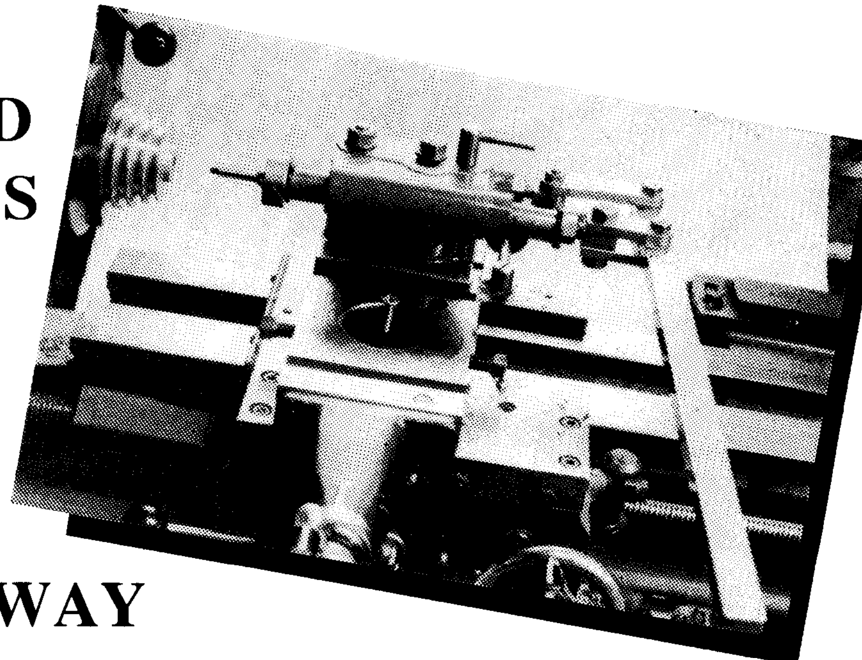
ARNOLD THROP'S NEW KEYWAY SLOTTING ATTACHMENT



CUTTING INTERNAL KEYWAYS in the home workshop is an operation for which no specific equipment has been available for a long time, and never on a low-cost basis.

In the construction of model steam locomotives few keys are used, but there are more in stationary steam engines, internal combustion engines, and quite a lot in traction engines.

Various writers on model engineering have recommended fixing a tool similar to a parting tool, on its side in the lathe, and actuating it by racking the saddle to and fro with the handwheel used for rapid traverse. This is a tedious and somewhat arduous process, since the gearing ratio of the saddle rack and pinion mechanism is really too high for driving a cutting tool, and the handwheel is too small to get either adequate leverage or a comfortable grip.

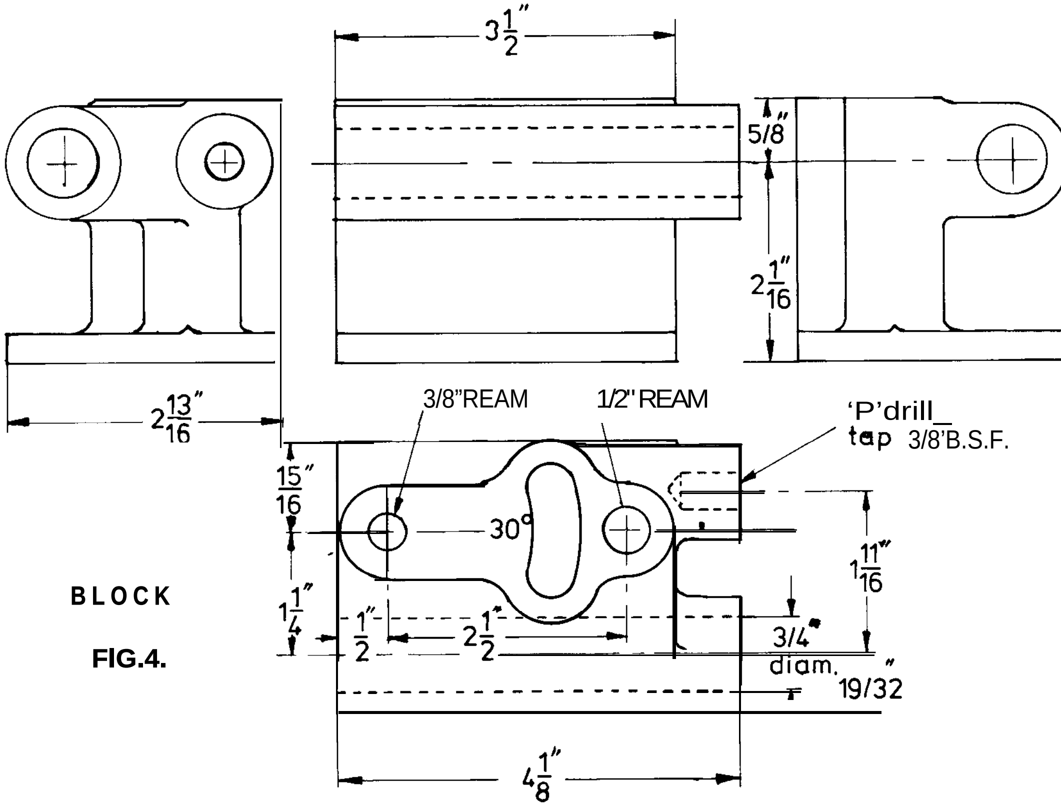
The line of thrust of the tool is by no means over the saddle guides or the rack, so there is friction due to this off-set. A few model engineers have designed for themselves, and fitted up, lever mechanisms to reciprocate the top slide. But this method means partly dismantling the slide, removing the screw, fixing the extras, and after doing the job, going through all the process in reverse. Rather time-consuming, proportionately high if only one keyway is to be done and. like the saddle-racking method it provides no satisfactory tool setting procedure,

