
British Standard Code of practice for

Safeguarding woodworking machines

Part 3. Vertical spindle moulding,
routing and shaping machines (moulding
machines for one side dressing)

Code de bonne pratique pour la sécurité des machines à travailler le bois

Partie 3. Machines à moulurer, mortaiser et fraiser sur une face à broche verticale

Leitfaden für Schutzeinrichtungen an Holzbearbeitungsmaschinen

Teil 3. Spindel- und Oberfräsmaschinen für einseitige Bearbeitung

Foreword

This Part of BS 6854 has been prepared under the direction of the Machine, Engineers and Hand Tool Standards Policy Committee.

It is Part 3 of a series of Parts and contains particular recommendations concerning the safeguarding of vertical spindle moulding machines. It should be used in conjunction with Part 1 of this standard which contains general recommendations. Other Parts are as follows.

- Part 2 Circular sawing machines
- Part 4 Planing machines
- Part 5 Narrow band sawing machines

The background to this code of practice is the high accident incidence rate encountered by woodworking employees and that an estimated 14 % of all machinery accidents occur on woodworking machines. Although the safeguarding of woodworking machines in this code is mainly directed at stationary machines, the same general principles apply to portable and transportable machines. Account has been taken of the fact that woodworking machines may be used for working on bone, plastics and materials other than wood or wood products. The guidance provided is also relevant to all woodworking machines designed for domestic use but used for industrial purposes.

This code should be of use to designers, manufacturers, suppliers, importers and users alike since in its development account has been taken of practical aspects of safeguarding woodworking machines together with the legal requirements contained in the Health and Safety at Work etc. Act 1974, the Factories Act 1961, and the Woodworking Machines Regulations 1974. The principles of safeguarding given in BS 5304 have also been incorporated.

The term 'reasonably practicable' used in the Health and Safety at Work etc. Act 1974, and adopted by this code, implies starting from the current state of the art and takes into account the cost of what is done in relation to the improvement secured. A manufacturer or supplier who sells goods produced to a British Standard specification and who makes clear the conditions of use for which they are intended will thereby, to the extent that the standard is adequate and appropriate for the particular workplace, be able to indicate compliance with his general duty under Section 6 of the Health and Safety at Work etc. Act 1974. To a similar extent employers, those in charge of premises and employees will be assisted by the provisions of this code of practice.

The code stresses the importance of built-in safety at the design stage, thus encouraging the concept that safeguarding should be viewed as a prime feature of a woodworking machine and not something which is an afterthought. Guidance is given to manufacturers and suppliers on identifying, eliminating or reducing both mechanical and non-mechanical hazards (e.g. noise, dust) which have a bearing on health and safety of persons when the machines are used.

This code will also be of help to purchasers and users when selecting machines, and provides practical guidance on safe working practices including the use of safeguards and safety appliances (e.g. push sticks). Successful implementation of the guidance given in this code of practice requires discussion between supplier and user, and the provision of adequate information.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

*In preparation.

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Code of practice

1 Scope

This Part of BS 6854 gives particular recommendations concerned with the safeguarding of the cutters and other dangerous parts of vertical spindle machines used for moulding, routing and shaping. Specific reference is made to vertical spindle moulding machines, high-speed routing machines (both hand and automatically operated), hand-held routing machines and shaping machines (rotary and linear). This Part should be used in conjunction with BS 6854 : Part 1 which deals with general recommendations.

NOTE. The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this Part of BS 6854 the definitions given in BS 6854 : Part 1 apply, together with the following.

2.1 vertical spindle moulding machine. A woodworking machine which consists essentially of a spindle which projects through the centre of a machine table, mounted on a box frame. The mechanism driving the spindle is contained in the main frame. The spindle may carry a range of interchangeable top pieces on which can be mounted a variety of cutters to suit the type of work to be done (see appendix A).

2.2 high-speed routing machine. A woodworking machine which is essentially an inverted spindle moulding machine in which the spindle is raised and lowered from above the machine table. The spindle is typically capable of running between 18 000 r/min and 24 000 r/min. A variety of tools can be mounted on the spindle, enabling a wide range of machining operations, including drilling and boring, to be carried out.

NOTE. In addition to the manually-operated routing machine, computer controlled machines (CNC), compound table routing machines and some special purpose machines are included within this definition (see appendix B).

2.3 hand-held routing machine. A hand-held routing machine, driven by an electric motor, usually held in both hands to guide the cutter over the workpiece.

NOTE. A variety of tools and accessories for use with the machine enables such operations as drilling, grooving, moulding, tenoning, slotting, dovetailing etc. to be carried out. The machine may also be capable of being adapted for stationary use, for example as a spindle moulding machine, providing that suitable attachments designed for the purpose, are used (see appendix C).

2.4 rotary and linear shaping machine. A machine incorporating one or more vertical spindles on which are moulding cutters similar to some of the types used on vertical spindle moulding machines. The spindles are mounted so that the cutters follow a template, to which the workpiece is attached on a jig, and they move in and out as the workpiece is either rotated past them on a rotary table or progressed on a linear conveyor system (see appendix D).

3 Statutory requirements

The general statutory requirements relating to the supply and use of woodworking machines to be used in the UK are set out in BS 6854 : Part 1.

Statutory requirements relating to the provision and construction of guards for vertical spindle moulding machines and the use of safety devices are contained in Regulations 5 and 32 to 39 of the Woodworking Machines Regulations 1974. It should be noted that not all of the machines covered by this Part of BS 6854 fall within the scope of the 1974 Regulations and attention is drawn to Section 14 of the Factories Act 1961.

4 Design recommendations for safeguards

4.1 Machine descriptions

Machines covered by this Part of BS 6854 are of the following designs:

- (a) a plain parallel arbor on which may be fitted slotted collars, square cutterblocks, circular cutterblocks, profiled heads or disposable heads with machined plain bore;
- (b) a fixed collet head to take shanked tools such as router cutters;
- (c) a removable arbor which can be replaced by a French spindle or a collet head.

Specific references to particular machines are given in appendices A to D. In design of these machines the recommendations of clause 5 of BS 6854 : Part 1 : 1987 apply, together with the specific requirements given in the Woodworking Machine Regulations 1974.

4.2 Toolholding and cutter design

4.2.1 Accuracy of arbors. The accuracy of arbors should comply with the tolerances given in BS 3800, as eccentricity could lead to vibration and cutter detachment or disintegration.

