

AN INTERNAL

KEYWAY CUTTER

By "Duplex"

THE commercial method of cutting internal keyways, by means of either a slotting machine or suitable broaching equipment, is hardly likely to be adopted in the small workshop for lack of the necessary tools. The old-time way of forming these keyways, with cold chisel and file, calls for the skilful use of hand tools, and is not much in favour in the present machine age, but we can recall occasions on which this was, in the circumstances, the only way of getting the work done.

In previous articles, we have described cutting internal keyways in pulleys and collars by adapting the lathe to serve as a hand-operated shaping machine; this method, although somewhat laborious, has the advantage that two or more keyways can be accurately spaced by indexing the work from the lathe mandrel.

However, if the workshop is equipped with either a hand or a power shaping-machine, a single keyway can be readily cut to a high degree of accuracy.

A job of this kind was done recently in the shaping machine when making a two-step belt pulley for an electric motor. Here, a keyway, $\frac{3}{16}$ in. wide, $\frac{1}{8}$ in. deep, and $1\frac{7}{8}$ in. in length, was cut in the bore, measuring $\frac{5}{8}$ in. in diameter.

Making the Tool

The special tool required for this purpose is best made in two parts: the shank, and the arm with its inset cutter-bit. The arm should be of as large a diameter as possible in order to avoid springing under the

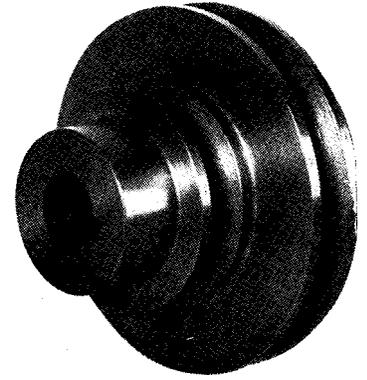


Fig. 1. The finished pulley

pressure of the cut; this part is made a light press-fit in the shank, and is secured with a nut. The size of the shank will, of course, depend on the capacity of the machine's tool-holder, but robust construction is advisable to maintain rigidity.