A good many years ago a lever operated attachment was made commercially, but for various reasons it worked out to be rather expensive, and never caught on, so only a very few units were ever completed and sold. The design of the attachment had some good features. and the workmanship was excellent, but it was rather elaborate as the designer had intended it to be fairly "universal".

For example it had a built-in vertical slide. to adapt it to lathes of different centre height,. The cylindrical tool-carrying ram moved in a casting which swivelled on a horizontal pivot, a feature which added its quota to the cost. I could never see practical justification for this, nor indeed a method of usage.

There was no stop pin or any device to set the ram in the horizontal position with accuracy, so to get it level meant using a scribing block and dial gauge on each end in turn. A tedious procedure, as each tightening of the securing nut carried the ram slide casting with it to some degree through friction of the parts, making fine rectification necessary but difficult.

However, using an appliance leads one to an



BLOCK

FIG.4.

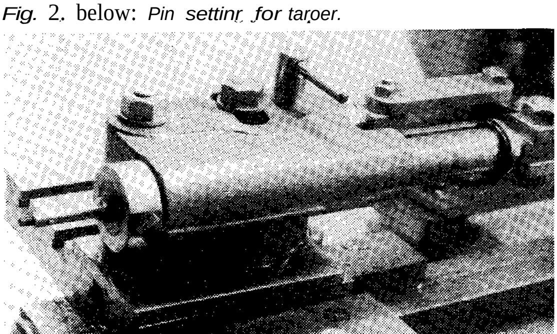
understanding of the good points and the faults, and the basic essential needs of the operation. For use on any one lathe the vertical slide feature is superfluous. Now that there are so many thousands of ML7 and Super 7 lathes in the hands of model engineers all over the world, there seems justitication for an appliance for these, even if it will fit no other.

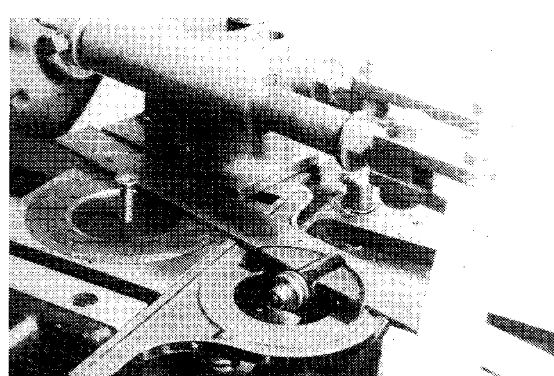
With this thought in mind I have designed a keyway slotting attachment which fits on the boring table, with just two bolts, and needs nothing dismantling to admit of its use. It has built-in setting devices for keyways of parallel or taper form, inclined either way, in parallel bores. It will also serve for keyways in taper bores up to I5 degrees a side, either way.

The design also reduces the difficulty of making and accurately setting the cutting tools. A cutter bar is mounted in an axial hole in the ram, which is exactly at centre height in a hole bored on the lathe itself. A cross hole for the tool bit is drilled on the lathe too, so this is exactly at centre height. The round tool bit can have the same amount ground off each side to keep the cutting form central in the bit, and this is the only task dependent on the skill of the worker.

fig. 3, *right: Setting thr block by protrcrctor.*

Fig. 2. below: *Pin settinr for taroer.*





Instructions will be given on how to achieve this with the minimum of error, though if a Quorn grinder is available, this last operation also becomes a precision machine process.

The complete attachment is shown in Fig. I.

A detailed description of the hardware which achieves the objectives set out above now follows. A cast iron block sits on the boring table, and has a 3/4 in. hole in which a cylindrical ram slides. As the block is bored on its own lathe the ram is inevitably parallel with the boring table, and at the centre height of the spindle. A hand lever is provided to work the ram to and fro, and has a leverage ratio of nearly 8 to I, SO there is plenty of power available to overcome the cutting resistance.

