

SECTION 1, CHAPTER 5

MARKING OUT

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Introduction

1. When an engineering item is produced from the raw material, all dimensions, contours, etc., of the finished product must be in accordance with those laid down in the relevant workshop drawing. This calls for accuracy in cutting, filing, drilling, etc., on the part of the tradesman at the workbench. A pre-requisite of such accuracy in manufacture is the scribing of reliable guidance lines on the material, to which the craftsman can work. This process is termed 'marking-out', and the importance of good marking-out cannot be over-estimated—a single error in marking out can ruin the work.

General Principle

2. The guidance lines to be scribed on the surfaces of the metal are really reproductions, to scale, of the lines appearing on the workshop drawing, and most marking-out is done in the same manner as a drawing is produced on a drawing board. Dimensions in all workshop drawings are tied to centre or datum lines; these lines are produced first, and they serve as the basis from which other lines and positions may be set out. In marking-out the same general procedure is followed: a centre-line is marked on the surface of the metal with a scribe, and from this basic line the requisite distances may be set off, arcs scribed, etc., with dividers. Alternatively, an edge of the metal may be cut or filed true, and then used as the datum in place of a scribed line.

3. The following points should be noted:—

(a) Only boundary and cutting lines should be scribed on light alloy sheet—scribed lines on this type of material may give rise to cracks. The marking of bend lines, sighting lines and development lines must be done with a pencil.

(b) The points of scribes and dividers must be kept keen to produce very fine scribing lines—thick scribing lines lead to inaccuracies in the finished work.

(c) Scribed lines must be clear and distinct; prior to marking-out, it may be advantageous to apply chalk or white-wash to the surface of the metal—this will improve the clarity of the scribed lines. Bright steel surfaces should be coated with copper sulphate (blue stone) solution.

(d) When the scribe is used in a scribing block, it must be clamped so that it is held rigidly in relation to the base of the block.

(e) All scribing should be done firmly so that there is no necessity for re-tracing lines—retracing increases the possibility of inaccuracy.

(f) The scribe point should always be set at the shortest practicable distance from the scribing block pillar—this reduces the tendency of the point to "whip".

(g) Always trail the point when using the scribe, whether in the scribing block or in the hand—this will ensure that the point does not dig in the metal and cause an uneven line.

Marking-Off Rectangular Work

4. File one face of the metal true, and square one edge to the true face; the work will then stand firmly on the marking-off table, and parallel lines can be scribed across its

the scribe point into a suitable scribing position, and the cutting line is then marked by rotating the bar against the scribe point.

6. **Finding Centre of Rough Bar.** Open out the legs of "odd-leg" calipers until they are at a distance which is rather less than the estimated radius of the bar. Scribe short arcs on the end of the bar from four positions, approximately equidistant from each other, round the circumference (Fig. 2). The centre of the bar lies at the centre of the small

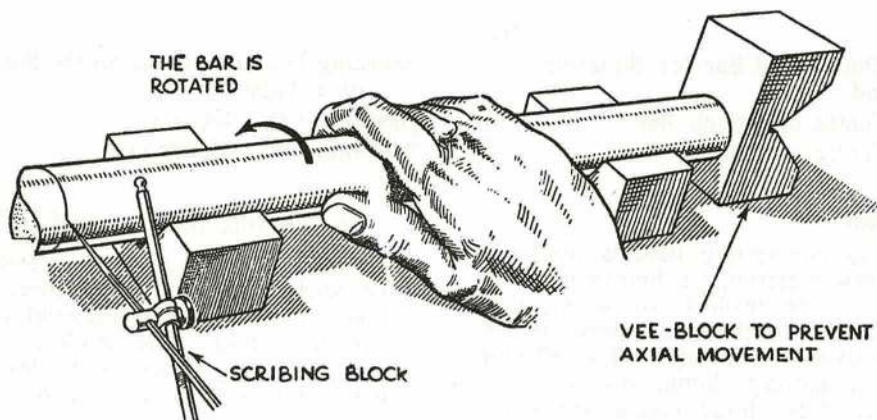


Fig. 1. MARKING OUT ROUND BAR FOR SQUARING-UP END

face, by means of the scribing block, to measurements from the true edge. When setting the scribe point at the required height, support the steel rule against the side of a V-block to ensure that it is truly perpendicular to the face of the marking-off table. When marking-off sheet metal, file one edge true, place the true edge on the marking-off table and support the sheet against the side of a V-block. Large sheet-metal work should be marked out from a centre-line, using dividers, scribe and rule.

figure thus scribed; this position is then estimated by eye and is centre-popped to mark it.