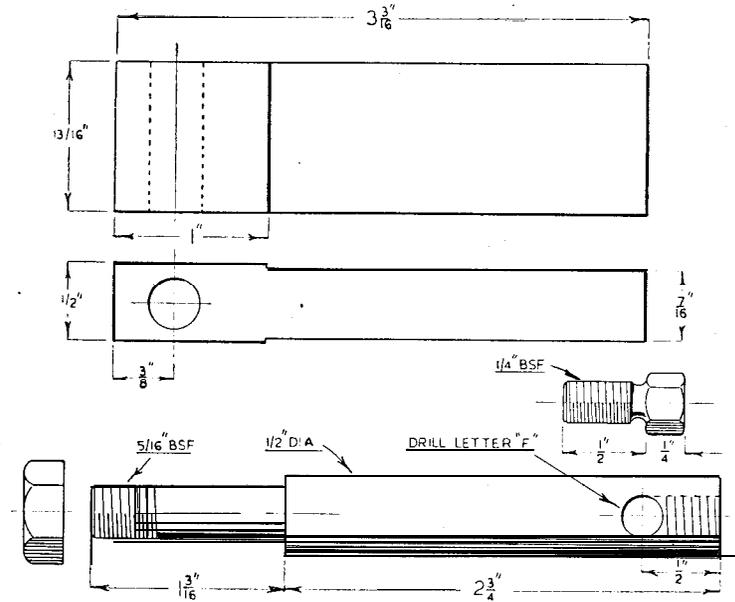


Fig. 3. The components of the keyway cutter

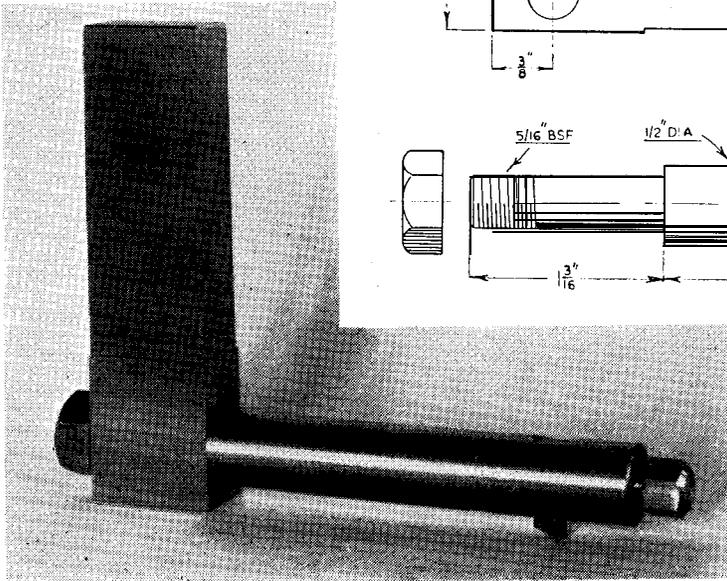


Fig. 2. The internal keyway cutting tool

The inset tool-bit, illustrated in Fig. 4, was ground to shape from a piece of 1/4 in. square high-speed steel, and its length was adjusted so as to cut the keyway to the finished depth while remaining fully supported in the arm. As the tool cuts in the forward direction, the back of the cutter-bit must be given support against a flat seating, to prevent tipping when under pressure. In the working drawing, the machined seating for the tool is shown as a drilled hole, but this seating was finished to size in the following way. After the arm had been cross-drilled with a letter "F" drill, a flat was filed at the mouth of the hole on its back surface in order to form a lead for the tool-bit. This allowed the cutter to be started

in the hole and afterwards forced for its full length into the arm by applying pressure in the vice.

In this way, the tool itself, acting as a broach, formed a seating with two small flat surfaces for supporting the back of the cutter.

The tool should be ground with the adequate clearances shown in the drawing, but top rake is generally best avoided, as it tends to make the tool dig into the work.

The pressure-screw should be accurately made, and provided with a flat surface at the tip, so as to

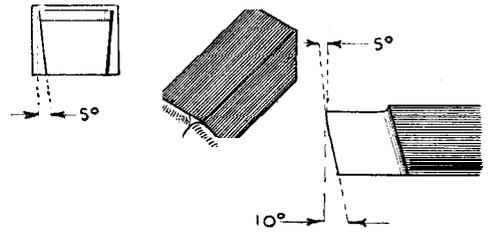


Fig. 4. Showing the form of cutter-bit used

give the maximum support to the tool. Some workers prefer to draw the tool through the work when cutting a keyway and, if this method is adopted, the cutting pressure will then be against the tip of the screw.

