

Fig 98 An adequate length—in the present case about 2 feet—of $\frac{1}{2}$" square bar is fire welded on. It is particularly important that this weld should be perfectly sound because twists have yet to be made in the bar and this weld occurs within one of the twisted sections.

The weld has been left at an incomplete stage in order to illustrate the method employed.

Fig 99 The spur bearing bar is completed in the following manner.

The first twisted section, a few inches adjacent to the spur, is formed. As this is a tight or close twist, the work is done at a red heat.

A collar, correctly orientated and drilled and tapped to accept $\frac{1}{4}$" Whitworth screws, is slipped on and the next twisted section is formed.

The second collar is slipped on in readiness for the following stage.

The second pair of spurs is forged and welded to a convenient length of bar by repeating the operation dealt with in Figs 89 to 97.

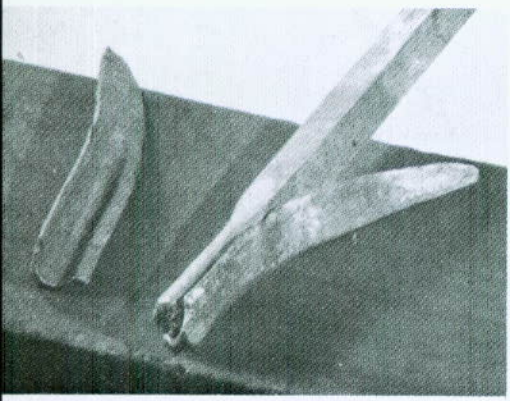


Fig. 95

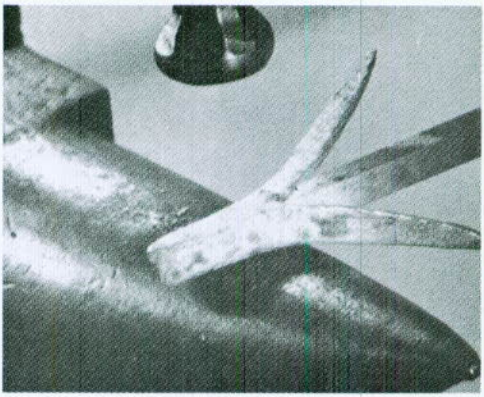


Fig. 96

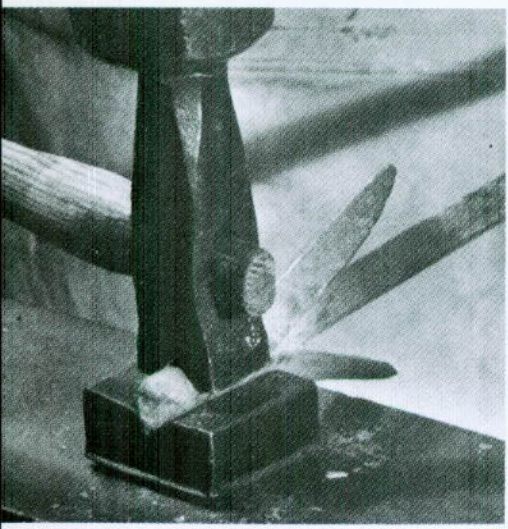


Fig. 97

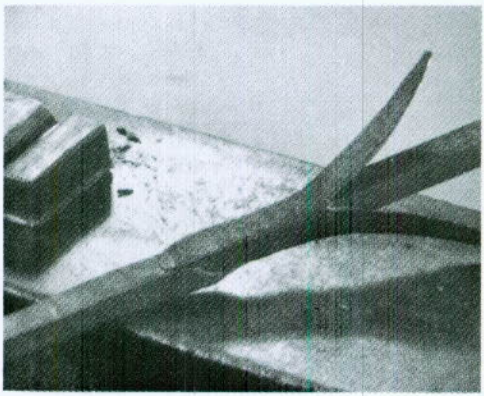


Fig. 98

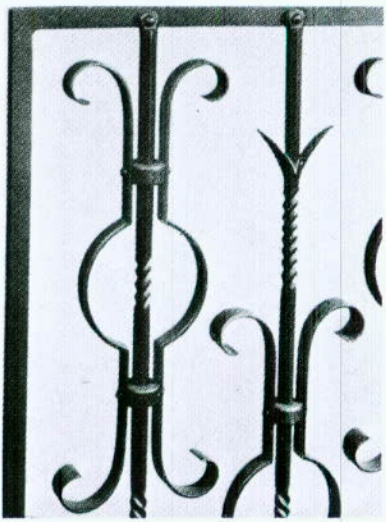
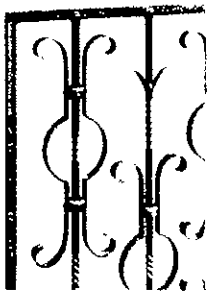


Fig. 99



DESIGN 5

This whole section is welded to length on to the main bar and the final twist is made.

After each twisting operation, work must be checked carefully to ensure that the alignment of collars, and spurs where they occur, is correct. Any inaccuracy in the setting of the collars will be magnified when the decorative motifs are attached to them and at that juncture adjustment may be difficult to effect.

In the case of uprights not carrying spurs, no welding is involved. Therefore, a start may conveniently be made at the centre twist.

A collar is slipped on after a twisted section has been formed and before the next is started. It must, in other words, be borne constantly in mind that these are not reduced twists.

The collars are secured in their correct position by means of screws which engage in notches made in the edges of the bars. The screws are of a length calculated to tightly engage these notches and at the same time firmly secure the motifs.

The frame of the illustrated example is made with the broad faces of the bars outwards. Therefore, the ends of the inner bars are flattened to provide riveting surfaces.