The block is fixed to the table by two 3/X in. bolts, one of which acts as a hinge pin for swivelling the block. The other comes through a curved slot, long enough to provide I5 degrees swing each side of the straight position. Through another hole, l/2 in. dia., a long pin is dropped, which at the bottom is reduced to 3/S in. dia. to fit the table slots, and this part is eccentric to the rest of the pin. At the top a small indicator pin is fitted in line with the eccentric centre.

With this pin parallel to the lathe bed the cylindrical ram is also parallel to it. Moving the indicator pin to front or rear rotates the eccentric and swings the block out of parallel. Thus, in the central position, the keyway is cut parallel to the lathe spindle, as is needed for a Woodruff key in a parallel shaft. With the eccentric thrown over, the keyway in a parallel bore will be tapered, which is right for an ordinary sunk key or saddle key that has to fit on the tapered top.

According to the way the indicator pin is placed the keyway will be big at the tailstock end, or big at the headstock end. Thus there is no restriction on which way the component has to be mounted in the lathe, so far as concerns the keyway. Either way is right. Fig. 2 is a close-up showing the pin set to give the large end of the taper at the mouth of the hole.

The British Standard taper for square and rectangular keys is l/8 in. per foot of length, which is very satisfactory in industrial machinery. But in model components, where the length of a keywayed bore may well be as little as 3/8 in. or even l/4 in., such a fine taper is hardly discernible. I have therefore dimensioned the eccentric so that it will give a taper of 3/16 in. to the foot. Setting the pin more eccentric when turning it can provide a bit more taper if anyone wants to have it.

But cases do arise where components such as propellers, flywheels, sprockets, levers, etc. are mounted on taper shafts. For these the keyway must follow the surface of the conical bore and be the same depth all along. The key used is then either a feather key (round-ended) or a Woodruff key, and in this application there would be clearance on the top of the key. Provision is made in this attachment for dealing with taper bores of this kind. By lifting the eccentric pin out of engagement with the table slot, the block can be swivelled over to suit taper bores up to IS degrees a side, which will cover almost any design of model component.

The edge of the base of the block is machined parallel to the ram bore, so that the block can be readily set to any desired angle with a protractor from this edge to the edge of the boring table. Fig. 3 shows this being done. Following this description of the appliance we can turn to machining of the components.

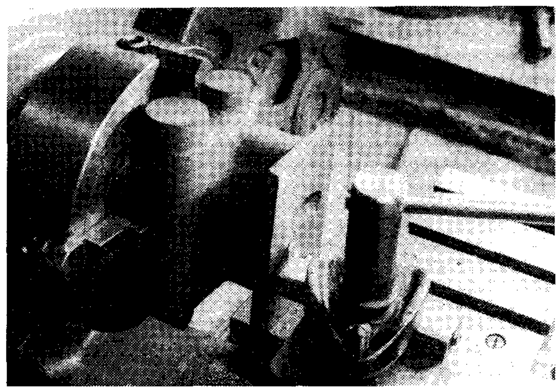


Fig. 5: Machining the block.

Block

This is shown in the drawing Fig. 4. It will best be gripped in the four-jaw chuck with two jaws reversed, and one goes snugly into the gap between the two bosses as shown in Fig. 5. After facing the bottom, reverse it and change the jaws back to face the top as in Fig. 6.

Care should be taken to get the faces parallel but the exact thickness is not important. Clamp on the boring table on packings as shown in Fig. 7 and end mill or flycut the setting edge until it cleans up. Flycutters, which can so easily be re-sharpened, are preferable to end mills for working on rough castings like this.

Now clamp the casting to an angle plate. letting the machined edge rest on parallels, chalk across top and bottom faces, as shown in Fig. 8. Scribe a line at the centre of the facing on the top of the casting and continue it round the other side, then mark the position of the bolt and pin holes on the bottom side of the casting. Fix the casting on the vertical slide as shown in Fig. 9, with some packings interposed, and drill and ream the two holes.

Then bolt the casting on the boring table with the setting edge at the front, and square it with the edge of the table. Flycut the end to clean up an area

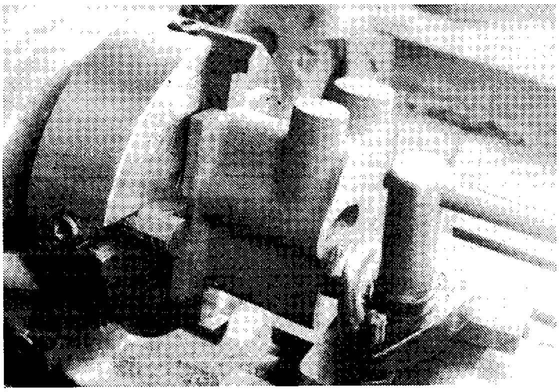


Fig. 6: Facing top of block.

