QUORN

TOOL AND CUTTER GRINDER

by D. H. Chaddock, C.B.E.

Part III *From page 71*

IF THERE is an error a square centre or a centre scraper will very quickly pull the hole a few thous in the right direction. This tip may be useful too to crankshaft and eccentric turners who would like to have their throw plates the same both ends. Only a detail perhaps but it all counts.

The wheelhead bracket, Fig. 13, is too large to swing on the faceplate of a 3½ in. lathe but it can be quite easily set up on the saddle for boring the 1⅜ in. hole for the grinding spindle quill as in Fig. 14. There is sufficient metal in the casting to accommodate a range of sizes, say from 1¼ in. to 1½ in. dia. but as the writer has two other spindles with 1⅜ in. bodies this is the size he adopted. The second major operation is to face the flat surface for the motor mounting. A very similar setting to that used for the boring can be used again for this operation, but of course with the casting slewed around at right angles to face a fly cutter held in the four-jaw chuck. Put a true 1⅜ in mandrel (the body of the quill which you have not yet turned does very nicely for this so wait for it!) in the appropriate hole and with

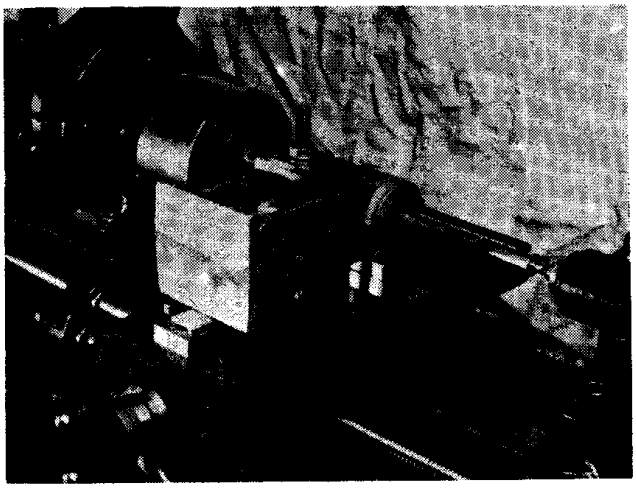


Fig. 14. Wheelhead bracket set up on the cross-slide for boring the 1 3/8 in. hole.

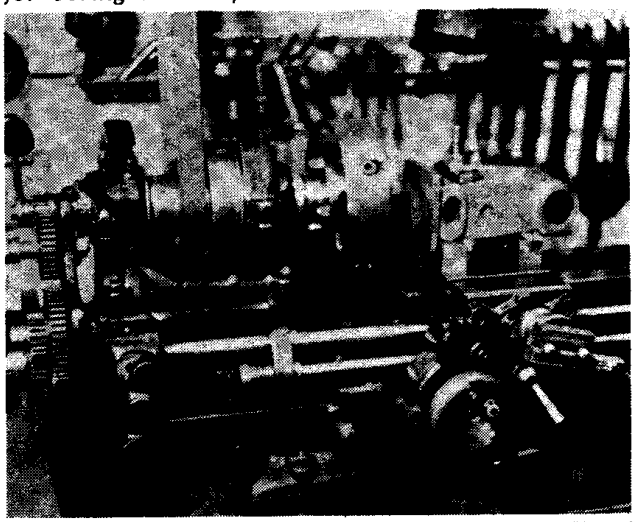
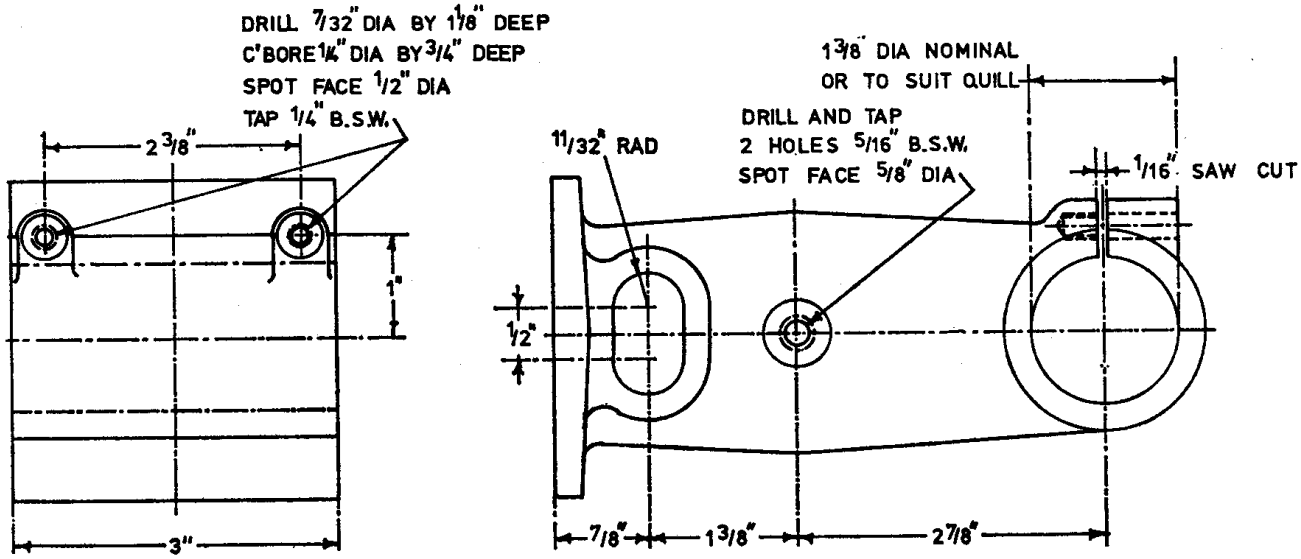


