CHAPTER 6

Servicing the Tools

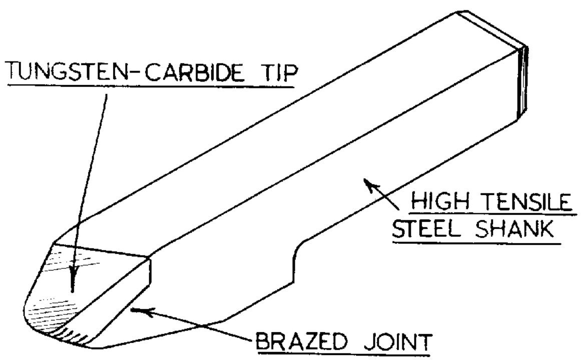
AS WITH ANY other machine tools the condition of the cutters used with it is of the utmost importance. No good work can be produced on a machine whose tools are blunt, so the shaper is no exception to the necessity for keeping them in good fettle.

In the previous chapter the various types of tool for use with the shaper have been discussed, but nothing has been said as to the various materials from which they can be produced.

As has been seen, many of the tools applicable to lathe work can be used in a shaper so a whole battery of special equipment designed specifically for it is really not needed.

In the past commercially produced sets of lathe tools tended to be made from carbon steel, a material of fair durability and capable of easy forming, hardening and tempering generally by the machine operator himself. However, its inability to remain sharp for long periods and its proneness to lose its temper when the cutting edge is subjected to conditions generating much heat, has led almost universally to the adoption of high-speed steel for the making of the necessary cutting tools.

Fig. 1 The Tungsten Carbide Tool



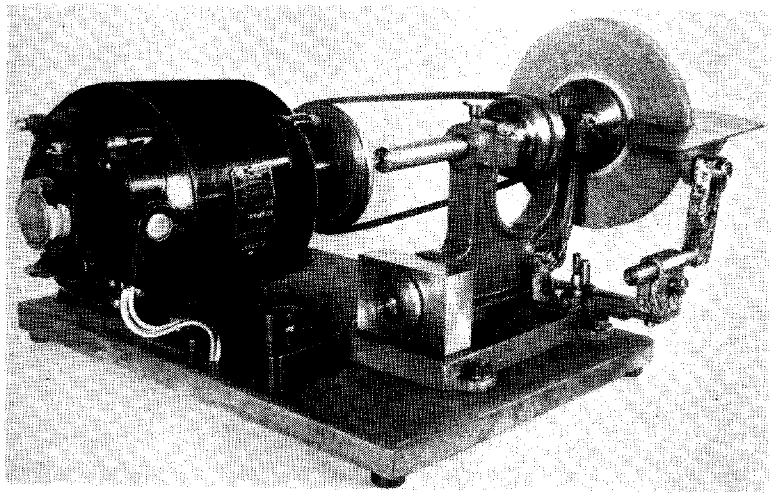


Fig. 2 Electric Grinder with Angular Rest

The use of high-speed steel has ruled out the operator as the initial producer of the tool itself, since he has neither the knowledge nor the equipment to do so. However, he can be expected to keep it sharp once handed to him, a matter to which we shall presently refer.

The carbon steel tool, on the other hand, although it suffers from the limitations that have been mentioned, can, as has been said earlier be formed by the operator himself when needed.

Both carbon and high-speed steel tools are satisfactory when machining drawn or rolled materials. When it comes to dealing with castings, however, the surface sand inclusion or in the case of cast iron, the chill spots (that is local hardening) often encountered immediately destroy the sharp edge of tools made from either carbon or high-speed steel. It is then that tungsten carbide can be employed with advantage to remove the surface material from the castings.

Tungsten Carbide

Tungsten carbide is a sintered product of great hardness capable of cutting through the surface of a casting without losing the edge sharpness of any tool made from it. The carbide, for the most part is formed into tool shapes that are themselves grafted on to steel shanks by a brazing process. In this way the minimum of expensive material is used and the tool as a whole is given adequate mechanical strength. The arrangement is depicted in the illustration Fig. 1.