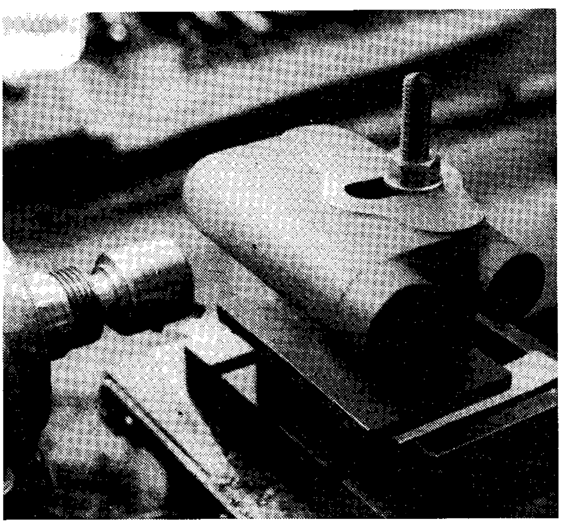
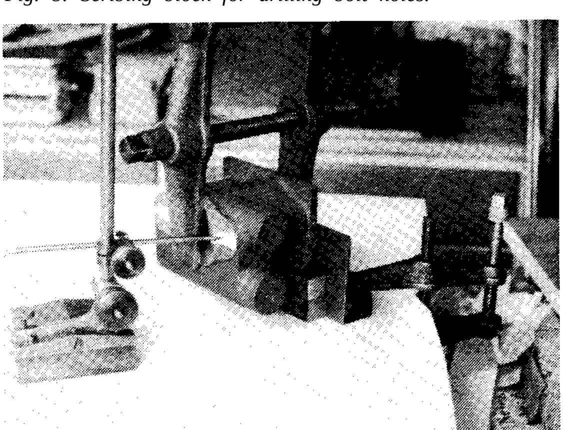


Fig. 7: Flycutting setting edge of block.

Fig. 8: Scribing block for drilling bolt holes.



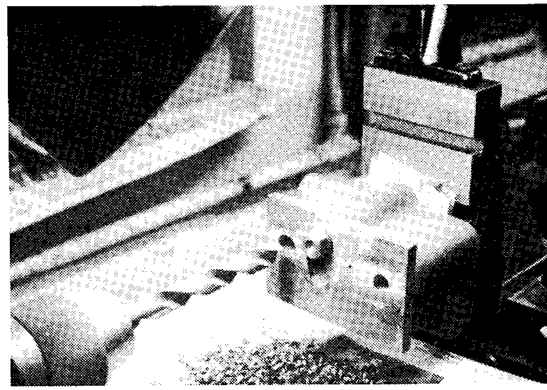


Fig. 9: Drilling bolt holes.

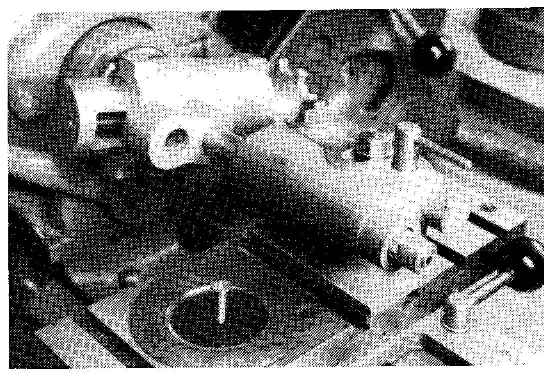


Fig. 10: Completing the boring operrrtion.

about the same size as the larger boss. Mark the centre of the hole for the ram, l/2 in. in from the front of the casting, and cross wind the table to pick up this centre with a vee-pointed D-bit or a very short drill well nicked to thin the web at the end.

Start the hole with this tool and then follow with the smallest drill of whatever length will pass through the 41/2 in. of metal. A new drill 23/64 in. or metric 9.10 mm or larger will serve. Then open out in stages with what drills are available. If the hole can be taken to 5/8 in. or a bit more there will be no need to make a small boring bar, as the standard 5/8 in. used in the Dore boring head will go through if set concentric with a tool bit projecting 30 or 40 thou from an angular hole.

At this stage a suitable speed will be next to bottom in gear with a feed of about 7 thou per rev. Later at the finishing stage the slowest speed and a finer feed will be better. But there is a nominal 1/16 in. a side to be removed to reach the 3/4 in. of the ram, so a few cuts will be needed.

It is,important not to go oversize, so care will be required when the final size is approached. Fig. IO shows this operation just finishing. After this is done turn the block round, pick up the centre of the solid boss at the other end, and drill letter "P" drill. Tap in. BSF.

To be continued