Fig. 15. The lathe set up for facing the wheelhead bracket, using a fly-cutter.



WHEEL HEAD BRACKET 1 OFF CI.

FIG. 13

a D.T.I. held in the lathe chuck make sure it is parallel to the lathe across slide-ways. Not strictly necessary in this job, but one day it may be, so gain the experience now. In Fig. 15 the lathe is in middle speed back gear, about 72 r.p.m. which with a fly cutter set at about 2in. radius gives a cutting speed of about 38 feet/min. The change wheels are giving a feed of about ½ thou per rev, as I find that the best way to reap off cast iron with a light and somewhat elderly lathe is with a slow speed, a fairly deep cut, say 1/10 in. deep and a steady feed. Not to worry if, as in Mr. Beck's case, the cutter takes off more metal at the back of its cut than at the front. Most lathes do this anyway if, as they should be, they are set to face concave and not convex. Just let the back cut right across the face and it will be as flat as makes no difference. Using this face as a datum the 1 3/16 in. x 11/16 in. slots for clearing the wheelhead collar locking bolt can be put in either by packing up on the saddle or by bolting to a vertical-slide, set parallel of course to the lathe axis. Owing to the draft on the casting some cleaning up of the inner faces of these bosses may be necessary before the wheelhead collar casting can be interposed between them. The other operations, including cleaning up the bosses upon which the micrometer adjustment screws will bear, are conventional.

As in the case of the wheelhead collar, and for the same reason, particular care needs to be paid to the positioning of the 5/16 in. tapped holes which take the centre screws and upon which the assembly rocks. So first drill them undersize to fit any convenient piece of silver steel. With this in place, the 1⅛ in. mandrel in the quill hole and the job on a surface plate check with a D.T.I. that both bars are free from "warp and wind" (more cheers from Derek Beck). Unless you are extraordinarily lucky they won't be, so draw them in the required direction with a round file, redrill to fit the next larger size of silver steel and try again. Before you reach 5/16 in. BSW tapping size you will realise just how inaccurate a drilled hole can be! If you can get them to say 0.001 in. in 6 in. you are doing very well indeed.

The other details to complete the wheelhead assembly are the adjusting and pivot screws in Fig. 16. One of the former will also be required for adjusting the rocking lever so make all three while you are about it. Only the tips of the screws need be case-hardened but unless you fear distortion it is no bad thing to case-harden the threads as well to combat the inevitable wear to which all grinding machines are subject. Knurling will be a test of your skill as a turner. Do it before finally parting the screw from the bar while you have plenty of stock to hold it by. Chamfer after knurling to remove the ragged overhanging edges. The pivot screws are kiddies practice jobs because, believe it or not, it is better that the 60 deg. conical points should not be too truly concentric with the screw threads. In the final assembly slight eccentricity here will be used to take out any residual error in the rest of the machining. So if you make them too accurately you may have to make one again deliberately eccentric!