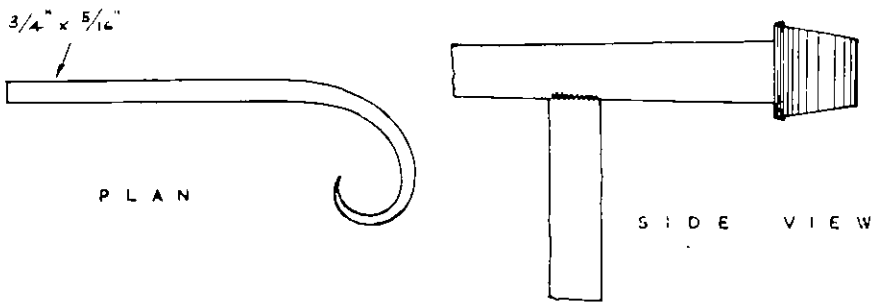
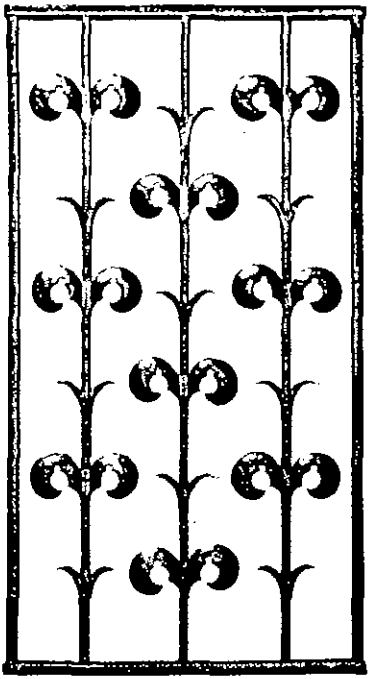


Fig. 100 Jig for forming curled ends



Design 6

The decorative effect of this design depends to a large degree *on the effective disposition of two contrasting motifs, one forged* in the traditional manner and the other formed by combining handwork with the use of machinery.

Opportunity to exploit the latter practice does not frequently present itself, and even when it does arise the advisability of following such a course must be most carefully considered.

On the other hand, however, when the assistance of machinery is appropriate, time may be saved and economic considerations can, in the modern world, be of importance and may, in fact, be the deciding factor.

The description of the technical operations which follows includes no dimensions, as proportions and motifs may be modified according to the perception of the designer, or by the dictates of a specific commission.

DESIGN 6

Fig 101 To fashion the spur motif a piece of metal long enough for a pair of spurs is drawn down at each end. It must be remembered that this piece must include enough metal for fire welding below the branching point.

A central impression is made with a fuller to facilitate bending. The piece is bent and folded on to the first section of the central stem which is a convenient handling length.

The branching points are now marked with a centre punch for guidance when welding.

The spurs are now removed from the centre stem which is heated to a bright red heat, quickly withdrawn from the fire and reinserted in to the folded spurs.

A light welding heat is taken to secure the spurs to the stem preparatory to taking a full welding heat. The spurs must not be allowed to slip during this operation.

Fig 102 Where an arc welding plant is available the spurs may be made separately and tack welded into position ready for the fire welding operation. Preheating of the centre stem is impossible. It is therefore necessary to ensure that sufficient heat reaches and penetrates into the stem without the spurs becoming overheated. Thus this method involves rather more soaking in the fire, but there is, on the other hand, no danger of the spurs slipping out of place.

Fig 103 A full welding heat is taken and a curved faced hammer is used to weld the spurs to the stem, back to the centre punch marks. This work is done on the anvil bick, which not only automatically leaves the end of the metal thick in readiness for scarf welding on the next section of the stem, but also prevents any reducing of the spurs which would result if the anvil face were used. Thorough welding is essential because any weakness would allow so short a length to pull away from the stem when the spurs are set to pattern.

Fig 104 The next section of the stem is scarfed and fire welded on. As this section will be cut to length after welding, at the point where