4.2.2 Spindle speeds and tool diameters. Spindle speeds and tool diameters should be so matched that circumferential speed of a tool is neither too high, as this may lead to detachment or disintegration, nor too low, as this may lead to snatching. It follows that widely varying tool diameters should only be provided for machines where spindle speed can be varied over a suitable range. Figure 1 provides a guide to determining rim speeds derived from tool diameters and spindle speeds.

The manufacturer should ensure that these design parameters for safe use of his machine are conveyed to the user.

4.2.3 Maximum speed marking. Cutterblocks, solid cutters and shanked cutters should be marked, where practicable, with the maximum speed. Where this is not practicable the manufacturer should ensure that this information is conveyed to the user in some other way.

4.2.4 Cutter design. Cutters should preferably be designed to be used in dimensionally similar pairs, formed to the same profile. Pairs should be mounted directly opposite one another. The manufacturer should ensure that instructions on balancing the pairs of cutters after grinding are given to the user.

4.2.5 Cutter projection. The design of cutterblocks should, as far as is practicable, be such as to prevent excessive cutter projection. Where the mounting arrangement permits projection which could subject the cutter to unsafe stresses, the maximum permissible projection for given cutter types should be specified in the user's instructions.

4.2.6 Hand-fed machines. For machines designed for hand-fed operations, where cutters are necessarily exposed, the use of chip limiting cutters should be recommended (see figure 2). For other hand and semi-mechanical feed operations, cutterblocks should have as little cutter projection as is practicable (see figure 3).

4.2.7 Tools for nuts and bolts. Where practicable, correctly fitting tools should be supplied by the manufacturer for use on cutter mounting bolts and spindle nuts. The manufacturer should give advice on the correct tightening of bolts and nuts.

4.2.8 Design for specific cutter types. For specific cutter types, the following design considerations are relevant.

(a) *Slotted collars* (see figure 4). Uniformity of matched cutter pairs and good cutter condition are essential. Irregularities can lead to incorrect seating, unequal grip and possible detachment. Instructions to this effect should be provided by the manufacturer.

Cutter retention arrangements based on friction only can be improved by the provision of a safety pin in each collar to correspond with an edge, notched on one edge of each collar.

An alternative arrangement involves adjusting screws in the top collar to engage in notches on the top edges of the cutters.

NOTE. BS 4361 : Part 1 specifies requirements for slotted collars and spindles for spindle moulding machines.

(b) *Square cutterblocks* (see figure 5). Unlipped square blocks with central slots can rotate in either direction, but blocks with off-centre slots have to be mounted with the slot closest to the cutting edge of the cutter it secures. Cutters should have closed mounting slots to obviate detachment on loosening.

(c) *Circular cutterblocks* (see figure 6). Cutters are normally retained by a tightening wedge action, but security should be increased in the case of heavier moulding cutters by keying cutters or serrating the back face to match serrations milled in to the seating. It is important that the manufacturer should specify the design of cutters to be used.

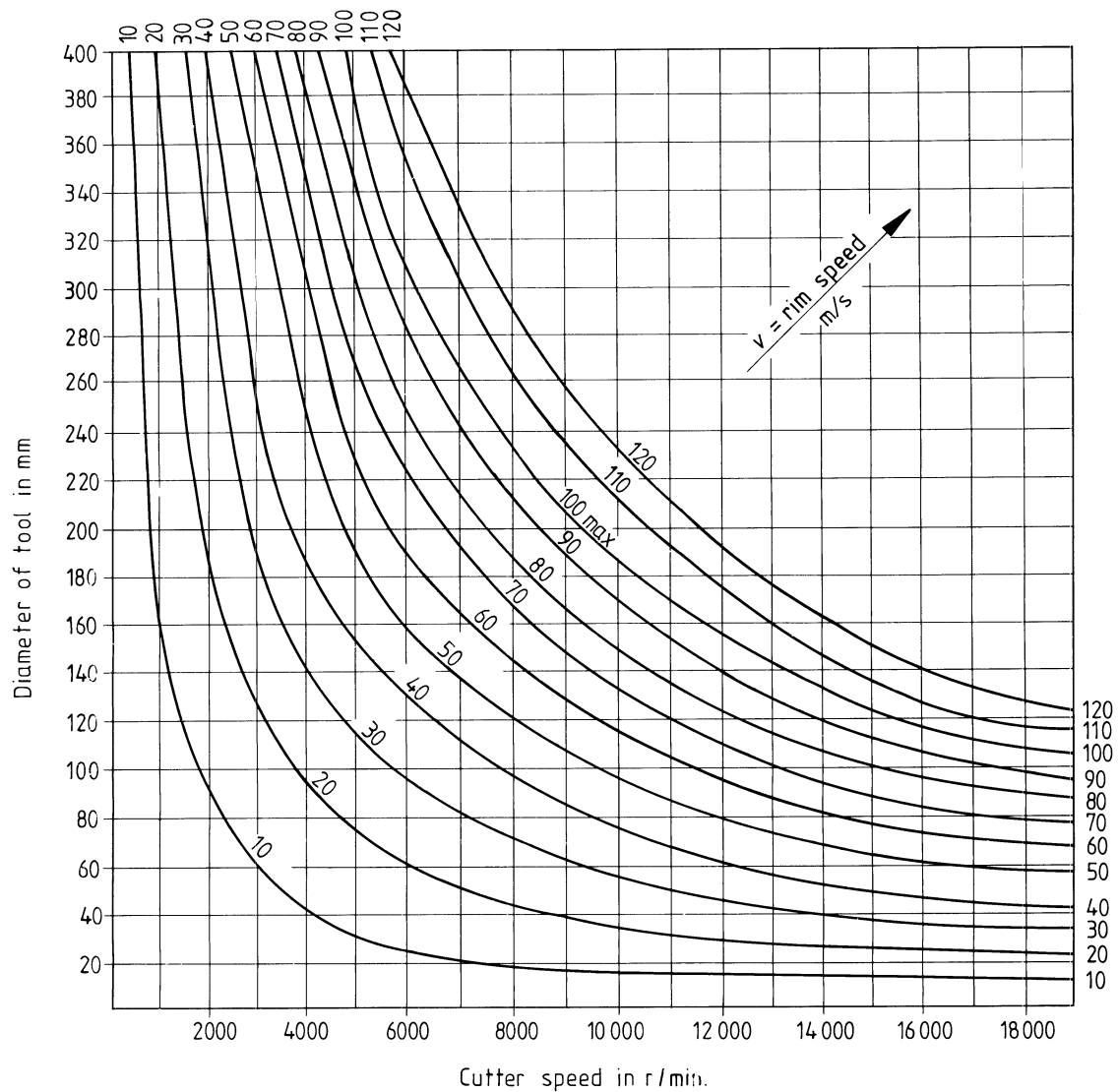
(d) *Solid profile cutters* (see figure 7). The manufacturer should specify the extent of grinding to avoid forming sharp corners in the gullets which could lead to stress and failure.