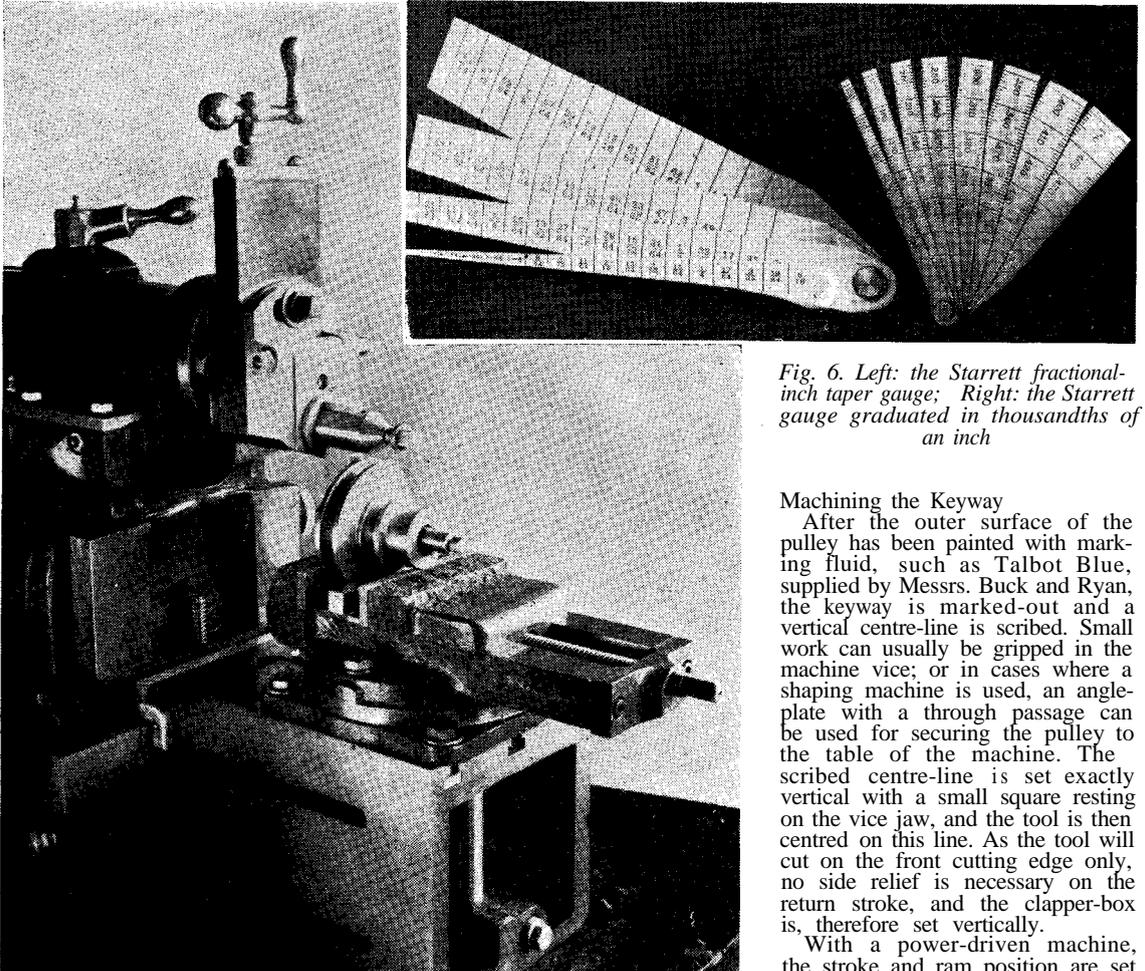


Fig. 6. Left: the Starrett fractional-inch taper gauge; Right: the Starrett gauge graduated in thousandths of an inch

Machining the Keyway

After the outer surface of the pulley has been painted with marking fluid, such as Talbot Blue, supplied by Messrs. Buck and Ryan, a vertical centre-line is scribed. Small work can usually be gripped in the machine vice; or in cases where a shaping machine is used, an angle-plate with a through passage can be used for securing the pulley to the table of the machine. The scribed centre-line is set exactly vertical with a small square resting on the vice jaw, and the tool is then centred on this line. As the tool will cut on the front cutting edge only, no side relief is necessary on the return stroke, and the clapper-box is, therefore set vertically.

With a power-driven machine, the stroke and ram position are set to enable the tool to clear the work at either end.

Fig. 5. The pulley set up for machining in the shaping machine

TEE VALTOCK AUTOMATIC BLOWLAMP

Although, when machining a batch of parts, it may be an advantage to make the cutter-bit the exact width of the finished keyway, it is perhaps better to work with a rather narrower tool; this will avoid chatter where the machine lacks rigidity, and will also enable keyways of various widths to be cut with a single tool.

A series of cuts is first taken to the full depth of the keyway, and the depth can readily be measured with a Starrett taper gauge of the kind illustrated on the left of Fig. 6; that is to say, the gauge is inserted in the bore and the diameter of the original bore is subtracted from the measurement obtained. Another method is to put a plug in the bore and then make a direct measurement with the gauge. After the correct depth has been reached, the reading of the micrometer index on the tool slide is noted. The width of the keyway can also be measured with a gauge of similar type; that illustrated on the right of Fig. 6 is a Starrett taper gauge graduated in thousandths of an inch. To machine the keyway to the full width, an equal amount of metal is removed on either side of the centre-line.

For this purpose; the micrometer index on the table slide is referred to, but any backlash present in the feed must, of course, be taken into account. If the table slide is locked, the amount of backlash in either direction can easily be determined on turning the feedscrew. For accurate machining, and to prevent chatter, it is important to adjust correctly the foot fitted to the overhanging end of the table; this support checks any tendency for the table to tilt downwards under the pressure of the cut, but is usually omitted in small, hand-operated machines.