The brazed joint can be made by a simple silver soldering process and this is usually adequate for most of the operations carried out by the amateur and in the small professional workshop. But it must be remembered that like many another metal cutting machine, the shaper operates with a series of interrupted cuts, that is to say the load on the tool itself is applied at its maximum during the cutting stroke and then is relieved suddenly when the ram reverses. This action tends to break the brazed joint, and has led industry to experiment with improved methods of brazing designed to prevent the carbide tips from detaching themselves under conditions that might prove dangerous.

Nevertheless, the owner of a shaping machine would be well advised to provide himself with at least one carbide tipped tool for use in the initial stages of machining a casting.

Other composite-material tools such as "stellite" are intended for heavy machining and are not likely to be of much import to the amateur user.

Grinding and Honing

Sharpening the tools for the shaping machine can be carried out in two ways. Firstly, when the tool is seriously blunted it must be reground on a suitable abrasive wheel. Secondly, if the cutting edge has become dulled, the tool can often be restored to its former efficiency by simply honing the cutting edge with a hand stone, a practice that can be employed with advantage following the grinding operation.

The information contained in Chapter IV relating to the various types of tool in use includes the angles to which the tools should be ground in order to obtain maximum serviceability. In industry the angles are often imparted free hand. Whilst the professional worker can often achieve success in this respect, the amateur needs some assistance in the matter. For the most part the tool rests fitted to grinding machines are fixed. This limits their versatility and involves the user canting the tool during the grinding operation and judging the angle by eye as he does so.

However, this difficulty can be remedied if the tool rests are made so that they can be fitted at any angle required. The fitting of an angular rest to a tool grinding machine is work for the user himself for there seem to be no commercial examples available.

An electric bench grinder with an angular rest is illustrated in Fig. 2. As will be seen, the table of the rest, which supports the tool during the grinding process, can be set and locked at the required angle for servicing the tool in need of treatment. Tools are ground on

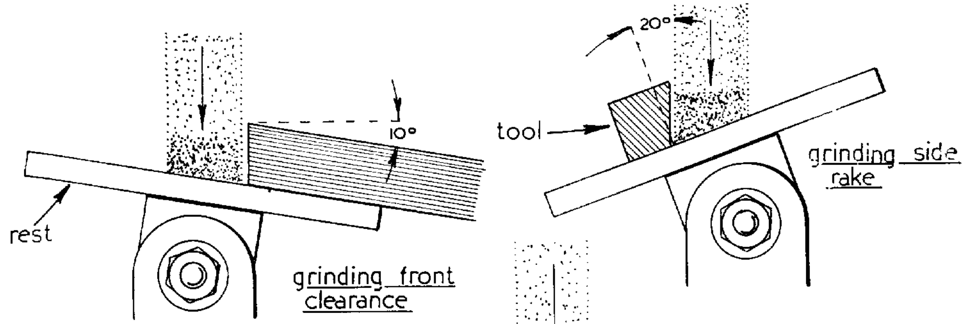


Fig. 3 Using the Angular Rest

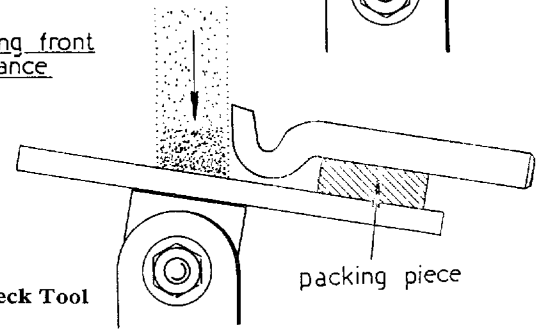


Fig. 4 Grinding a Swan-Neck Tool

the side of the wheel, either side being used according to the handling of the tool, and the rake or clearance angles to be imparted to it. A diagrammatic example to illustrate the method is given in Fig. 3.

Grinding Swan-neck Tools

Tools that are straight-shanked are placed directly on the table of the rest. Swan-neck tools, however, do present some little difficulty but this is easily resolved if the procedure depicted in Fig. 4 is employed.

Here, the tool is supported on a packing piece so that the swan neck can clear the surface of the table itself. A loose packing piece will serve if only the odd tool needs grinding; should there be a number of tools to deal with, however, it would be advisable to make the packing a fixture that can be removed or replaced as necessary.