(e) *Cutterblocks with disposable cutters* (see figure 8). The manufacturer should ensure that precise location and retention of cutters is provided, for example by the use of pins. Any specific operational requirements should be brought to the attention of the user.

(f) *Chip limiting cutters* (see figure 2). These are generally used for hand feeding operations, and clear instructions on use should be provided by the manufacturer.

(g) *Router cutters* (see figure 9). Cutters designed for particular purposes should be identified by the manufacturer, and clear instructions for their use should be provided.

(h) *Automatic shaping machine cutters* (see figure 10). Examples of cutter design for automatic shaping machines are given in figure 10.



NOTE. Curves show rim speeds in m/s derived from r/min and diameter of tool. Cutter speed in r/min required can be seen from the graph if diameter and rim speed are known. Cutter diameter may be determined when cutter speed in r/min and rim speed are known.

Examples

- (a) Cutterhead: 120 mm dia.
Cutter speed: 12 000 r/min
 $v = 76 \text{ m/s}$
- (b) Cutter: 160 mm dia.
Cutter speed: 9000 r/min
 $v = 76 \text{ m/s}$
- (c) Shank-type jointing cutter: 58 mm dia.
Cutter speed: 18 000 r/min
 $v = 50 \text{ m/s}$

Figure 1. Rim (rotational) speed of tools as a function of their diameter and of the cutter speed

4.3 Power feed

See appendix A.

4.4 Clamping

See appendices A, B and C.

4.5 Anti-kickback devices

See appendices A and B.

4.6 Work guides

See appendices A, B, C and D.

4.7 Controls

See appendices A, B and C.

4.8 Braking systems

A braking device which automatically isolates the power should be provided whenever reasonably practicable.

4.9 Stability

See appendices A and B.

4.10 Physical safeguards

Guidance on guard selection for hand-fed vertical spindle moulding machines is given in the flow-chart given in figure 11. See also appendices A, B, C and D.

5 Safe working practices

5.1 General

The recommendations given in clause 6 of BS 6854 : Part 1 : 1987 apply but see also appendices A, B, C and D for details of safe working practices for particular types of machine. Particular recommendations for safe use of toolholders and cutters are also given in the following sub-clauses.

5.2 Toolholders and cutters : selection and safe use

5.2.1 General. It is advisable to reduce the length of cut where possible when making a complex cut by sharing it between more than one pair of cutters, thereby reducing the chip size.

5.2.2 Cutters. Cutters should preferably be used in dimensionally similar pairs, formed to the same profile, and they should be balanced in pairs after grinding. Pairs should be mounted directly opposite one another so that both will cut.

Excessive cutter projection should be avoided because:

- (a) there is an increased likelihood of cutter disintegration or disengagement;
- (b) where it is not practicable to enclose the cutter effectively (in freehand work for example) there is evidence that the greater the cutter projection the greater the extent of injury on contact;
- (c) it has been shown that kick-backs become more likely and more ferocious with increasing cutter projection.

NOTE. In freehand work this increases the likelihood of contact with the cutters, and even where the cutters are enclosed there is increased risk of the workpiece being projected in a dangerous manner.

Tilting of the arbor may permit a deeper cut with less projection. In hand-fed operations where cutters are necessarily exposed the use of chip limiting cutters is recommended (see figure 2). For all other hand-fed operations and those with semi-mechanical feed arrangements (e.g. where a power feed is used) the risk of workpiece projection on kick-back should be minimized by the use of cutterblocks with as little cutter projection as is practicable (see figure 3).

Cutter mounting bolts and spindle nuts should be tightened using correctly fitting tools. Where practicable these tools should be those supplied by the manufacturer. Care should be taken when tightening as under-tightening may allow cutter detachment, and over-tightening may damage screw threads. The condition of screw threads and bolt heads should be regularly checked, and damaged or worn components replaced.

Attention should be paid to the manufacturer's instructions on the maximum rim (rotational) speed of a tool (see figure 1).

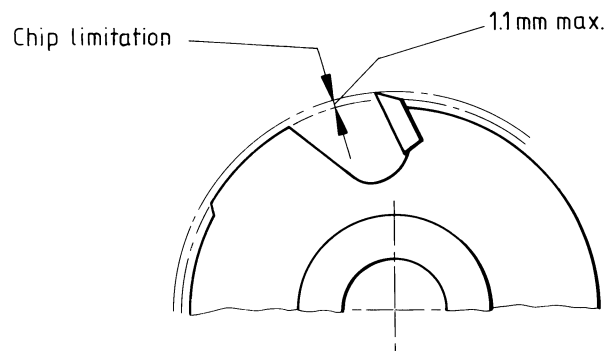
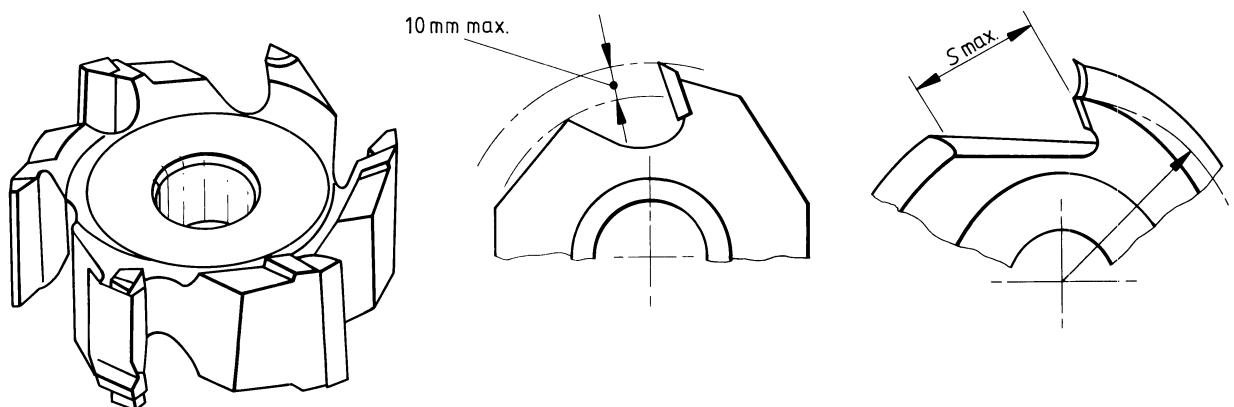


Figure 2. Chip limiting cutter for use on vertical spindle moulding machines when hand fed



NOTE. The cutter projection should be as small as practicable. The maximum chip clearance gullet S depends upon the cutting edge circle.