If you have opted for a screwed vertical column, now is the time to make the adjusting nut with its peg and friction pad shown in Fig. 16. The peg finds its own angle to match the spiral lead on the vertical column. On the writer's milling machine and grinder, both of which have this feature, the peg stays in place without any other fastening. If you have any doubt a dab of Loctite will fix it — after it has aligned itself with the thread of course. The idea of the friction pad is to prevent the nut backing off after the wheelhead is locked and the machine is running. As drawn it seems to give about the right friction, but this can easily be adjusted by altering the depth of the saw cuts. So make them rather less deep at first and deepen them until you have got the feel that you like best.

The workhead assembly shown in Fig. 17 comprises four main castings. The base casting shown in detail in Fig. 18 can either be clamped to or slide along the front bar of the machine. In the clamped mode the angular position of the workhead is controlled by the rocking lever which is in turn clamped to it. In the sliding mode the rocking lever also slides along the rear bar which becomes, in effect, the rear shear of the machine. A vertical extension on the base casting carries the tilting bracket, detailed in Fig. 20 which, as its name implies, is the means by which front and side rake is given to the tools being ground. It in turn provides the bearing for the rotating base, to be shown in detail in Fig. 24, which controls the front and side clearance angles and, when free to rotate between stops, provides the axis about which radii are generated in tool and cutter grinding. A boss on the head of the rotating base carries optional long and short bar beds upon which interchangeable tool and cutter holders and a tail centre may be mounted.

Commencing therefore with the workhead base, which is an iron casting, the first and most critical operation is to bore the long 1in. dia. hole a really close sliding fit for the front bar. If your lathe is above suspicion for this kind of work, and mine is not, the procedure indicated in Fig. 19

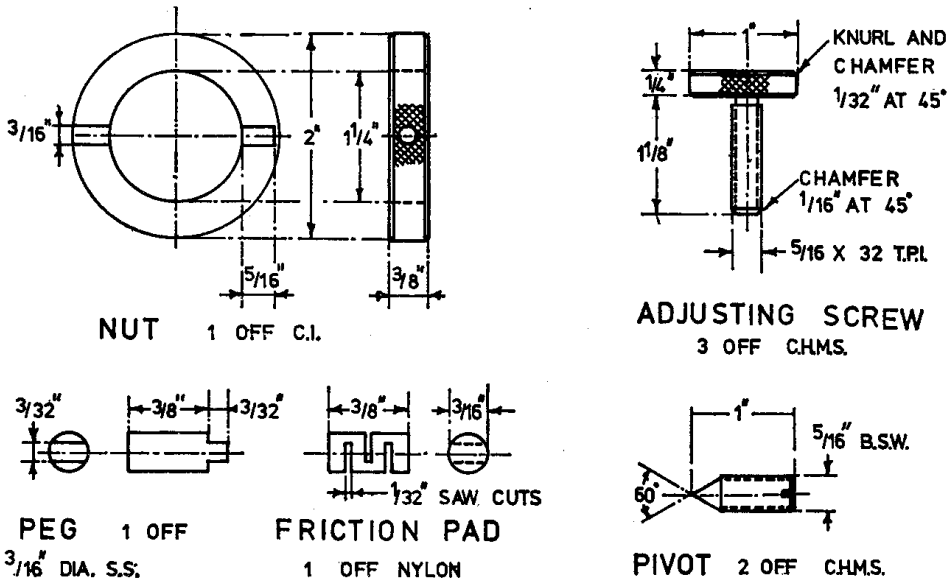


FIG. 16

can be adopted. The casting is held at the boss end in a four-jaw chuck and the far end, after dressing up the edges of the cored hole, supported on a large tail centre, preferably a running one. Sufficient support is then given for the 1.250in. dia. spigot to be turned to the finished length and diameter. The spigot then serves as a truly turned bearing for the fixed steady and in this way the casting is firmly supported front and rear for the long hole boring operation. Here it is essential that the fixed steady is absolutely truly adjusted because if it pulls the casting in the slightest towards or away from the lathe centre line the hole will not be parallel, even if the lathe in normal chuck work has been adjusted to bore parallel.