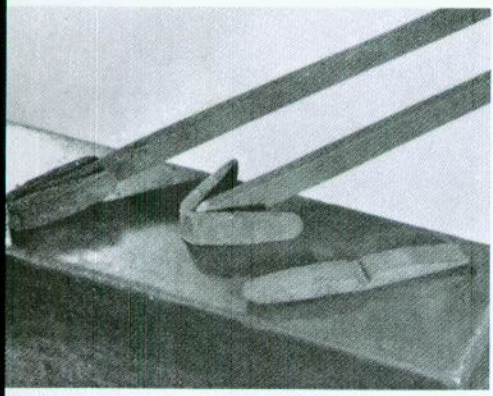


Fig. 101

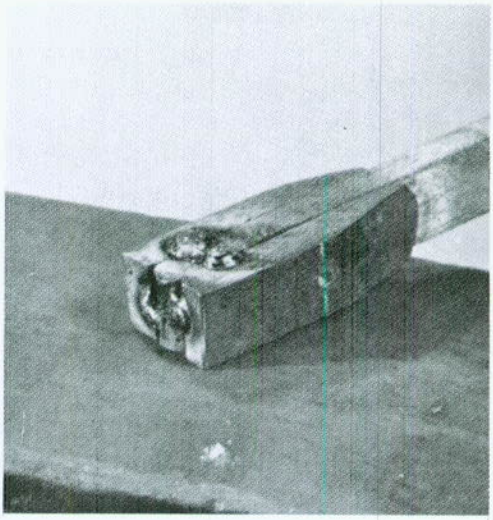


Fig. 102

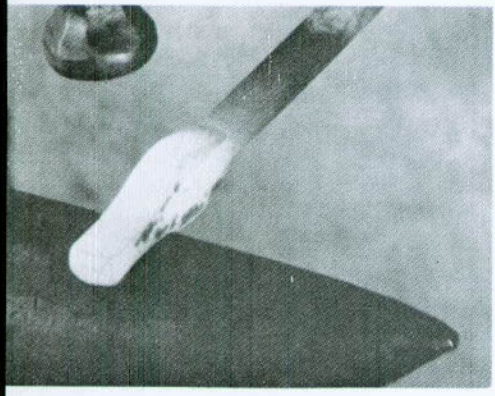


Fig. 103

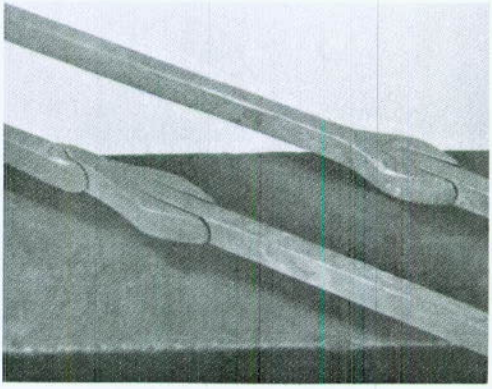
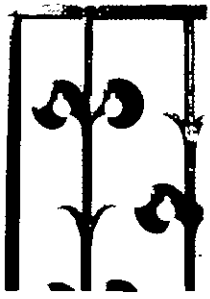


Fig. 104

the next pair of spurs is to be attached, an ample length of metal must be used. It will be noted that in the nearest example displayed on the anvil face the weld has been left unfinished in order that the juncture of the scarfed ends may be observed.

The position of the next pair of spurs is marked to conform with the working drawing and any surplus stem is cut off. These spurs are now welded on and the sequence of operations is repeated as many times as necessary.



DESIGN 6

Fig 105 Spurs of so short a length are difficult to set unless a stake of special design is employed. The shape of the required stake is illustrated (Fig 64, page 40). This is gripped in the vice and the spurs are curved to shape with a hammer designed to reduce this and similar operations to single-handed work, obviating the use of a fuller and the consequent employment of a mate.

Fig 106 The blanks for the leaf features are next cut from sheet steel $\frac{1}{8}$" in thickness. The design employed permits part of their outlines to be formed either by the punching or the boring of a number of holes of equal diameter. Punching with a fly press is illustrated; alternatively blanks may be stack piled and drilled.

After the series of holes is either punched or bored the remainder of the outline is trimmed away. In the illustrated example it will be noted that additional notches were made in order to break the regularity of the circular holes.

Fig 107 At a red heat the edges are hammer-chamfered using a curved faced hammer on one side of the work only.

Fig 108 The leaf motifs are now dished by beating them, at a dull red heat, on a concave surface of lead in a steel socket of suitable diameter. During this operation the lead is never allowed to accumulate sufficient heat to melt it. The inner and outer edges of the cylindrical socket should have been filed to produce a rim of rounded section.

During the beating process, changes in outline develop as the contours of the motif are formed. It therefore follows that the final form to be achieved is dependent on the initial outline of the blank in which suitable allowances must have been made.

The development shape may be determined by first modelling the motif in plasticine. A thin sheet of this material is rolled out, formed and subsequently carefully flattened to give the guiding outline. A trial made in sheet metal will either confirm the result or will reveal points where modification is needed. Lead sheet could be used for the same purpose but plasticine is recoverable.