Figure 3. Cutter for use on hand-fed and power-fed vertical spindle moulding machines

5.2.3 Safety precautions relevant to specific cutter types. The following precautions should be taken with particular cutter types.

(a) *Slotted collars* (see figure 4). Where cutter retention arrangements include the provision of a safety-pin to correspond with a notch in each cutter, notches have to be extended as cutters are advanced to compensate for wear. Cutters should be discarded when their retained length is not less than 90 % of the slot length. With slotted collars, uniformity of matched cutter pairs and good individual cutter condition are both essential. Irregularities can lead to incorrect seating, unequal grip and possible detachment.

(b) *Square cutterblocks* (see figure 5). These are not recommended for hand-fed operations because in the event of an accident involving contact with the operator more severe injuries are likely than would be the case with a circular block. They also tend to produce more noise than circular blocks. Cutters on square cutterblocks are generally larger and heavier than other types, and correct balancing is very important. Bent or otherwise damaged cutters should be discarded, and the face of the block should be checked for distortion near dovetail slots and nuts. Tee bolts and dovetail slots should also be checked for thread damage and stretching and cracking under the head.

Paper packing may be used under the heel of the cutter to counteract the effect of bowing when tightening. Sandpaper or cardboard should not be used as packing material, as it can compress during use causing cutters to loosen.

The extent to which packing may be safely used will vary according to the design of the block. Some blocks have hollow faces which make the use of packing unnecessary. Where there is any doubt, the advice of the manufacturer should be sought.

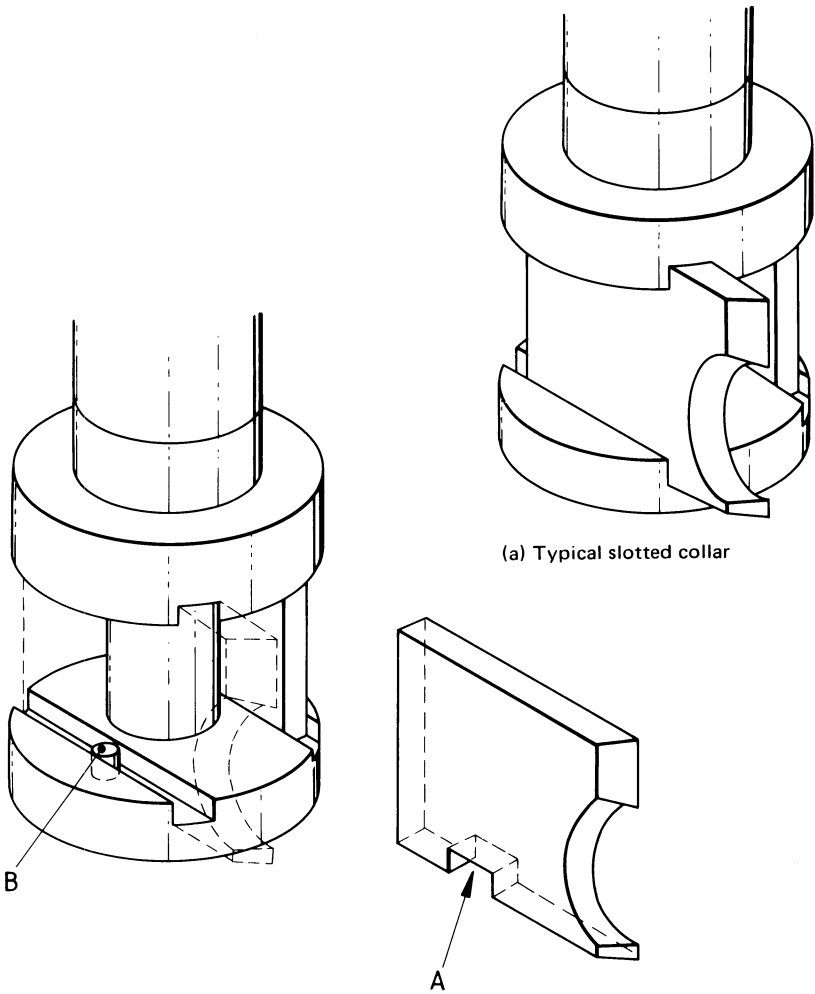
(c) *Circular cutterblocks* (see figure 6). Circular cutterblocks may incorporate two or more cutters generally smaller and lighter than those found on square cutterblocks. Planing cutters are generally lighter than moulding cutters. Circular cutterblocks are less likely to cause severe injury on inadvertent contact and are preferable from a safety stand-point. However it is important that only cutters meeting the manufacturer's specification are fitted. If two cutterblocks are to be used in tandem, with long cutters spanning the two, it is important that only a matching pair are used to ensure slot matching. The cutter should always be at least as wide as its wedge.

(d) *Solid profile cutters* (see figure 7). These should be carefully ground to avoid the forming of sharp corners in the gullets which could lead to stress and failure. Manufacturer's instructions on grinding should be followed.

(e) *Chip limiting cutters* (see figure 2). These heads restrict the bite of cutters and help prevent kick-back. This can contribute to safety, particularly in hand-feeding, provided manufacturer's instructions are followed carefully.

(f) *Router cutters* (see figure 9). Care should be taken to ensure that these cutters are used for particular purposes as specified by the manufacturers. The use of non-specified cutters and substitute tools such as twist drills has led to serious injuries following cutter disintegration. Cutters with brazed tips should only be reconditioned to the original manufacturer's recommendations.

5.2.4 Pressure pads (Shaw guards). Pressure pads of the Shaw guard type are most widely used on vertical spindle moulding machines and can provide a tunnel when correctly adjusted with the fence. The pads are spring loaded to give the resilience needed to cater for minor dimensional variations in the workpiece, since resistance would be encountered when feeding over-size workpieces while chattering would occur if they were under-size. The two wooden pressure pads are connected by screws through elongated holes of their bow springs. The elongation permits the slight outward movement of the ends of the spring as it tends to straighten under pressure. Pads of various lengths and widths are necessary to accommodate the range of sizes of workpieces (see appendix A). Other forms of hold-down spring which do not incorporate guarding are not a substitute for the Shaw type. A method of providing guarding with the use of hold-down springs is shown in figure 6.