It will have been observed that the tool needs to be ground on one side of the wheel or the other according to the tools handling. If much tool servicing is likely to be undertaken then an angular rest of the type illustrated in Fig. 5 may be found convenient. The construction of this form of rest will be apparent from the illustration where it will be seen that there are in effect two separate angular rests that may be set and locked at the requisite angles. In this way re-adjustment of the grinding rest to accommodate handed tools is avoided.

It is somewhat pointless to provide working drawings for the device as detail dimensions will obviously depend on the particular grinder involved in the application.

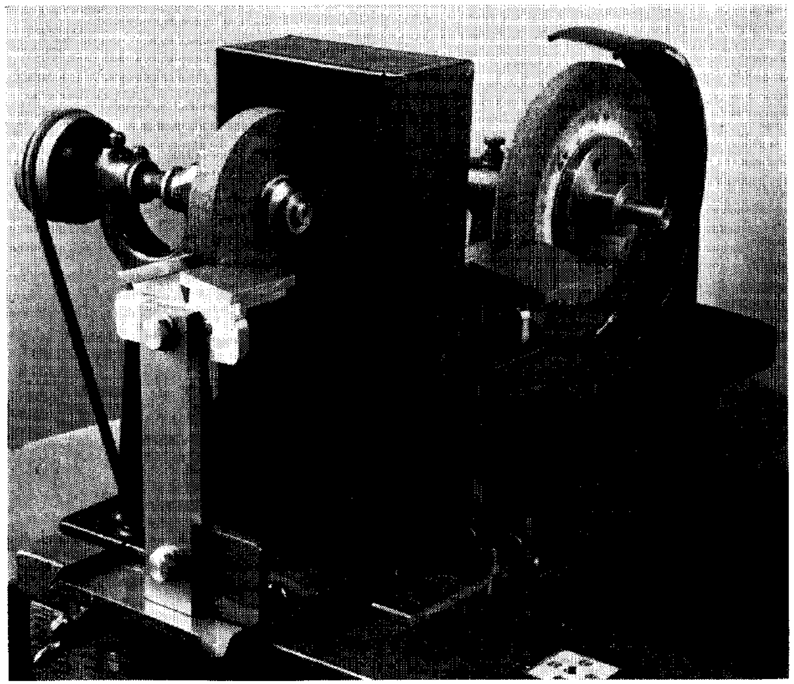
Grinding Wheels

Recommendations on the class of grinding wheel to be employed for tool grinding have been given elsewhere in the past notably in *Lathe and Shaping Machine Tools*, *The Novices Workshop* and *The Amateurs Workshop*, all published by Model & Allied Press Limited.

However, to recapitulate some of the advice given in these manuals, if possible a pair of grinding wheels should be provided; one for rough grinding and forming when needed, the other for finishing.

For roughing out a 60 grit wheel is commonly employed, whilst finish grinding is best carried out on a wheel composed of abrasive grains designated 80 grit. If the workshop is normally involved in the turning of small and delicate components then a 100 grit wheel may be advisable.

Fig. 5 Modified Angular Grinding Rest



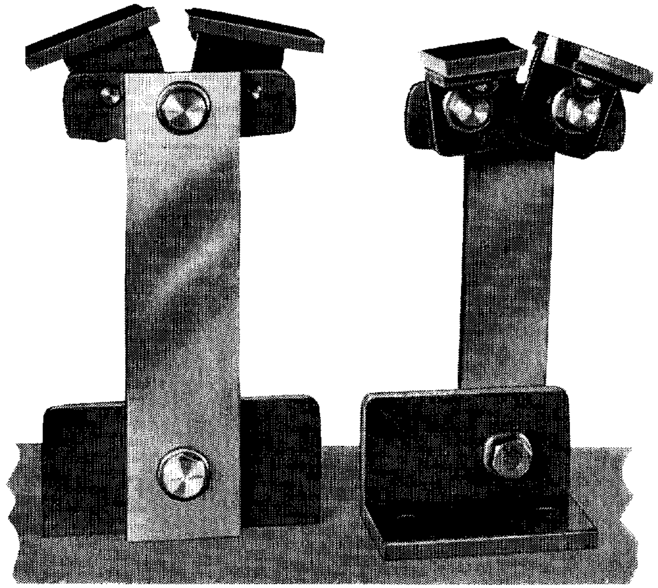


Fig. 5A Showing the construction of the Rest

Grinding Wheel Speeds

In the small workshop the grinding wheels are usually mounted on the spindle of a bench machine running at 3,500 r.p.m., the correct speed for wheels of 6 in. diameter and giving to them a cutting rate of 5,500 surface feet per minute approximately, this being the rate commonly recognised as being the most efficient for all general purposes.