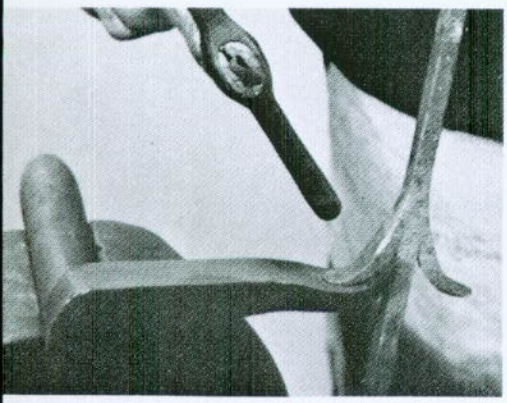


Fig. 105

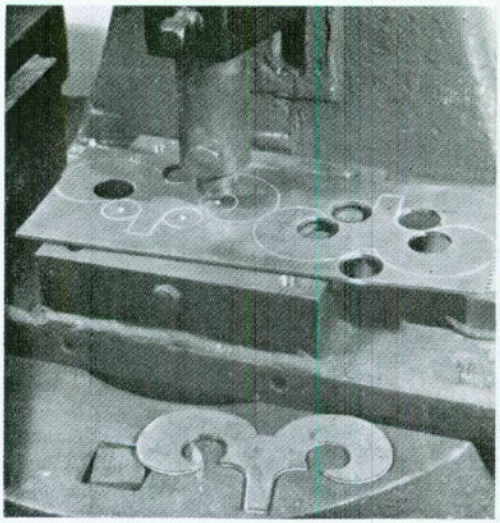


Fig. 106

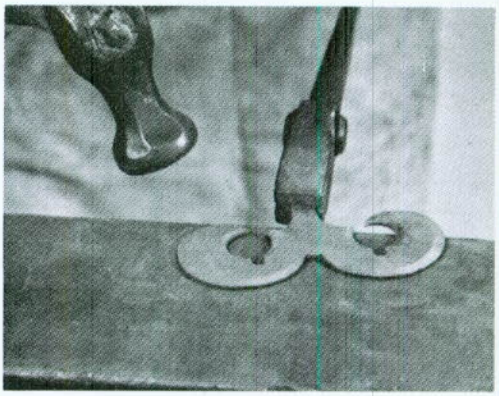


Fig. 107

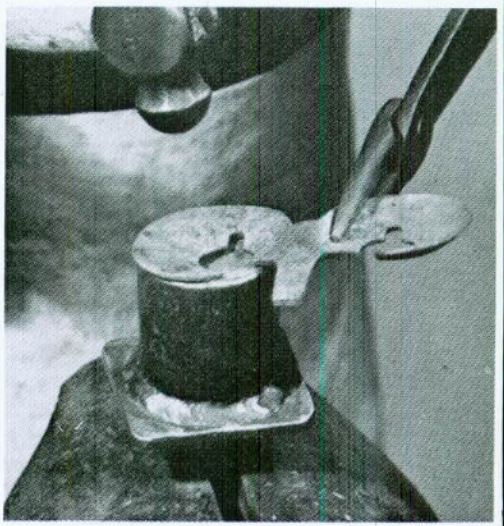
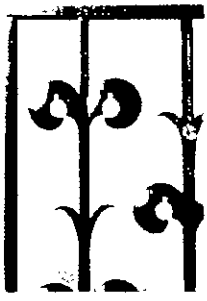


Fig. 108



DESIGN 6

Fig 109 The flattened surfaces bisecting the motifs are trued with a hand punch (drawing, Fig 113, on page 68) of correct width. This operation prepares the correct seating areas matching the width of the bars to which they are attached.

Fig 110 The intervals in the bars are now accurately marked out and recessed to the correct depth to accommodate the flattened areas of the motifs.

Fig 111 Flush riveting the motifs to the bar is the next operation and if it is considered desirable the junctures between the sheet metal and the parent bar may be lightly hammered-up to conceal them.

Alternatively the skilful use of bronze welding could be instrumental in the saving of time without impairing the visual effect of work.

Fig 112 Riveted tenon construction has been used to assemble the grille illustrated, but alternative methods may be adopted such as the form used in several other grilles described in this book.

In some instances work must present a similar appearance from both sides. The design dealt with in this chapter has, as it stands, a face side and reverse. Conversion to double sided work may be effected by facing the other side with additional leaf motifs, back to back wise, carried on rivets common to the pairs.