(b) Slotted collars with a safety pin (B) and a matching notched cutter (A)

Figure 4. Typical slotted collar design

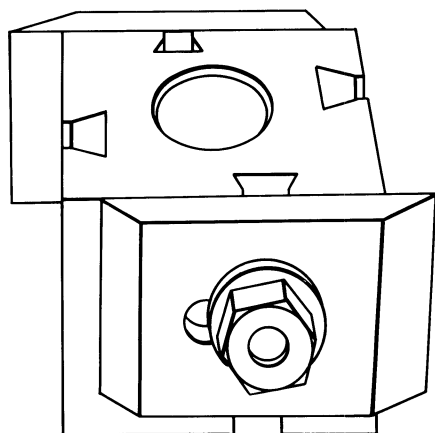


Figure 5. Square cutterblock with closed slot cutters

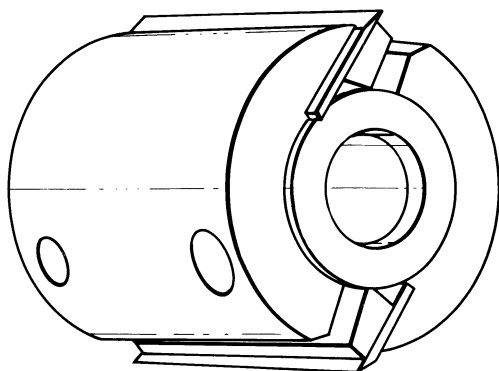


Figure 6. Circular cutterblock

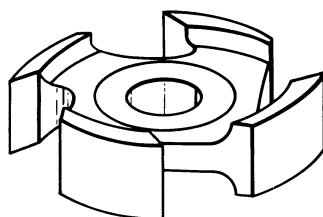


Figure 7. Solid profile cutter

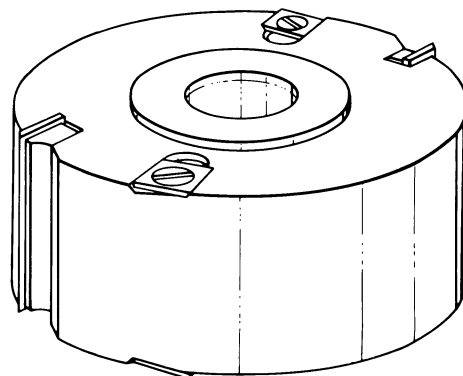
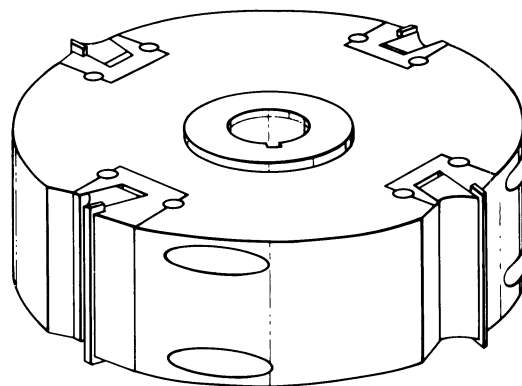
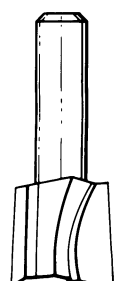
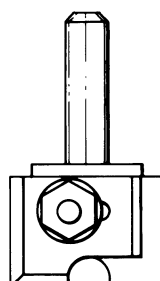


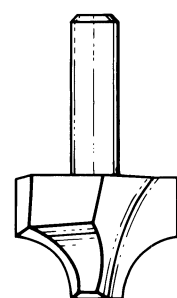
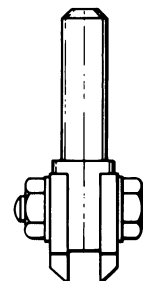
Figure 8. Cutterblock with disposable or throwaway cutters



Stair housing



Expanding cutterhead

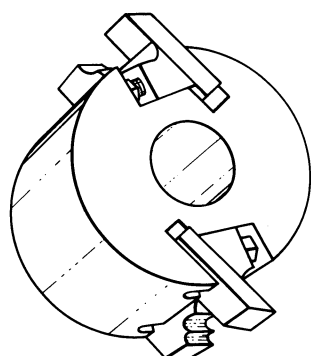


Dovetail cutter

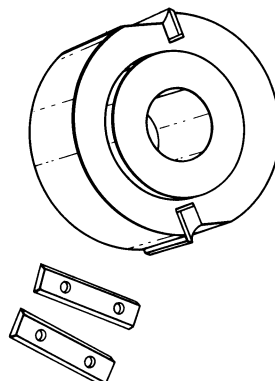


Profiling and sinking cutter

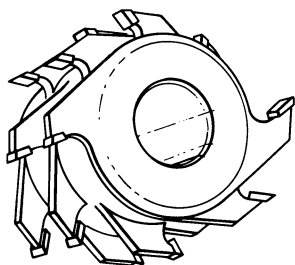
Figure 9. Examples of cutters for use on high speed routing machines



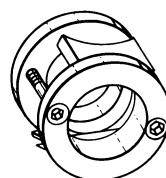
(a) Safety block with 8 mm thick blades



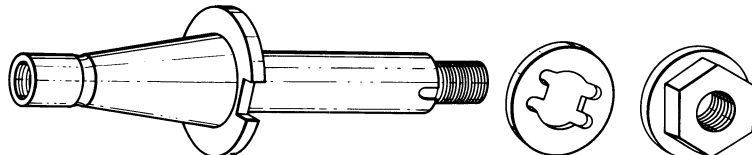
(b) Safety block with hard metal tipped blades



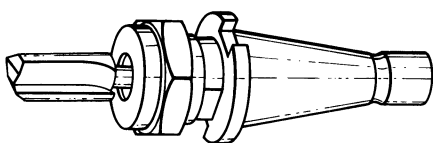
(c) Hogging block with staggered TCT teeth



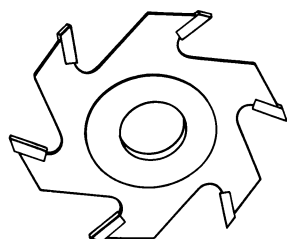
(d) Slotted collar with profiled knives



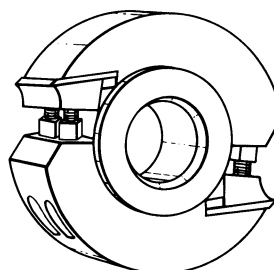
(e) Reversible 'knock-out' arbor with safety tab washer and retaining nut