For those who use or contemplate using wheels of a diameter differing from the example given above, the following table may be of interest:

Wheel dia. in inches	Speed r.p.m.
3	6,000
4	4,500
6	3,500
8	2,200
10	1,750

Grinding Tungsten Carbide Tools

Carbide tools cannot be properly ground on the abrasive wheels normally used with off-hand grinding machines. They can, however, be sharpened with an abrasive wheel known as a green grit wheel.

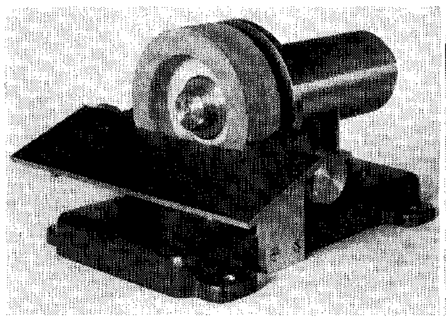
Industrially a wheel of this type is used for rough grinding, and is followed by a diamond impregnated wheel to impart the fine edge necessary for some work. Nevertheless, the green grit wheel, if well lubricated with a thin mineral oil, will provide a sufficiently keen edge for dealing with work in the small workshop.

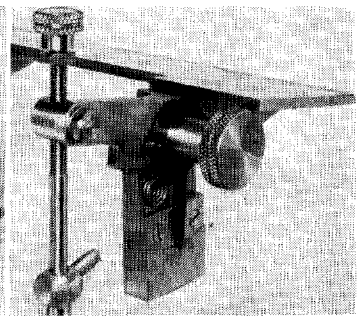
When grinding tungsten carbide tools one should remember that the material itself has little mechanical strength. Therefore on no account should these tools be ground on the rim of the wheel since grinding in this way produces undercutting that weakens the cutting edge.

The friability of the carbide material makes a special grinding technique essential, in which the direction of the wheel is downwards toward the cutting edge and NOT away from it. To achieve this requirement a cup wheel needs to be used, with a hinged tool rest set across the face of the wheel and a driving motor that can be reversed. In this way the tool can be presented in such a way that the wheel always cuts downwards. A typical grinder used for servicing carbide tools is illustrated in Fig. 6.

Fig. 6 Grinder for Carbide Tools

Fig. 6A Showing the Angular Adjustment for the Grinding Rest





CHAPTER 7

Installing the Machine

WHETHER THE SHAPER is hand or machine powered, it is essential that the stand prepared for it is strong and capable of holding the machine firmly. This requirement is particularly important in the case of hand-powered machines where a firm foundation will make all the difference between being able to take a heavy cut and being reduced to light working only.

When Drummond Brothers were in production with their shaping machine it was possible to obtain a heavy cast iron stand for it. This stand was so designed that the column supporting the machine was set well back on a footing of quite large area. In this way the stand itself could cope with all the forces normally acting in a shaping operation, and the foundation bolts, if used, merely served to retain the machine in place. The Drummond pedestal could be obtained in two heights, one for working standing up the other for operating the machine sitting down.

This was an important alternative provision, and one that had a profound bearing on the installation generally. Before mounting the shaper then, one must first decide if it is to be used with the operator standing or, alternatively, with him sitting. For the first position a mounting on a work bench of normal height is, for the most part, quite satisfactory. To obtain a comfortable working height when sitting however, it is possible to make a "dummy run" with the machine set up on a wooden box and packed up till the situation is satisfactory. A firm mounting can then be constructed to suit the conditions so found. Wooden benching to support machines should at all times be amply strong and well braced. If the bench is free standing the legs should be made from 4-in. square material and the top from 9 in. by 2 in. deal planking. The framing, tenoned into the leg mortices, should be from $1\frac{3}{4}$ in. to 2 in. thick to allow ample room for the wooden keys that hold the frame together, as depicted in the illustration Fig. 1.

The upper members of the bench can be made deeper with advantage. They should be set flush with the top of the legs to allow