If you do not fancy this method, the casting can be quite easily clamped to the saddle of the lathe and the hole bored with a boring bar between centres, as was done for the base casting shown in Fig. 5. In this case you have assurance that even if the lathe is not in the pink of condition the hole will be the same size both ends. If boring the long hole is the first operation the second should be to cross drill and split the clamping boss after which, with a jury bolt through the hole it can be readily clamped to one of the 1in. dia. bars as a mandrel for turning the 1.250in. dia. spigot and facing the ends.

The second critical operation is to bore and face the 5/16in. dia. hole which carries the pivot bolt for the tilting bracket as accurately as possible truly at right angles to the long 1in. dia. hole. Although the casting has at its back a chucking piece it cannot, because of the mould-

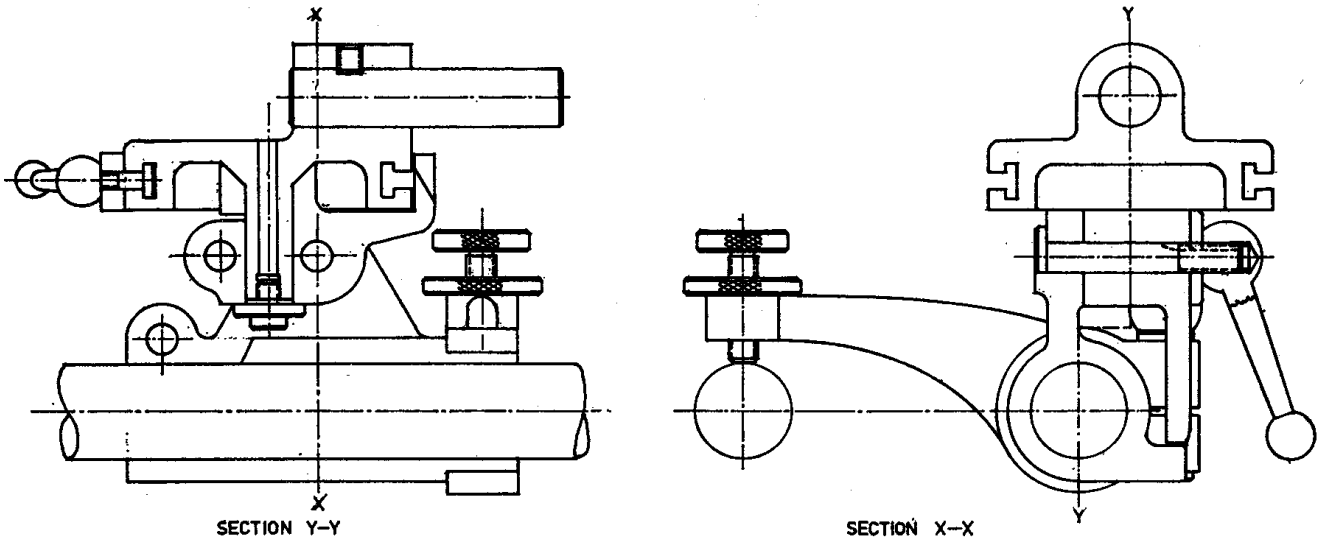
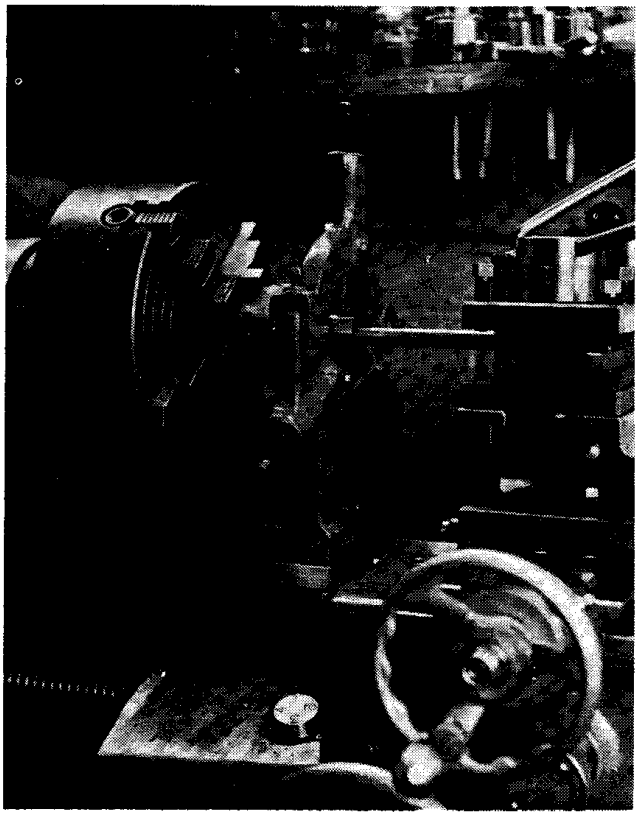