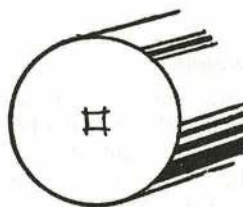


Fig. 2. FINDING CENTRE OF ROUGH BAR

Marking-Off on Round Bars and Tubes

5. **Squaring-up End of Bar or Tube.** Fig. 1 shows a simple method of marking-off for squaring-up the end of a round bar or tube. The bar or tube is supported in a pair of V-blocks which set it up parallel to the surface of the table, and a third V-block, laid on its side, abuts the end of the bar to prevent axial movement. The scribe is clamped firmly in the scribing block at a height and angle which brings

7. **Finding Centre of Finished Bar.** If the bar has been machined to true cylindrical form with end surface square to the cylindrical face, the centre of the end surface may be determined accurately as follows:—

(a) Support the bar in V-blocks as described in para. 5, adjust the scribe in the scribing block so that the scribe point meets the vertical diameter of the bar at a point about midway between the approxi-

mate centre and the upper edge, then scribe a line across the end of the bar at this level (Fig. 3).

(b) Set the scribed line vertical by turning the bar in the V-blocks and using a fitter's square to check the setting.

(c) Without altering the setting of the scriber in the scribing block, scribe a second line, which will be at right angles to the first, across the end of the bar.

(d) Repeat (b) and (c) twice more, thus completing a square on the end of the bar.

(e) Scribe diagonals to this square; the intersection of the diagonals is the true centre of the bar.

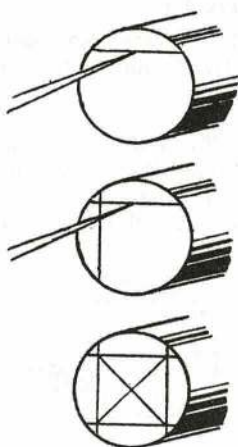


Fig. 3. FINDING CENTRE OF SMOOTH BAR

8. Marking-Off for Taper Pin Holes. Where a socketed joint, between two tubes or a tube and a solid round bar, is to be secured by taper pins, it is most important that the holes for the pins should pass through the exact centres of both members. Machine-finished solid bar offers no difficulty in this respect; the true centre of the end section can be found as in para. 7, and a diameter line scribed across the end can be continued, parallel to the axis of the bar, on the longitudinal surface to form a guide line on which the whole centre is located—the diameter line can then be set vertically, by means of a fitter's square, when the bar is positioned on the table of the drilling machine. With open-end tube the position is rather more complicated, and the following procedure should be adopted:—

(a) Position the tube in a pair of V-blocks, then set the point of the scriber in the scribing block to the approximate centre height of the tube.

(b) Scribe a short line (X) on one side of the tube; move the scribing block to the opposite side of the tube and scribe a second short line (Y) at the same height (Fig. 4).

(c) Rotate the tube approximately 180° until line X takes up the original position of line Y, i.e. under the scriber point.

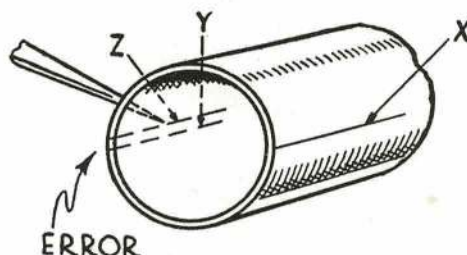
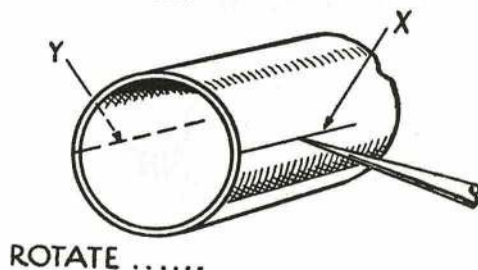
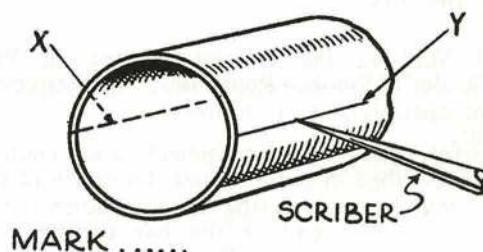