(f) Ball bearing follower roller

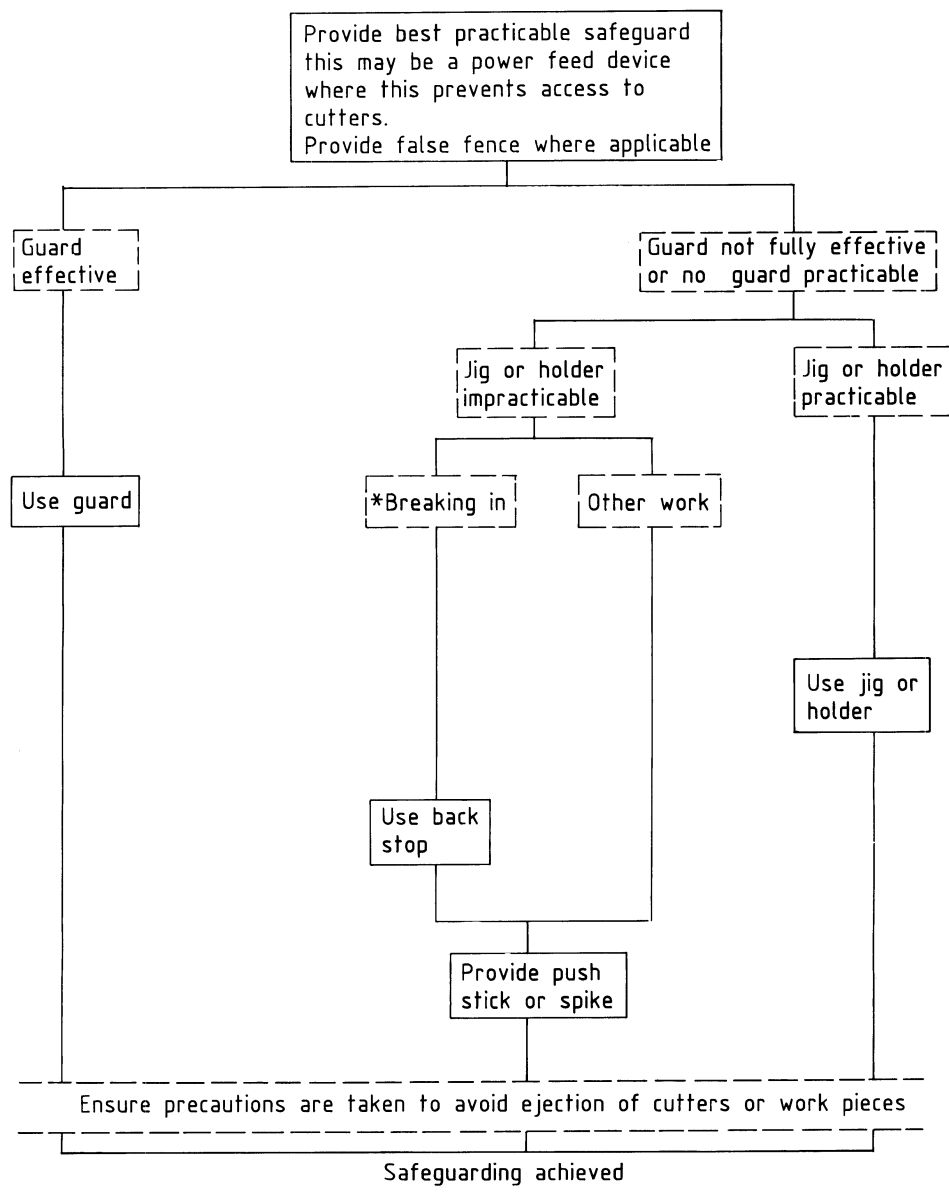


(g) Grooving cutter



(h) Safety block with straight knives

Figure 10. Examples of cutters and other equipment used on shaping machines



*NOTE. Stopped work (see A.3.3), when material is progressed in the direction of movement of the cutters, should not be carried out without a jig or holder.

Figure 11. Selection procedure for safeguards on vertical spindle moulding machines subject to Woodworking Machines Regulations 1974

5.3 Safety devices

5.3.1 General. The recommendations given in 5.4 of BS 6854 : Part 1 : 1987 apply, with the supplementary guidance given in 5.3.2 to 5.3.5.

5.3.2 Hand-held devices

5.3.2.1 Jigs and holders. See the recommendations given in appendices A and B, with the following supplement.

The design of jigs and holders is determined by the work to be done. The essentials for safe working are accurate location and secure clamping of the workpiece together with secure hand holds.

In general, jigs should be made with secure handles and a wide base to provide the operator with a firm grasp at a safe distance from the cutters. Workpiece locators should be provided and one should always be positioned at the trailing end of the workpiece to give support against the thrust of the cutters. Usually, the materials used in the construction of a jig are hardwood or plywood. If metal parts are used they should not be where they are likely to come into contact with the cutters; but if this cannot be avoided, they should be of aluminium which will minimize the risk of injury from cutter break up.

Clamps should be positive in operation and have sufficient movement to allow for variations in the thickness of the workpiece. Toggle clamps are an example of suitable clamps.

Effective clamping is particularly important when cutting against and across the grain as this operation absorbs more power from the machine and the workpiece tends to pull in, towards the cutters.

Even where workpieces are irregularly shaped and very limited production runs are involved jigs have to be used where practicable. Jigs which can be adjusted to accommodate a range of workpieces may be appropriate (see figure 28).

5.3.2.2 Push sticks. The nature of the work may require the use of push sticks. Push sticks should be constructed from hard straight grained wood, capable of withstanding the pressure necessary to feed the workpiece. There should be no metal attached to the lower end. A straight push stick with a rounded grip is preferred (see figure 12). A curved grip should not be used because of its cross-grained section which may break under pressure.

5.3.2.3 Push blocks. See appendices A and B.

5.3.2.4 Spikes. See appendix A. When working on small complicated shapes, for example light moulding on the edge of an ornamental relief, and when no other means of safeguarding is practicable, a spike may be used. The spike should be made of steel and securely fixed to a wooden handle by means of a tang and ferrule or wire binding. The design of the handle should be formed with a shoulder piece and a comfortable hand grip (see figure 13). A spike for use on a high-speed routing machine may be smaller and its attachment to a plain wooden rod may be found more suitable.