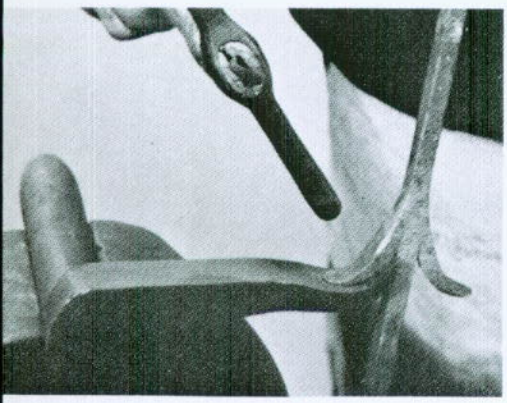


Fig. 105

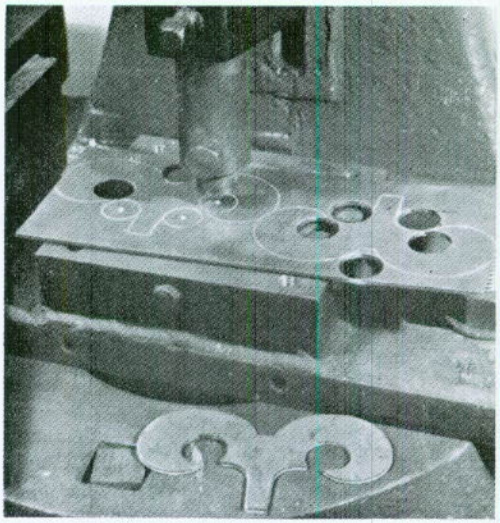


Fig. 106

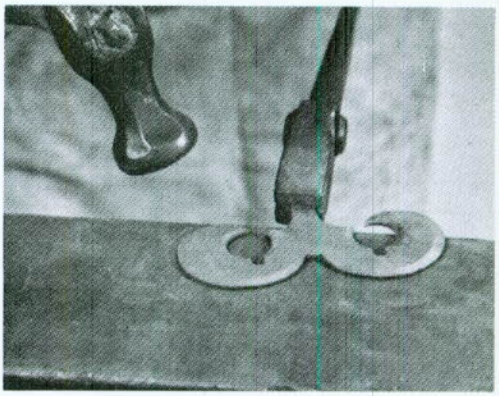


Fig. 107

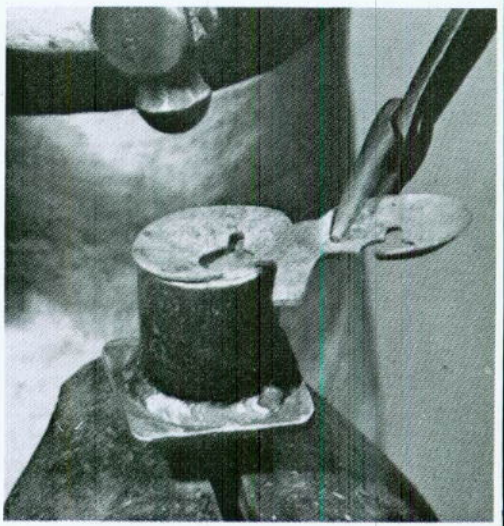


Fig. 108

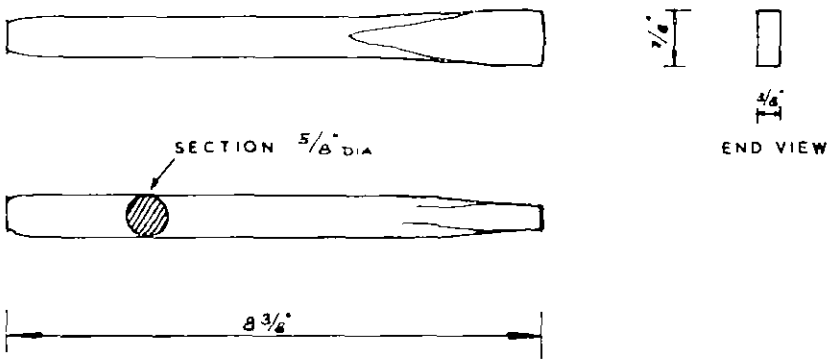
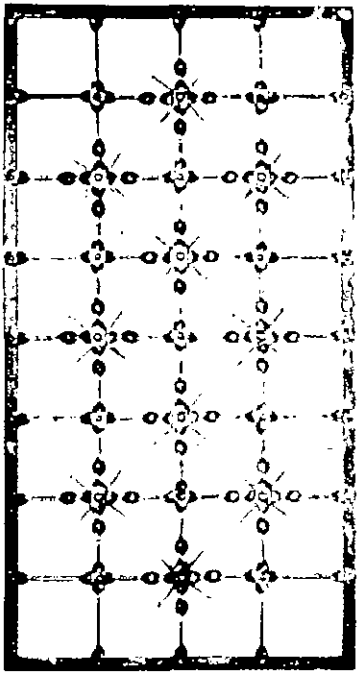


Fig. 113 Hand punch of correct width



Design 7

The decorative features in this example are simple in character and are formed by the intersection of cold twisted bars.

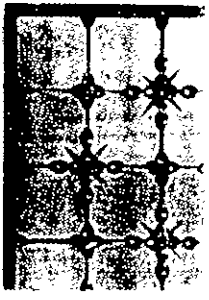
The design may be carried out in bar sizes ranging from $\frac{1}{2}'' \times \frac{3}{16}''$ to $1'' \times \frac{1}{4}''$. If sizes in excess of $1'' \times \frac{1}{4}''$ are used, then hot twisting must be resorted to with its attendant technical complications.

The size of bar chosen must be closely related to the division of the given area into squares, if the flower-like features are to tell with full decorative effect. The use of too narrow a bar will, for instance, result in the features becoming insignificant. Therefore, in describing the processes involved, measurements relating to the bar size used in the illustrated example, $\frac{3}{4}'' \times \frac{3}{16}''$, are detailed and given in drawing, Fig 125, on page 75.

It is essential that a trial of any given bar be carried out in the first instance for the craftsman's or designer's guidance when setting out work employing this technique. An adequate working drawing cannot be made if this preliminary step is omitted.

The frame of the illustrated grille is of $\frac{3}{4}'' \times \frac{3}{8}''$ bar, $2'\ 11\frac{1}{2}'' \times 1'\ 6\frac{1}{2}''$ overall, giving an opening of $2'\ 10'' \times 1'\ 5''$. The bars, $\frac{3}{4}'' \times \frac{3}{16}''$, intersect at $4\frac{1}{4}''$ centres, producing a satisfactorily rich effect, neither meagre nor too overpowering in feeling.

No further reference will be made to the frame as it is assumed that its construction presents no problem to the skilled worker.



DESIGN 7

For the same reason the riveted assembly is not mentioned.

The formation of the twisted bars, however, requires description.

Fig 114 All horizontal and vertical bars are cut to adequate lengths, care being taken to include a surplus to accommodate the wrench adequately during the formation of the final twist.

In this instance the horizontal bars are 1′ 10″ long, giving a 4″ surplus.

To make the top horizontal bar, with its large centrally placed star-decorated motif, flanked by the two smaller motifs, the bar is marked in the middle with a centre punch and gripped in a vice dog with this point coinciding with a mark made centrally on one jaw (drawing, Fig 126, page 76).

The width of the vice dog jaws forms a gauge for one of the essential measurements in this pattern; the length of the flats at crossing points.

A wooden gauge is made to predetermined measurements, i.e., taken from the full size working drawing. Using the widest leg of the gauge, $1\frac{3}{4}$″, the wrench (see drawing, Fig 127, page 77) is positioned and tightened on to the bar.

Fig 115 A three-quarter twist, 270°, is made in a clockwise direction.

The wrench is removed and the work released from the vice dog, turned end for end and the operation is repeated.

Fig 116 One half of the larger star-bearing motif has now been formed. The $\frac{7}{8}$″ flat surface left between the twists will become a riveting point when crossed at right angles by a similarly twisted bar.

Fig 117 It might be assumed that twisting operations materially shorten the length of the bar. Shortening does take place but in the quarter twist, 90°, which follows, it is negligible. The distance to the next riveted intersection point may, therefore, be marked with the dividers set at precisely $4\frac{1}{4}$″.

