of the latter will rise to a sufficient hight without raising the valve to permit of emptying the chamber. At the point of discharge, the weighted rod, J, is thrown past the vertical and, closing the valve to one chamber, opens the induction pipe to the other, depressing that float sufficiently to close the escape valve. In

SICKLES' METER,

Fig. 9, the liquid flowing into the chamber, D, is, by means of the valve, C, admitted alternately to each end of the hollow valve, B, which is divided into compartments by the partitions, *l l'*. From these the fluid flows alternately through appropriate ports behind the pistons, *a a'*, on the rod, *b*, which has tappets that strike the pins, *e e'*, on the upright shaft, *d*, causing its partial rotation and operating the slide valve, C, which admits the fluid into the compartments of the valve, B.

We add, in Fig. 10, one more device used in connection with liquids, to which the name of

LIQUOR THIEF

has been applied. It is simply a tube which is let down through the bung hole of a cask and then closed, so as to withdraw liquid therefrom. It is closed at the bottom by a plug, actuated by a rod passing through the top, as shown.

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

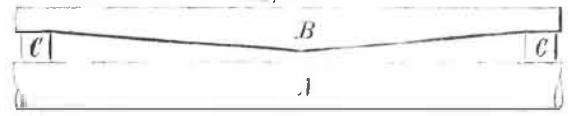
NUMBER XXXVIII.

MARKING OUT ENGINE GUIDE OR MOTION BARS.

If an engine guide bar is to be made parallel in its breadth and thickness, it may be marked off from the directions already given for marking a scale. Such bars, however, should always be made thicker in the middle than at the ends (as they are always made in English locomotives) for the following reasons: If the strain upon the bars is equal at all parts of the stroke, the middle of the bar will be subject to deflection because of its distance from the blocks or supports at the ends. Again, towards and at the end of the stroke, the connecting rod stands nearly parallel with the center line of the bore of the cylinder, and then the strain upon the guide bars is very slight; but as the stroke proceeds, the angle of the connecting rod increases until (near the center of the stroke) it becomes the greatest, and therefore places the most pressure upon the guide bars. If, then, the latter deflect in consequence of this pressure, the gland and packing ring in the cylinder cover act as a fulcrum, and the piston rod as a lever, forcing the piston against the top and bottom of the bore of the cylinder, tending to wear it oval and also to wear it to a larger bore in the middle than at the ends, because the deflection of the bar is inappreciable at the ends, whatever it may be in the middle. That the deflection of such bars is sufficient to be of practical importance will be perceived from the following:

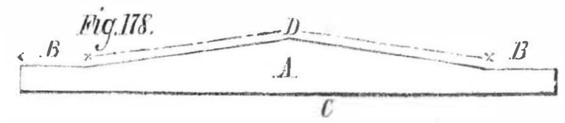
During the years 1864, 1865, and 1866, I fitted up under contract nearly one thousand guide bars (for locomotives) their average size being about 30 inches long, 3½ inches broad, and 1⅝ inches thick or deep at the ends, and 3 inches thick in the middle of their length. They were filed up in the vise, and made practically true to a surface plate. When the first few sets were delivered to an inspector for examination, they were rejected on the ground of being hollow in their length, to a degree plainly perceptible in the surface plate marks, which showed very plainly at the ends of the bar, and graduated away until, in the middle of each bar, they were barely perceptible. This difference was obviously in the wrong direction, since the middle of the bar should, if there be any difference, mark the plainest, because it sustains the most abrasion. I was sent for by the inspector, who had a bar placed upon the bench, supported by a block of wood under each end; and by request, I applied the surface plate, and found, to my astonishment, the marks to be as above stated. As a consequence, the whole of the set of eight bars were returned to me to be refitted. Upon replacing them in the vise and applying the surface plate, I found each bar to mark as true and even as could be desired, and hence returned them untouched, perceiving that the bars, stout as they were, deflected from their own weight, the amount of the deflection being doubled by supporting them, in the one case in the middle and in the other by the ends. The inspector claimed that, by testing the bars while supported at their ends, he had tested them in the position in which, and supported them as they would be, when in their working places: but since no provision had been made for holding them (while being filed up) in that position, and since the top bars stand upside down when upon the engine, it was plainly impracticable to file them up in such a position. The bars were passed, the controversy having served to demonstrate their appreciable deflection, and also that the bottom bars should be filed up a little rounding and the top ones level in their respective lengths. To mark off such a bar as is here described, one face must either be first trued up, or the marking-off must be performed at two separate operations. The better plan is for the marker-off to examine the bar as to size, and have one face planed off. If either face appears defective, it should be the first planed. If the bar appears sound all over, the outside edge face of the bar should be the one to be planed off preparatory to marking off; and in setting it to surface it, care should be taken to set it true with the top and bottom faces, if they are parallel to each other; and if not, to divide whatever difference there may be between them. The bar may then be placed upon the marking-off table in the position shown in Fig. 177, A being the marking-off plate, B the guide bar, C C pieces of wood to lift the bar off the plate. By means of small thin wedges, the planed face, B, of the bar is set at a true right angle to the surface of the plate, and tested by a square. The next operation is to mark off the top or uppermost face, and the question here arises: Shall it be so marked that there will be an equal amount of metal taken off the top and bottom faces, or otherwise? First, then, since the quality

Fig. 177.