5.3.3 Other safety devices

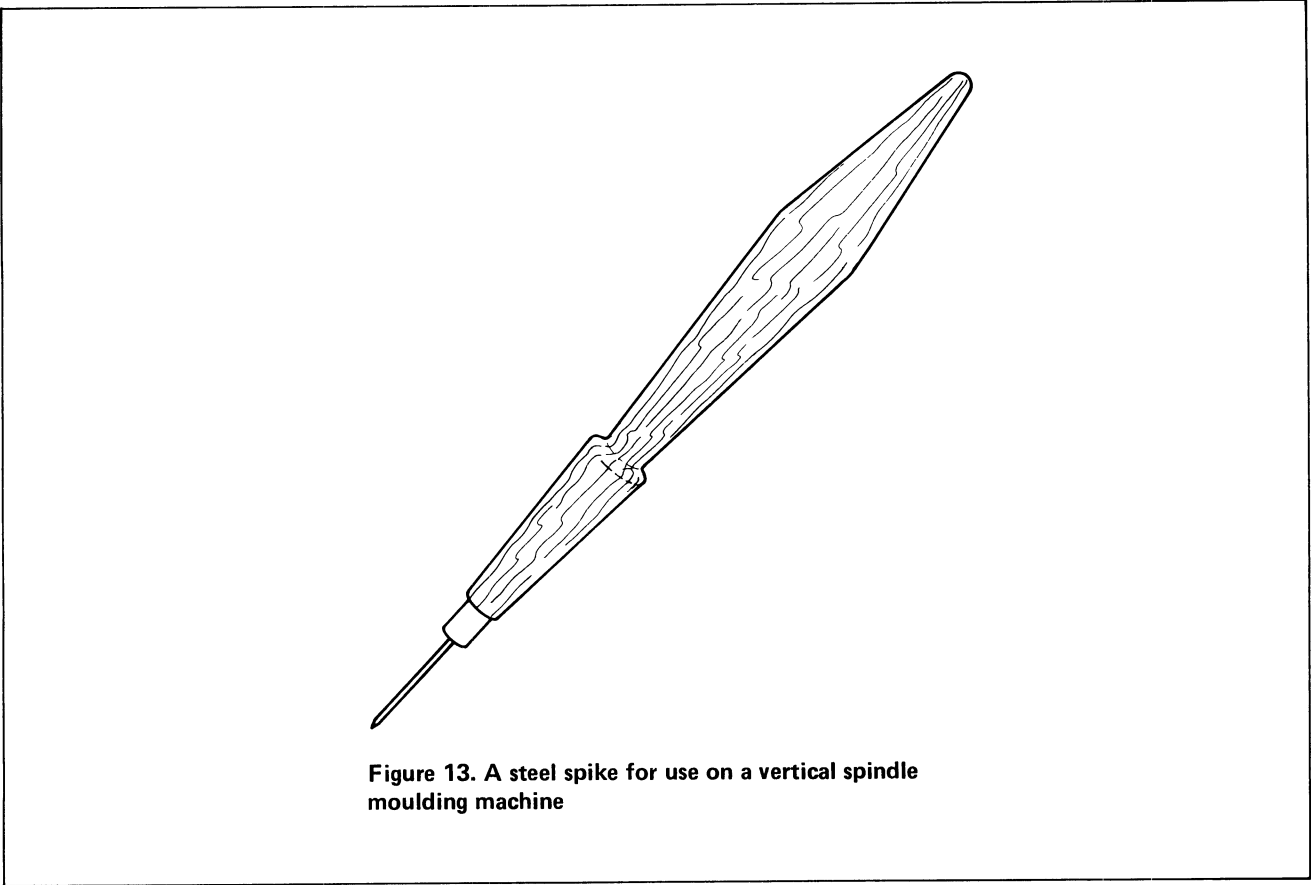
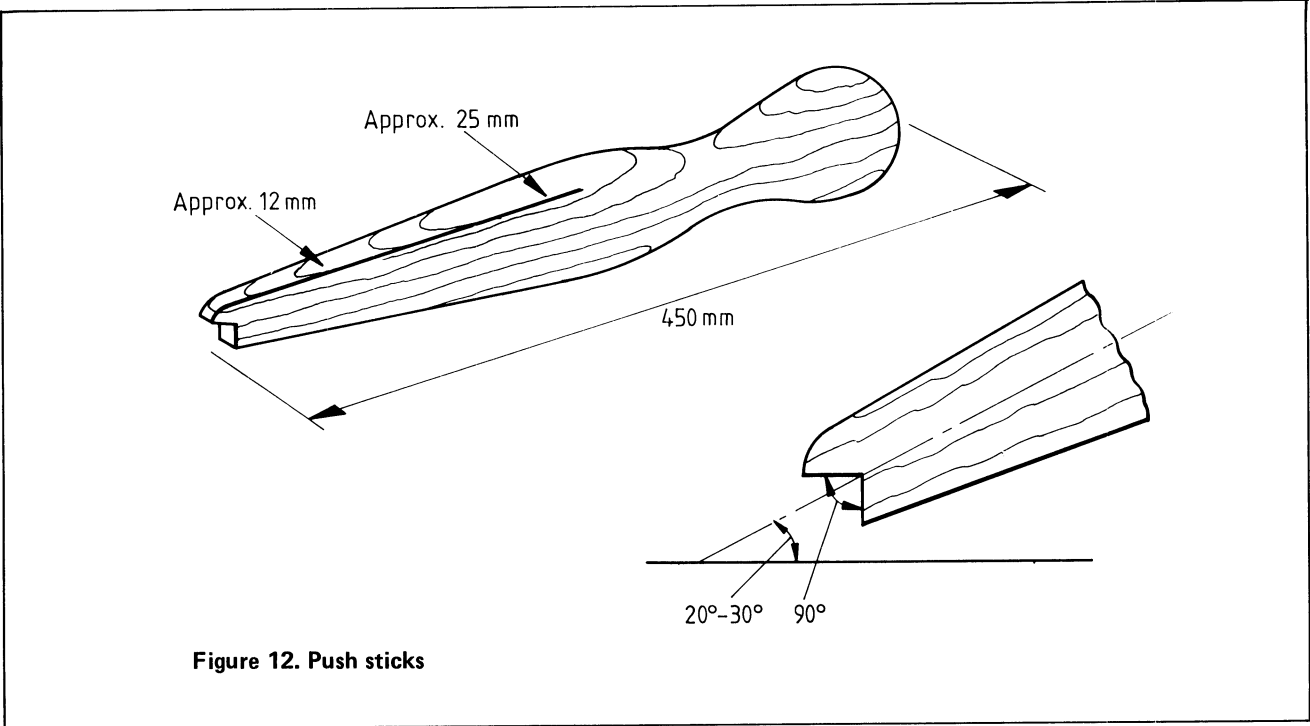
5.3.3.1 False fences. See appendix A.

