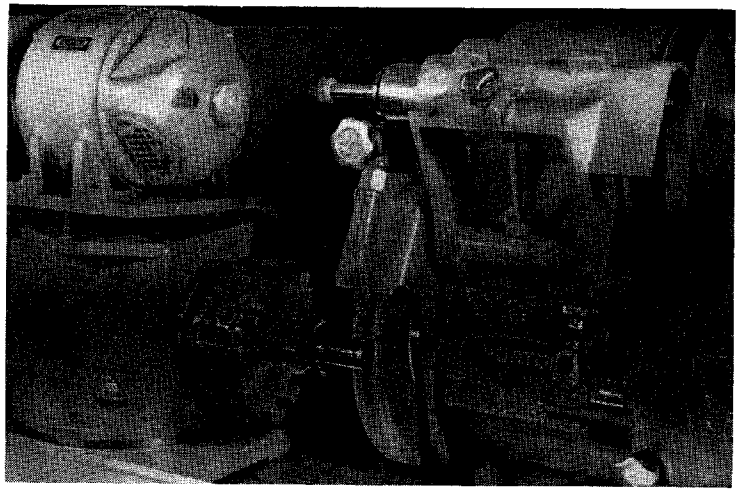


A universal grinder set up for cylindrically grinding an arbor

CHAPTER IX

Miscellaneous Tool Room Grinding Operations

Cylindrical Grinding

If the tool room is called upon to do much grinding of plain cylindrical parts, it is advisable to use a regular cylindrical grinding machine of suitable size. For handling occasional jobs of ordinary tool room variety, the versatile universal tool and cutter grinder, set up for cylindrical grinding, is satisfactory. For handling large work and a wide range of jobs, the so-called universal grinder such as the Norton 10″ and 12″ Universals, is particularly suited.

In the majority of ordinary cylindrical operations, the work is dogged at one end and supported between centers in

the usual way. The headstock swivel of the tool and cutter grinder is set so that the wheel spindle is parallel with the work table. The work rotates on two dead centers and will be ground true provided the centers of the machine and the center holes in the work are accurate. If the work is not ground straight, adjust the swivel table a slight amount in the proper direction.

To insure accurate work, the center points should be reground as soon as they show the slightest amount of scoring or other imperfections. Center grinder attachments are available for regular cylindrical grinding machines. For tool and cutter grinders, swivel the headstock or table to give the required angle of 60°. Use a slow table traverse and a depth of cut no more than .0005″ per pass. Remove only enough material to true up the center. Test the accuracy of the angle with a center gauge against a strong light. It is equally important that the center holes in the work be made as accurate as the centers themselves in the machine.

Basic Rules

The following additional rules for cylindrical grinding should be observed to insure the best possible results:

1. As far as possible, maintain the wheel speed between 5500 and 6500 surface feet per minute.
2. The proper work speed will depend upon the nature of the material being ground, the grain and grade of the wheel and the finish required. In general, the work speed and the table speed should be the fastest possible to obtain the desired results. Increasing the work speed tends to make the grinding wheel act softer, and vice versa.

3. The traverse speed for roughing should be such that for each revolution of the work, the table will advance a distance slightly less than the width of the grinding wheel. For finish grinding, the traverse speed is greatly reduced. Experience only will teach an operator what work and traverse speeds he should use for a given operation.
4. The depth of cut or wheel in-feed likewise depends upon a number of factors, such as the specifications of the grinding wheel, the size and nature of the work ground, the finish desired and whether the grinding is being done wet or dry. In general, the depth of cut for roughing averages .003" per pass and for finishing, .0005". Wet grinding permits the use of slightly harder wheels.
5. Be sure the grinding wheel is always in good balance. Out-of-balance wheels are responsible for chatter marks in the finished surface.
6. On long work, use a sufficient number of steady rests, properly applied.
7. In wet grinding, use a large stream of coolant directed upon the work at the point of contact with the wheel.
8. Eliminate all sources of vibration in the grinding machine, particularly where a good finish is important.
9. Dress the grinding wheel frequently with a sharp diamond tool to maintain a free cutting action.
10. Use grinding wheels of the grains and grades recommended by the wheel maker.

Grinding Wheels Recommended

The principal factors which influence the grain and grade selection of wheels for cylindrical grinding are the nature and

hardness of the material being ground, size of the work, amount of stock to be removed and the finish desired. The harder the material, the softer the wheel required. The larger the work diameter, the coarser and softer the wheel. The amount of stock to be removed, together with the finish desired, will determine the economical grain size to use. Light and continuous automatic feeds permit the use of finer and softer wheels.

High-speed steel	32A60-K8VG	Alundum vitrified
Hardened steel	19A60-L5VG	Alundum vitrified
Soft steel	44A54-LVBE	Alundum vitrified
Stainless steel*	37C46-MVK	Crystolon vitrified
Cast iron, brass	37C36-KVK	Crystolon vitrified
General purpose wheel	44A54-KVBE	Alundum vitrified

Surface Grinding

Precision surface grinding operations are an important part of modern tool room practice. The accuracy of jigs, fixtures and other special tools is dependent upon the accurate surface grinding of the various parts that enter into their construction.