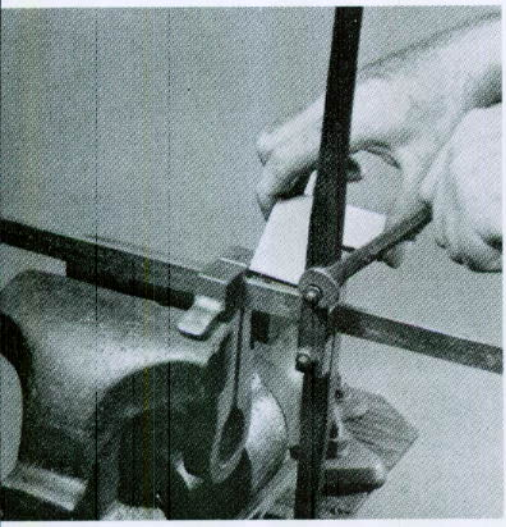


Fig. 114

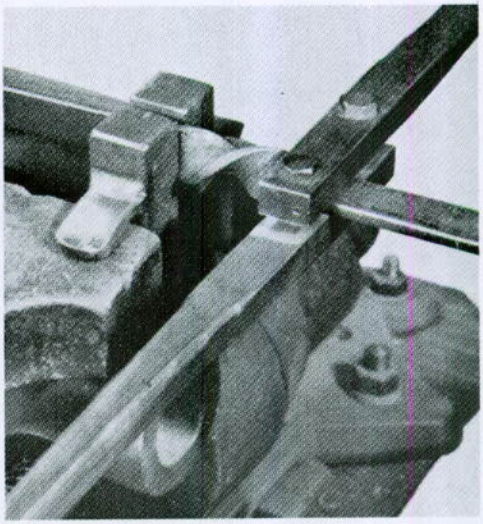


Fig. 115

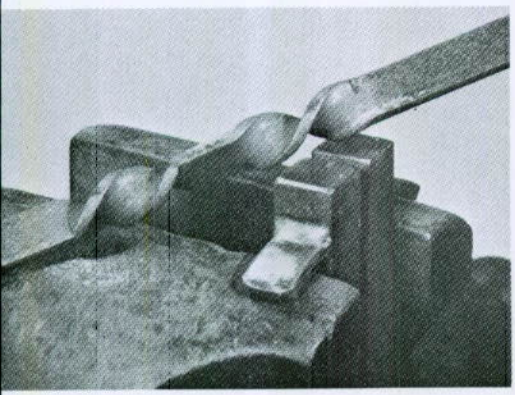


Fig. 116

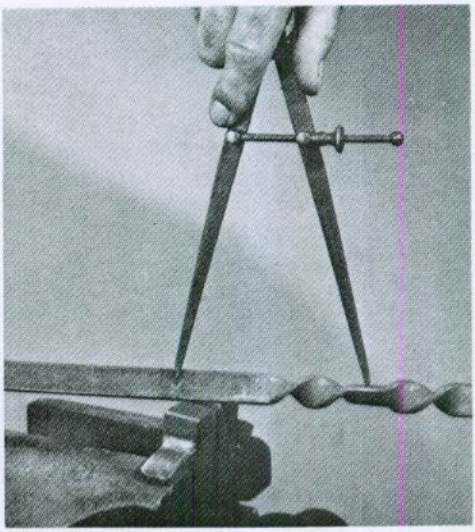
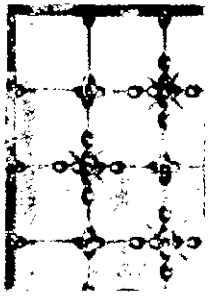


Fig. 117

This is a convenient juncture at which to emphasise the necessity of marking the bar as each successive twist is made. By so doing any slight shortening resulting from twisting need not be taken into account.



DESIGN 7

Fig 118 The bar is gripped with the mark in the centre of the vice dog and using the small leg, $\frac{5}{8}$", of the gauge the wrench is tightened in position as before. Care must be taken when aligning the marks.

Fig 119 A quarter (90°) twist is made, but this time in an anti-clockwise direction. The wrench is removed by taking out one bolt, and the work is released from the vice dog, turned end for end and the operation is repeated.

One half of the smaller motif has now been formed. As before, the $\frac{3}{4}$" *flat surface becomes a riveting point.*

Fig 120 It will be noticed that the operation carried out in Figs 117-119 have been repeated on the other side of the larger twisted motif, leaving only the final twists at each end of the bar to be made.

These twists do not form part of intersections, but make junction with the frame. Therefore the measurement required to position the wrench is taken from the centre of the bar and is half the inside measurement of the frame, in this case $8\frac{1}{2}$". This point is marked, and coincides with the inner edge of the frame. The wrench is, therefore, tightened with its innermost edge to this mark.

The work is now entered into the jaws of the vice dog and the bar is moved towards the dog. The vice is tightened when the gauge, $\frac{5}{8}$", fits between the dog and the wrench.

One quarter (90°) twist is made in an anticlockwise direction.

Fig 121 The ends of each bar are heated, rounded and hammer chamfered; they are cut off short to allow for the lengthening which will take place.

Fig 122 The finished bar ready for drilling.