Fig. 4. MARKING DIAMETER LINES ON THE SURFACE OF A TUBE

(d) Move the scribing block back to its original position, and make a third short line (Z); this line will be near, but is unlikely to coincide with, line Y.

(e) Using the fine adjustment on the scribing block, reset the scriber point towards line Y, one quarter of the distance between Y and Z.

(f) Move the scribing block an inch along the tube, and repeat the operations (b) to (d); the two lines Y and Z should this time be almost in agreement.

(g) Reset the scriber point as in (e), and repeat (f); continue until lines Y and Z are in exact agreement.

(h) Scribe horizontal lines along the tube through the final X and YZ lines; locate the hole centres on each of these lines. When drilling, drill through one wall only of the tube; the complementary hole must be drilled from the opposite face of the tube.

9. Marking the Largest Square on End Section of Finished Round Bar. The sequence of operations is as follows:—

(a) Using the equipment and method described in para. 7, find the centre of the end section; scribe a line horizontally across the end of the bar through the centre point (Fig. 5).

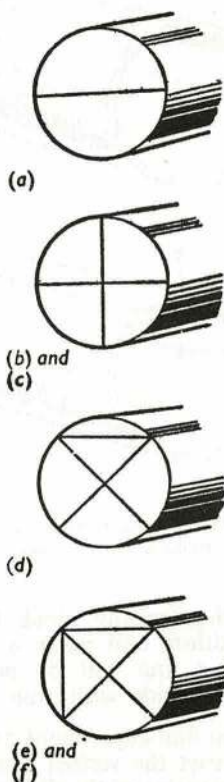


Fig. 5. MARKING OFF A SQUARE

(b) Set this line vertical by turning the bar in the V-blocks and using a fitter's square to check the setting.

(c) Scribe a second line horizontally across the end of the bar through the centre point; it will be at 90° to the first line.

(d) Turn the bar in the V-blocks until the upper ends of the two lines are at the same height above the surface of the table; join these ends by scribing across with the scriber point set to this height.

(e) Turn the bar until the line scribed in (d) is vertical; check by means of a fitter's square.

(f) Scribe a second boundary line across the end of the bar, keeping the scriber at the same height as in (d).

(g) Repeat the procedure detailed in (e) and (f) twice more to complete the square.

10. Marking the Largest Hexagon on the End of a Round Bar. One method used is to proceed as for marking a square (para. 9), but using a bevel protractor set at 60°

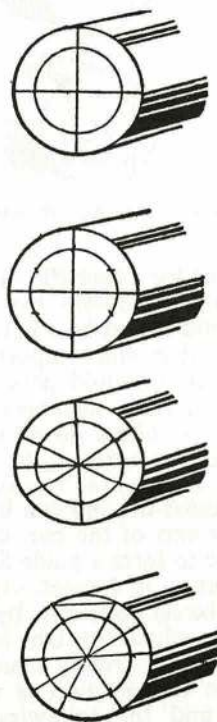


Fig. 6. MARKING OFF A HEXAGON

MARKING OUT

in place of the fitter's square for centre and boundary lines. Another method is as follows:—

(a) Find the centre height and centre by two lines at right angles (Fig. 6).

(b) Centre-pop the centre, and use dividers to scribe a circle rather smaller than the bar size.

(c) Step off round the circumference of the circle at the same divider setting; it will go exactly six times.

(d) Scribe lines from the centre through each of these points.

(e) Rotate the bar until one of these lines is horizontal, and scribe across the top of the ends of the other two lines.

(f) Repeat operation (e) using the same scriber setting (two scribing blocks are necessary, one to set the line through the centre horizontal, the other at the fixed height for scribing).

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