There are perhaps a dozen different types of surface grinding machines in general use. For light tool room surface grinding, the two types of machines described on the following pages are in common use.

Reciprocating Table, Horizontal Spindle, Surface Grinder

The modern development of this common type of surface grinder, in the convenient smaller sizes equipped with mag-

*No. 300 series.

Norton 6" Surface Grinder, using 8 x ½ x 1¼" wheel

netic chuck and hydraulic table traverse, is particularly suitable for miscellaneous tool room work. Grinding is usually done dry. If it is possible to arrange the machine for wet grinding, a slightly harder grade wheel can be used in each case.

It is good practice to take light cuts and to use a fast table traverse, particularly on the finishing passes, to avoid burning the work and also insure a perfectly flat surface.

Grinding Wheels Recommended

High-speed steel	32A46-H8VG or	Alundum vitrified
	32A60-F12VBEP	Alundum vitrified
Hardened steel	32A46-G8VBE	Alundum vitrified
Soft steel	19A46-J5VG	Alundum vitrified
Cast iron and bronze (soft)	37C36-KVK	Crystolon vitrified

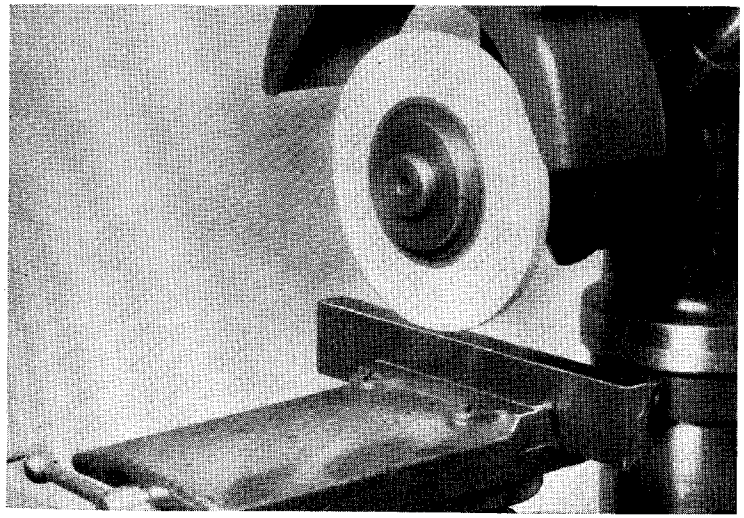
Universal Tool and Cutter Grinding Machine

This popular type of tool room grinder can be arranged for either face grinding, or for conventional surface grinding with the work clamped in a vise and traversed back and forth under the grinding wheel.

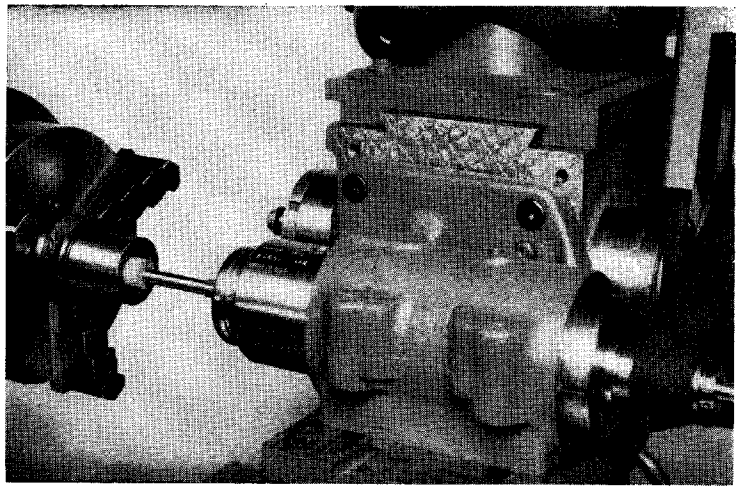
Gear shaper cutters, slitting saws, milling cutters and circular blanking dies are good examples of face grinding work. When it is desired to grind perfectly flat, the wheel head is set at 90° to the line of table travel; when a slight taper is desired, to provide cutting clearance, for example, the wheel head is swiveled horizontally a slight amount.

Grinding Wheels Recommended

High-speed steel	32A46-H8VG	Alundum vitrified
	32A60-F12VBEP	Alundum vitrified



Universal tool and cutter grinder setup for light surface grinding



Norton universal tool and cutter grinder arranged for internal grinding

Hardened steel ..	32A46-H8VG	Alundum vitrified
	32A60-F12VBEP	Alundum vitrified
Soft steel	19A46-J5VG	Alundum vitrified

Internal Grinding

For the ordinary run of light internal grinding work that comes up in the tool room, a universal tool and cutter grinder arranged for internal grinding is usually considered adequate. The illustration above shows a Norton universal tool and cutter grinder set up for internal grinding. For larger work, a universal grinder with hinged internal grinding spindle and provision for wet grinding is recommended.