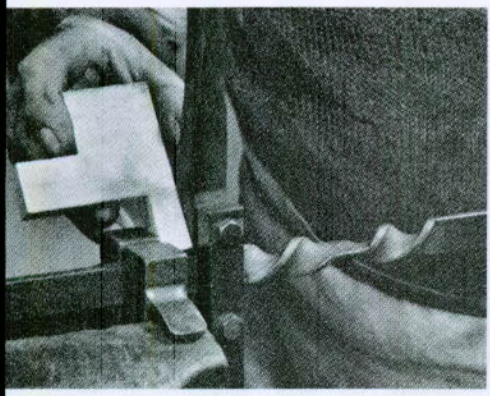


Fig. 118

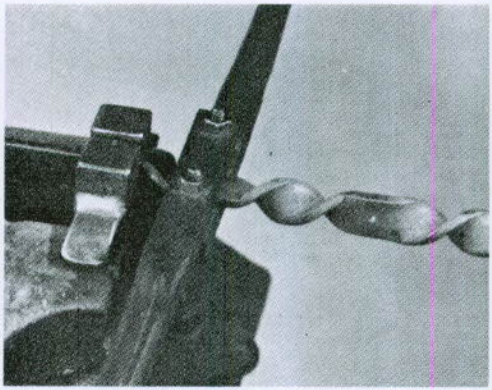


Fig. 119

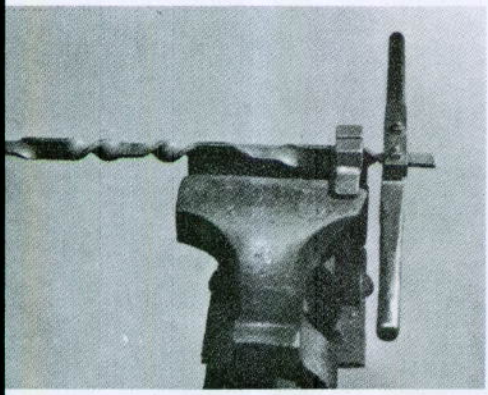


Fig. 120

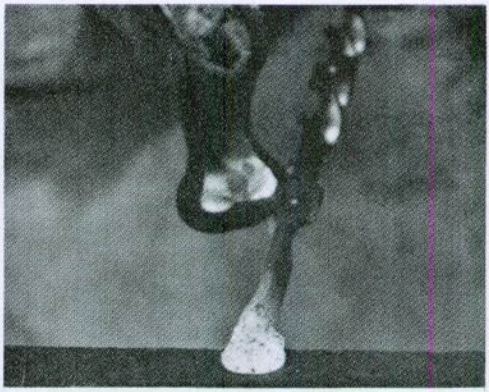


Fig. 121

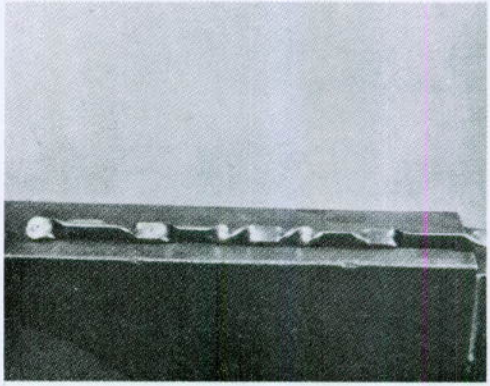
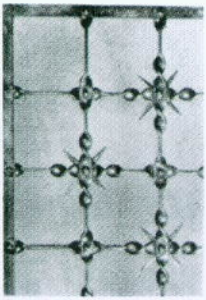


Fig. 122



DESIGN 7

Fig 123 The four-way stars are made from $\frac{3}{8}'' \times \frac{1}{8}''$ bar to a size proportionate to the overall design. A handling length of bar is taken and drawn down to a point, care being taken to observe accurately the amount of draw which occurs. The point is hammer chamfered along its edges on both face and undersides. The piece is now cut off at a point taking into account the length of draw already determined, and similarly pointed at the other end.

Two more points are made which are cut off to a length which will produce a balanced feature when assembled by means of oxy-acetylene welding.

Fig 124 The remainder of the bars, both horizontal and vertical, are made by repeating the operations described, the sequence varying as dictated by the design. Thus alternate bars will start in the centre with the smaller motif flanked by the star-bearing motif.

When the grille is riveted together the star features are not placed between bars but at the back of the intersection.