With a little practice, quite accurate fitting can be done in the shaping machine and, in the present instance, the keyway was cut exactly at right-angles to the diameter of the bore, and the key itself was a light press-fit in the finished seating.

Tool-bits of the Eclipse brand are supplied heat-treated and ready for use; those of 3/16 in. and 1/4 in. square section are obtainable in lengths of 2 in. and 2-1/2 in. respectively.

As the tool-bit for the present toolholder is only some 5/8 in in length, the material will have to be cut to the finished length after the point has been ground. For this purpose, the tool is either nicked on the grinding wheel, and then broken off, or a special cut-off abrasive wheel can be employed.

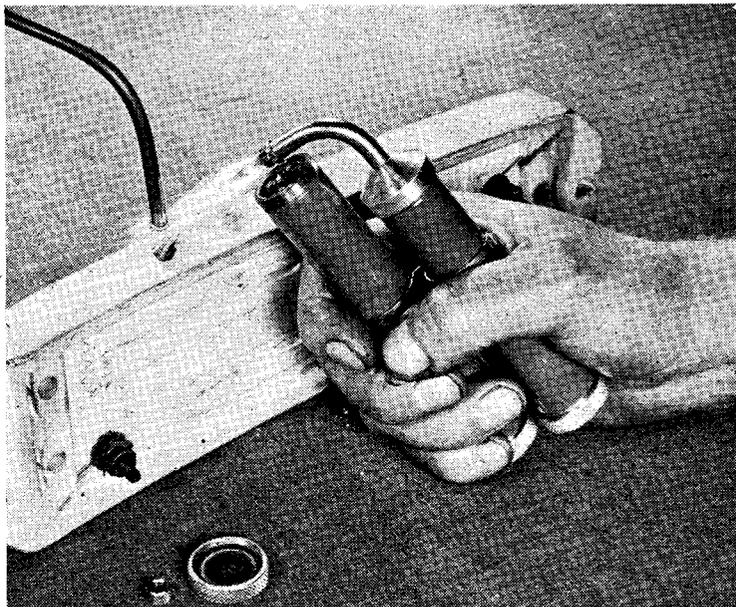
A NEW type of miniature blow-lamp to work on methylated spirit has been introduced by Valtock Ltd., 5-6, Sherwood Street, Piccadilly Circus, London, W.1, and is obtainable from most tool dealers. It is of the self-blowing vaporising type, and its design enables a high pressure to be obtained at the jet nozzle, resulting in a concentrated high-intensity flame. No pumping is necessary to obtain the pressure, and the vaporiser is of a simple type which cannot clog or carbonise.

The blowlamp consists of two cylindrical containers, both of which can be completely sealed, so that it does not spill when carried in the pocket or tool, kit; these are held parallel to each other by a spring clip which allows of lateral individual adjustment. Both cylinders contain wicks, one having a plain cap, while the other terminates at the top with a bent tube, having a fine jet at the outlet, which can also be capped when not in use. In use, the cap is removed from the first cylinder, and this is used to form a pilot heater for the jet tube, causing vapour to be generated in the second cylinder under the pressure of its own expansion. As the vapour escapes from the jet it is ignited by

the pilot flame and burns with a smokeless, almost non-luminous high temperature flame.

This is an extremely useful appliance for many operations within the sphere of the home workshop, including soft-soldering and sweating, light silver-soldering, glass working, etc. It should, however, be remembered that while the actual temperature of the flame which it produces is extremely high, it is small in volume, so that the actual quantity of heat it produces is less than that of a larger flame of lower intensity. We mention this, not as a criticism of the device, but because inexperienced operators often attempt to use small gas or spirit blowpipes for large work which is definitely outside their capacity, or without taking precautions to conserve and prevent dissipation of heat. The Valtock blowlamp will silver-solder small fittings, but cannot be expected to cope with a boiler.

The appliance is very well made and finished, the cylinders being of solid brass tube with screwed-on caps, no soldered joints being used. It weighs only 5-1/2 oz. and is 5-1/2 in. in overall height; all parts are interchangeable, and spares can be obtained if and when required.



The Valtock blowlamp in use, silver-soldering a 1/4 in. Pipe nipple