A tool post grinder mounted on the bed of a lathe is perhaps the simplest form of an internal grinding machine. Usually motor driven, it is a very convenient and efficient type of grinder for light tool room work where the expense of a

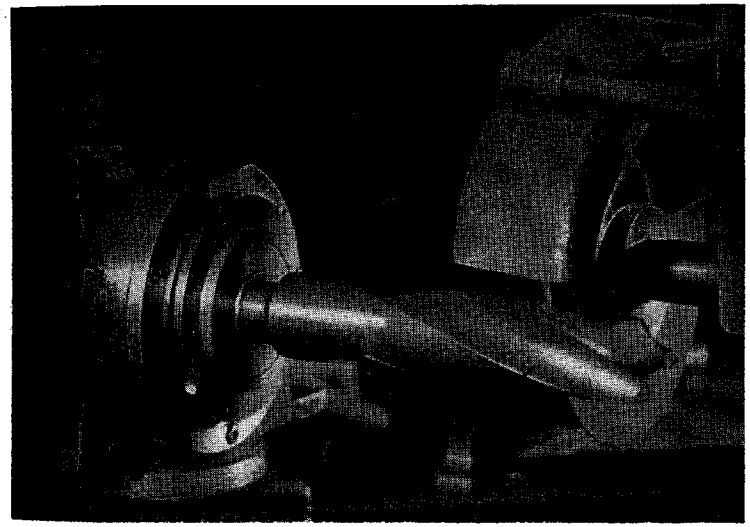
regular internal grinding machine would not be justified. On small work, mounted points and mounted wheels are particularly suitable for internal grinding.

Grinding Wheels Recommended

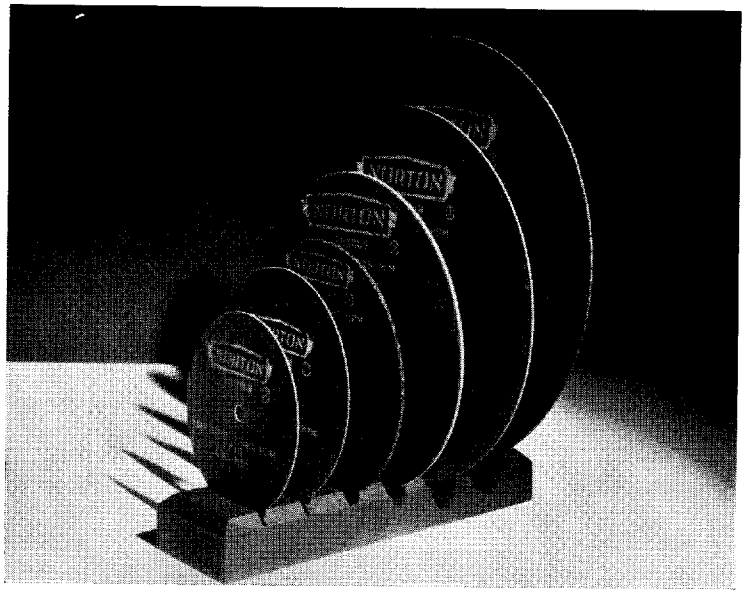
High-speed steel	32A60-K8VG	Alundum vitrified
Hardened steel	32A60-K8VG	Alundum vitrified
Soft steel	32A60-L7VG	Alundum vitrified
Cast iron	37C46-J5V	Crystolon vitrified
Bronze (soft)	37C46-J5V	Crystolon vitrified

Cutting-Off

The average tool room is frequently called upon to cut different kinds of materials such as solid bar stock and tubing,



Cutting off the end of a broken drill with an abrasive cut-off wheel on a tool and cutter grinder



Group of Norton abrasive cut-off wheels

as well as hardened steel in various forms. Tool bits, drills and taps, burned or broken in use, can often be reclaimed by cutting off the damaged end with a suitable abrasive wheel and regrinding.

While most of these small cutting-off jobs can be handled on tool and cutter grinding machines by clamping the work in a vise and traversing it back and forth under the grinding wheel, the more rapid and effective method is to use an abrasive cut-off machine designed for this purpose. These machines are available in several different types and sizes and for cutting either wet or dry.

The subject of Norton cut-off wheels is treated fully in a separate booklet, Form 517, which may be obtained upon re-

quest. Briefly, they are made of three types of organic bonds —resinoid, rubber and shellac. Each bond has its special applications.

Grinding Wheels Recommended

The following wheels are recommended for cutting-off in the tool room, using wheels 6″ and 7″ in diameter and $\frac{1}{16}$″, $\frac{3}{32}$″, and $\frac{1}{8}$″ in thickness:

Miscellaneous Steel, Tool Bit Stock, Drills and Taps (salvaging)

Most durable wheel	A60-M8B2	Alundum resinoid
Cooler cutting but shorter life	A60-N4E	Alundum shellac