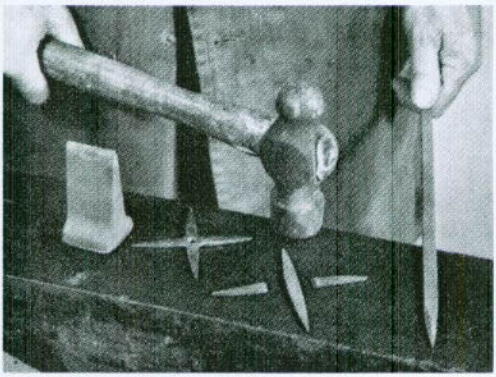


Fig. 123

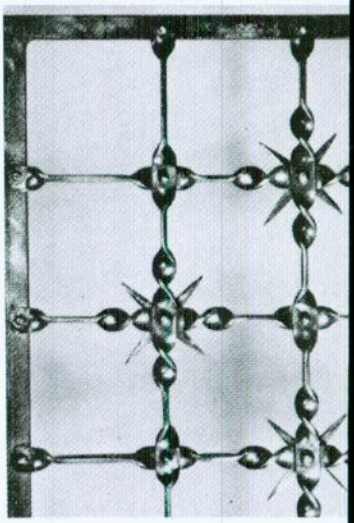


Fig. 124

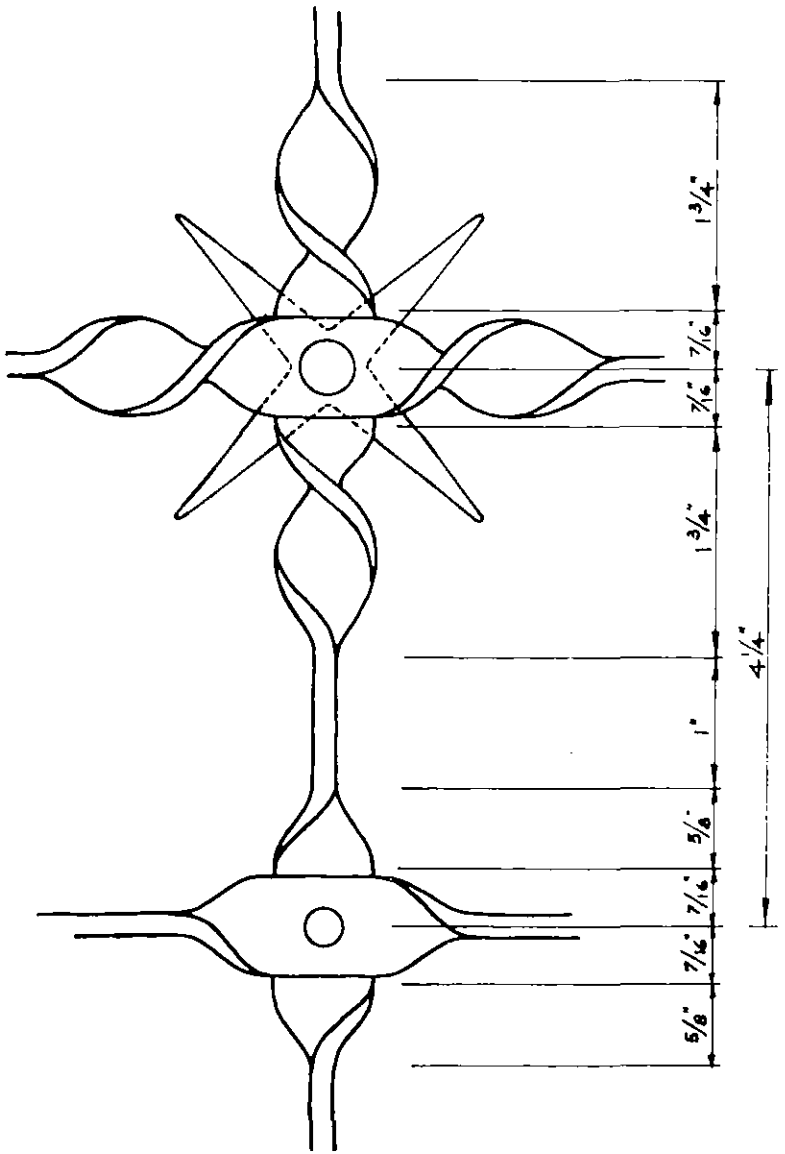
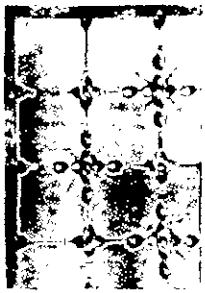


Fig. 125 Working measurements



DESIGN 7

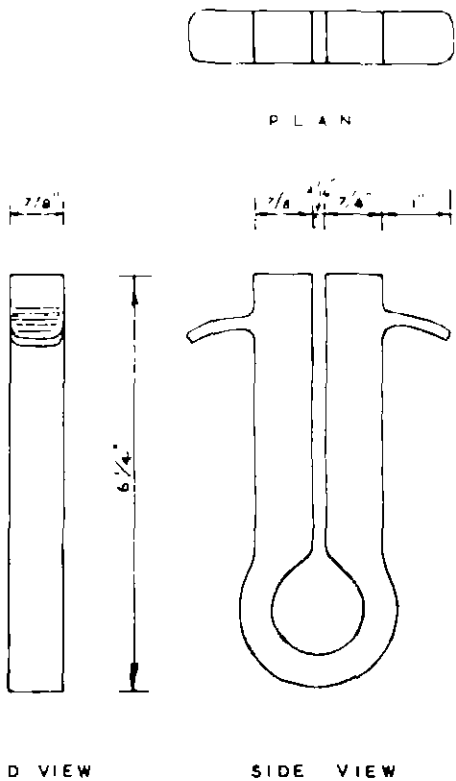


Fig. 126 Vice dog

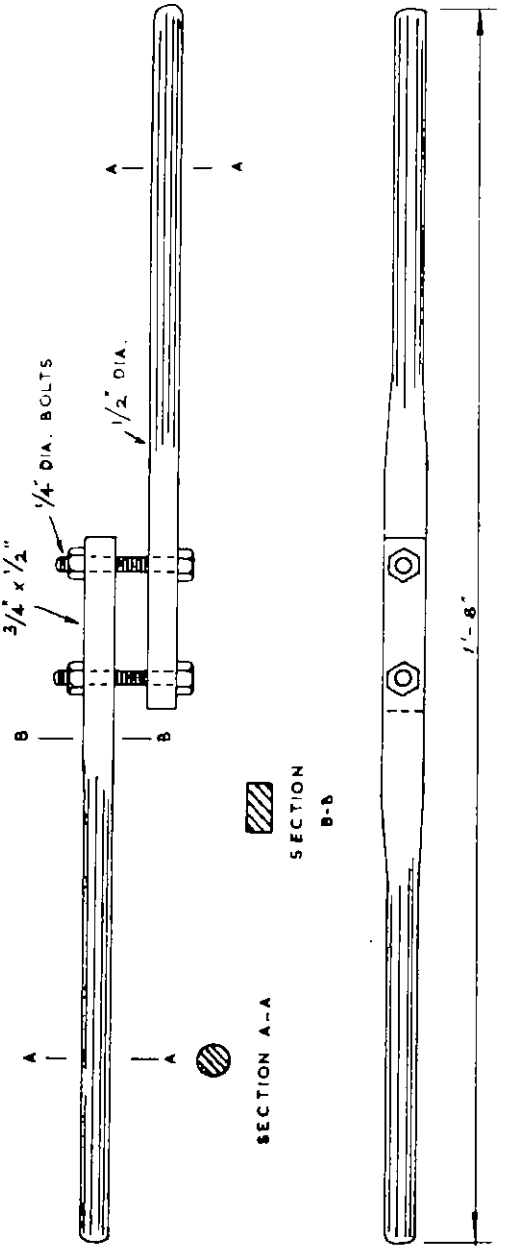


Fig. 127 Twisting wrench

INDEX

CONVERSIONS

1/8"	=	3.175mm
1/4"	=	6.35mm
3/8"	=	9.25mm
1/2"	=	12.7mm
5/8"	=	15.875mm
3/4"	=	19.05mm
7/8"	=	22.225mm
1"	=	25.4mm
2"	=	50.8mm
3"	=	76.2mm
5"	=	127mm
12"	=	304.8mm
3'	=	915mm