5.3.3.2 Ring fences. See appendix A.

5.3.3.3 Back and front stops. See appendices A and B.

5.3.4 Pressure and hold down devices. See appendices A and B.

5.3.5 False tables. See appendix A. On hand-fed machines a false table may be used to limit the extent of cutter exposure, to extend the machine table to provide additional support and to provide a mounting to stops and guides (see appendices A and B).



6 Training and supervision

The recommendations given in clause 7 of BS 6854 : Part 1 : 1987 apply, together with the following supplementary recommendations.

The Woodworking Machines Regulations 1974, Regulation 13, requires that all persons employed to operate woodworking machines receive training at machines of a class to which that machine belongs, in the kind of work on which they are to be employed. It is essential that operators are carefully instructed as to the dangers arising in connection with such a machine and the use of guards, devices and appliances required by the Regulations.

No person under the age of 18 years should operate any vertical spindle moulding machine, without having successfully completed an approved course of training at that machine, unless actually operating the machine as part of such a course of training under the supervision of an experienced person.

7 Noise

7.1 General

The general recommendations of BS 6854 : Part 1 apply.

7.2 Elimination or avoidance of hazard

The recommendations given in 8.2 of BS 6854 : Part 1 : 1987 apply but the relevance of the features listed in items (a) to (h) of 8.2 of BS 6854 : Part 1 : 1987 will vary according to which of the machines covered by this Part is under consideration. Details of particularly appropriate features are given in appendices A to D, but in general terms the following recommendations apply.

(a) Cutter design will always be relevant and, generally, design improvements which increase safety will tend to lead to more streamlining which can reduce noise. Generally maximization of the cutting angle, so far as process requirements allow, will reduce noise.

(b) Spindle speeds will generally be governed by considerations other than noise which affect safety but, where a range of speeds can be safely used, the selection of a lower speed will generally result in noise reduction.

(c) Safety has to be the prime factor when considering workpiece restraint in relation to the machines covered by this Part of BS 6854 but vibration damping to reduce noise will be relevant, particularly in relation to the automatic machines covered by appendices B and D where the workpiece is fixed to a table.

(d) The automatic machines covered by appendices B and D lend themselves more easily to the application of noise absorption techniques but on most of the machines covered by this Part of BS 6854 there are opportunities to reduce noise emissions from the opposite side of the spindle to the cutting area. Cutter guards of heavy construction, for example, are desirable for interception of noise. Reflection back towards the cutting area can be reduced in some cases by the use of noise absorbing linings.

(e) Vibration damping of parts of machines, including extraction systems, will be relevant. Where router-cutter heads are used, vibration isolation may be applied.

(f) Consideration of air flow characteristics is particularly relevant in respect of streamlining of shells round cutter-blocks and the design of nozzles used for blowing away chips from routing cutters. Badly designed nozzles can produce extremely high noise levels.

(g) Machines covered by this Part of BS 6854 tend to produce large chips at very high rates. High extraction rates are therefore necessary (see clause 8) and space may have to be allowed at the rear of the machines to allow good aerodynamic design of ducting.

7.3 Physical safeguards

The recommendations given in BS 6854 : Part 1 apply, particularly in relation to automatic machines. See appendices B and D for details.

7.4 Provision of information by suppliers of woodworking machines

See the recommendations given in appendices A, B, C and D.

8 Extraction equipment

See appendices A, B, C and D. It is particularly important that efficient extraction equipment is provided on the machines covered in this Part of BS 6854, where practicable, because of the rapid build-up of chips and the danger in attempting to sweep them away from the table by hand.

9 Power systems

The recommendations given in BS 6854 : Part 1 apply with the following supplement.

The loose table rings and their seatings on vertical spindle moulding machines should be checked to see that they are not damaged so as to cause unsteadiness which would interfere with the normal feeding of workpieces.

10 Maintenance of safeguards

The recommendations given in BS 6854 : Part 1 apply.

11 Provision of information

The recommendations given in BS 6854 : Part 1 apply with the following supplement.

An instruction plate should be fixed on the machine, where practicable adjacent to the drive mechanism, to enable the user to select the correct speed for the cutter equipment to be used.

12 Machine identification

The recommendations given in BS 6854 : Part 1 apply.

Appendices

Appendix A. Vertical spindle moulding machines

A.1 Machine descriptions

Examples of vertical spindle moulding machines are illustrated in figure 14.

The drive and speed change mechanisms are all enclosed within the main body of the machine.

The controls of the machine, i.e. stop and start, and brake pedal should be conveniently accessible from the operating positions.

The complete enclosure of the underside of the table, with a dust chute through the rear of the main frame and extraction hood behind the fence of the machine, provides a means for the attachment of an extraction system (see figure 15).

A.2 Safeguards

Because of the wide variety of work which can be undertaken on vertical spindle moulding machines using different types of top spindles, cutterblocks and cutters, no one type of safeguard can be considered effective for all conditions. Each operation should be considered separately and the best practicable safeguard selected for that particular job. Also, the type of cutterblock, the cutter projection and the height at which the block is set, will determine the minimum size of the hole in the table. This can be obtained by using the loose rings provided so as to give the smallest possible hole, thus reducing the risk of the workpiece dipping and catching the edge as it passes over the gap.

Guarding should enclose the cutters to the greatest extent permitted by the nature of the operation. Where guarding to this extent still allows the operator to reach the cutter with his hand, and the use of holders is practicable, the use of such jigs and holders is mandatory.

A power feed unit fitted to a vertical spindle moulding machine with a straight fence can have the effect of enclosing the cutters to the greatest extent practicable (see figure 16), and often represents the best method of guarding on these machines. Such feed units should be easily adjustable to suit different sizes of workpieces and should not in themselves create a trapping hazard.

If a power feed is not used, pressure pads, for example a Shaw guard, with the vertical and horizontal spring-loaded pressure pads forming a tunnel through which the workpiece can be fed (see figure 17(a) and (b)) is also suitable for straight work over the full length of the workpiece if used in conjunction with a false fence or other means of closing the gap between fences. Enclosure of the cutter behind the fence can be achieved by the provision of a suitable extraction hood (see figure 17(c)). Where there is no straight fence, an extraction hood should be provided and securely fixed as close to the source of ejected material as possible.

Where extraction is not provided, enclosure of the chip exhaust should be completed in such a way that the cutter cannot be reached and the discharge of chips is not impeded (see figure 17(c)).

Other types of guard, for example bonnet or cage guards (see figure 22) may also be used on vertical spindle mounting machines in conjunction with other safety devices, depending on the type of work.