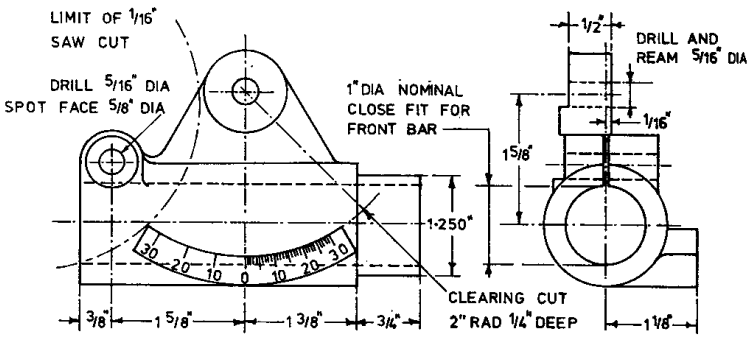
FIG. 17. WORKHEAD ASSEMBLY

ing draft, be held securely in a chuck. So first file three or preferably four parallel flats on it so that it can be held, without shake or wobble in either a three- or four-jaw chuck. Put one of the 1in. dia. ground bars in the already bored hole and in a "turn around test" with a dial test indicator held in the toolpost or on the saddle check that the reading is the same both ends. It won't be, so you will have to draw the flats on the chucking piece until the error is reduced to reasonable proportions, say .001in. at either end. This is a very sensitive test and will serve to demonstrate that just grabbing a casting by the chucking piece and hoping for the best is not conducive to precision work. It is there for convenience in holding, not a jig to ensure accuracy. That you have to put in yourself.

Once truly chucked, the 5/16in. dia. hole can be rough drilled, trued with a small boring tool and reamed to size. Take particular care that the face against which the tilting bracket seats is faced as truly as possible, slightly concave but never convex. The clearing cut for the pointer and facing the surface on which the protractor scale will eventually be engraved involve interrupted cuts so take it steadily, middle back gear, preferably with autofeed. Before breaking down this setting and while the surfaces are still running true it is very convenient to engrave the protractor scale and stamp the numbers. This will be dealt with in detail in connection with the rotating base and is the same for all the scales with which this machine is equipped. After it is complete the chucking piece will be machined away in the process of milling the seating for the locking bolt.

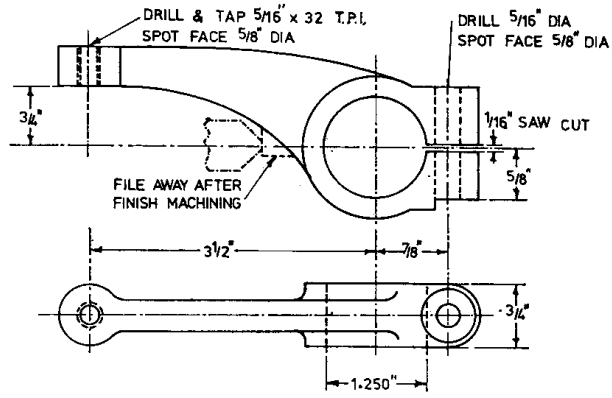
Fig. 19. Boring the long 1 in. hole in the workhead base. (Photograph: N. Hemingway.)





WORKHEAD BASE 1 OFF C.I.

Fig. 18.



ROCKING LEVER 1 OFF C.I.

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Fig. 20.