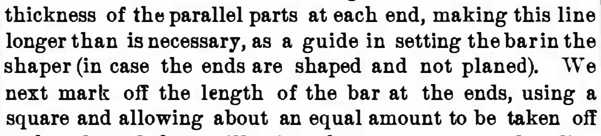
of the metal is the best towards the surface, it is a consideration to take off as little as possible, so as to leave a hard wearing surface; this may appear a small matter, but it is always right to gain every superiority attainable without cost. Therefore, all other things being equal, we should prefer to take as little metal off the top face as would be sufficient to make it true, and should therefore mark it out with that view. Here, however, another consideration arises, which is that the outline of the bottom face is not straight, and cannot therefore be planed lengthways from the center of the bar to the ends; and if such bottom face is to be shaped across its breadth, instead of lengthways, it is a comparatively slow operation, and much time will be saved by so marking off the bar that the bottom will only just true up, so that all the surplus metal will be cut off the top face, which, being done in a larger machine, and lengthways, is a much more rapid operation. There is, however, a method of obtaining both the advantage of taking as little as possible off the top face, and planing the bottom face for the most part lengthways. It is shown in Fig. 178, A being the bar;

Fig. 178.



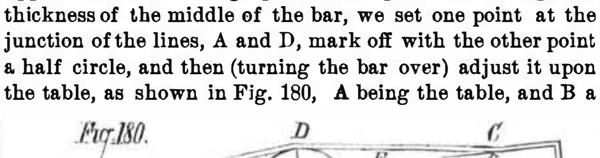
the two faces, B B, may be first planed parallel (as required) with the face, C; the back of the bar may then be planed in two operations from the point, D, to the junction with B at each end. Were the method of procedure employed, it would pay to leave the most metal to come off the back of the bar; but there are yet other considerations, which are the facilities in the shop. If the shaping machines are not kept fully occupied, while the planing machines are always in demand, it will pay (if there are not many bars to be planed) to leave as little as needs be to be taken off the bottom of the bar and the remainder off the top. If, however, many bars are to be planed, the most economical of all methods will be to plane the backs by placing, say, 8 of them at a time across the table of the planer, cutting off the ends at the same chucking. Supposing this plan to be adopted, we set the scriber of the marking block just below the lowest part of the surface of the bar, and draw a line along its planed surface, and then another line along each end, to denote the thickness of the parallel parts at each end, making this line longer than is necessary, as a guide in setting the bar in the shaper (in case the ends are shaped and not planed). We next mark off the length of the bar at the ends, using a square and allowing about an equal amount to be taken off each end; and then, still using the square, we mark a line equidistant between the end lines, to denote the center of the length of the bar, which will then present the appearance shown in Fig. 179, the inside line, A A, being for the top

Fig. 179.



face, the lines, E, for the parallel ends, the lines, B B, for the ends, and the line, D, denoting the middle of the length of the bar. We now turn the bar so that its planed face is uppermost; and setting a pair of compasses to the required thickness of the middle of the bar, we set one point at the junction of the lines, A and D, mark off with the other point a half circle, and then (turning the bar over) adjust it upon the table, as shown in Fig. 180, A being the table, and B a

Fig. 180.



block of wood and wedge to adjust the bar so that, if the scribing block be applied along the table, the needle or scriber point will mark just fair with the top of the circle at D and the mark, C, at the end of the taper part of the bar, A (the mark, C, showing the required distance from the end of the bar). Having made the adjustment, we draw the line, E, thus completing the marking of that half of the bar. We next remove the block of wood and wedge to the other end of the bar, and repeat the last operation, when the marking of the bar will be, so far as its outline is concerned, complete. It will be observed that we have drawn the lines in each case on the one planed surface of the bar only, and not all around the work. The reason for this is that the planed face is a guide, whereby to chuck the work and ensure its being set true. In the absence of one true face, it would be necessary, in marking off the first face, to mark the lines all around the work, which, when planed up, would serve as a guide whereby to set the work during the successive chuckings.

After the faces and ends are planed up, the holes in the ends may be marked by the compass calipers and compasses, as shown in Fig. 181, A being the bar, and B B the compass

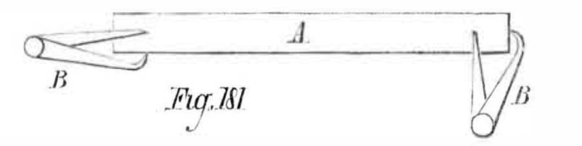
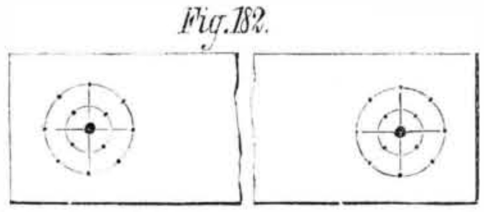


Fig. 181.

calipers set to the required distance. At the junction of the marks thus made, we make a light centerpunch mark, and mark off the circles for the holes, first marking a circle of the requisite size and defining its outline by other light centerpunch marks. We next draw from the same center a circle smaller in diameter, and define its outline also by small centerpunch marks; after which we take a large centerpunch, and make a deep indentation in the center of the circle, which will appear as shown in Fig. 182. The philosophy of

Fig. 182.



marking the holes in this manner is as follows: If the outside circle alone is marked, there is nothing to guide the eye during the operation of drilling the holes (in determining whether the drill is cutting the holes true to the marks or not) until the drill has cut a recess nearly approaching the size of the circle marked; if the drill is not cutting true to the marks, and the drawing chisel is employed, it will often happen that, after the first operation of drawing, the drill may not yet cut quite true to the marks; and it having entered the metal to its full diameter, there is no longer any guide to determine if the hole is being made true to the circle or not. By introducing the inside circle, however, we are enabled to use the drawing chisel, and therefore to adjust the position of the hole during the earlier part of the operation; so that the hole being cut is made nearly if not quite true before the cutting approaches the outer circle, which shows the full size of the hole. If, on nearly attaining its full diameter, the outer circle shows it to be a little out of truth, the correction is easily made. It is furthermore much more easy to draw the drill when it has only entered the metal to, say, half its diameter than when it has entered to nearly its full diameter.

The object of making a large centerpunch mark in the center is to guide the center of the drill, and to enable the operator to readily perceive if the work is so set that the point of the drill stands directly over the centerpunch mark. This is of great importance in holes of any size whatever, but more especially in those of small diameter, say, for instance, ¼ inch, because it is impracticable to describe circles of so small a diameter whereby to adjust the drilling; and in these cases, if the drill runs out at all, there is but little practical remedy. The centerpunch marks for such holes should therefore be made quite deep, so that the point of the drill will be well guided and steadied from the moment it comes into contact with the metal, in which case it is not likely to run to one side at all. If a motion or guide bar requires to have one corner rounded off, as it should have to prevent its leaving a square corner on the guide block, which would weaken the flange of the latter, the corner cannot be marked off, but a gage should be made as shown in Fig. 183, A in the left hand

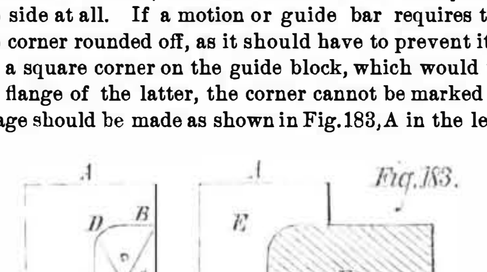
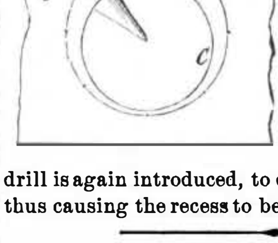


Fig. 183.

figure being a piece of sheet iron, say $\frac{1}{32}$ inch thick, with the lines, B and C, and the quarter circle, D, marked upon its surface. The metal, G, is then cut away, and the edges carefully filed to the lines, thus forming the gage, A, which is shown upon the bar, F, in the position in which it is applied when in use. It is obvious that such a gage will scarcely suffice to get up a very true round corner; this, however, is accomplished by leaving the corner of the work a little full to the gage and then filing it up to the piece of work fitting against it.

Reference having been made to drawing the position of the recess formed by a drill before it has entered the metal to its full diameter, we may as well explain that process. Suppose A, in Fig. 184, to represent a piece of metal requiring to have a hole of the size of the circle, D, drilled in it, and that the recess cut by the drill is out of true, as shown by the circle, C. A round-nosed chisel is then employed to cut, at D, the groove there shown, running from the outside to the center of the recess, and which will have the effect, when the drill is again introduced, to draw the recess toward that side, thus causing the recess to be true with the marks.

Fig. 184.



THE largest flouring mill in America, it is said, is owned by Hon. C. C. Washburn, of Minneapolis, Minn. It is seven stories high, and crowded with machinery from top to bottom. Its cost was $300,000, has 40 run of burrs, and turns out 1,000 barrels of flour per day.