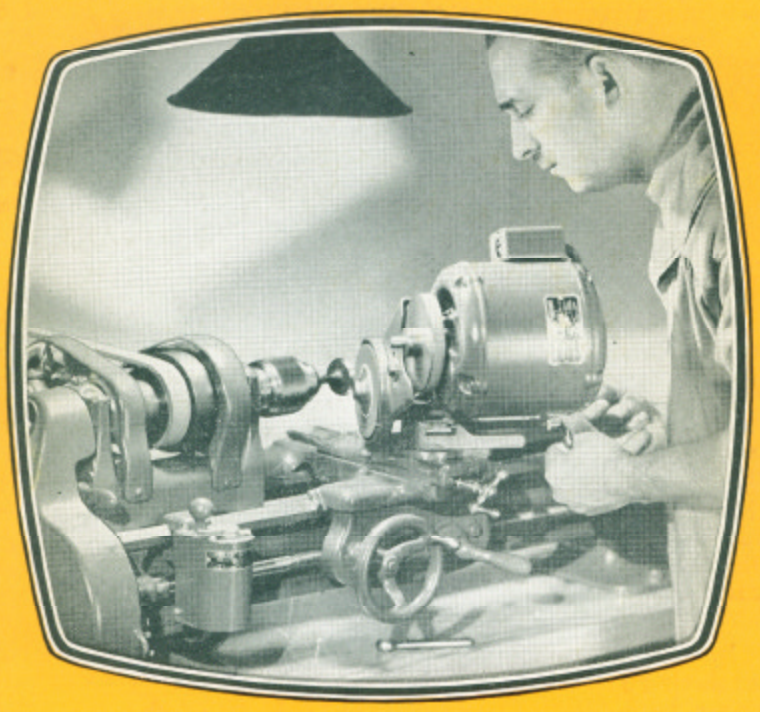
BULLETIN NO. 1A

How to Grind Valves

and Sharpen Reamers and Cutters



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SOUTH BEND LATHE WORKS
941 E. MADISON ST. SOUTH BEND, INDIANA, U. S. A.

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Bulletin No. 1

How to Grind Valves

In the Motor Service Machine Shop

This bulletin illustrates and describes the up-to-date method of refacing valves. A modern back-geared screw-cutting lathe, of any size from 9-inch to 36-inch swing, fitted with an electric grinding attachment, is the practical equipment for valve grinding.

All sizes and all types of intake and exhaust valves for automobiles, aeroplanes, buses, trucks, tractors, stationary engines, air compressors, electric refrigerators, etc., can be refaced by grinding in the lathe. The graduated compound rest of the lathe may be swiveled to any angle required. The lathe spindle has a wide range of speeds for various sizes of valves of any material such as cast iron, steel and alloys.

Valve servicing in the modern automotive repair shop is no longer confined to lapping the valve to the valve seat and adjusting the tappets. The modern shop must be equipped to reface the valve seats, install valve seat inserts, reface valves to the exact angle of the valve seat, make valve seat replacement rings, test and straighten bent valve steems, true rocker arm face for overhead valves, square the end of the valve stem, square the end of the tappet adjusting screw, square the end of the tappet, etc. The back-geared screw cutting lathe, (unlike the single-purpose machine,) will handle all of these jobs because it is a universal tool.

In addition to refacing valves, the lathe may be used for machining pistons, truing and undercutting armature commutators, boring rebabbitted connecting rods, making bushings and bearings, cutting right and left-hand screw threads and general machine work of all kinds. Only a few minutes are required to set up the lathe for refacing valves and, when the valve work has been finished, the lathe may be quickly arranged for many other jobs.

South Bend Lathe Works

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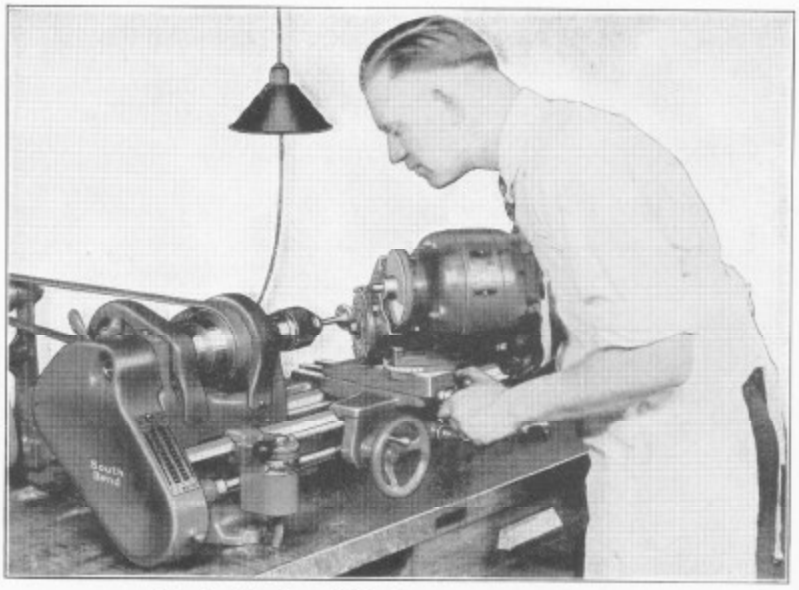


Fig. 1. Refacing a Valve by Grinding in the Lathe.

Grinding Valves in the Lathe

Automobile engine valves made of steel, cast iron, or special alloys, any size or type, can be refaced by grinding to any desired angle on any size of South Bend Lathe. The time required to reface a valve depends upon the metal from which it is made and the size and condition of the valve. A set of 12 valves can usually be refaced in the lathe in from ten to fifteen minutes.

The South Bend Method of refacing valves by grinding in the lathe permits doing the work with such precision that a perfect gas-tight fit may be obtained without lapping the valve to the valve seat, provided the valve seat is also accurately finished. Modern engines have valve seat inserts of stellite or other very hard metal which, for best results, should not be lapped.

The Valve Is Held In A Precision Chuck

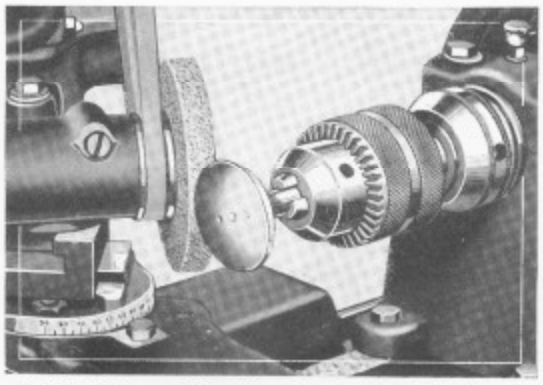


Fig. 2. A Close-up View Showing Precision Valve Chuck and Graduated Compound Rest Swivel.

The valve is held in a 3-Jaw Precision Valve Chuck which accurately centers the valve stem. See illustration and description of this chuck on page 2.

The grinding wheel is fed across the face of the valve by turning the compound rest feed screw. Depth of cut is controlled by the cross feed screw which has a collar graduated in thousandths of an inch. The compound rest may be swiveled to any angle required for refacing the valve. See Fig. 5.

Precision Chuck Used to Hold Valves in the Lathe

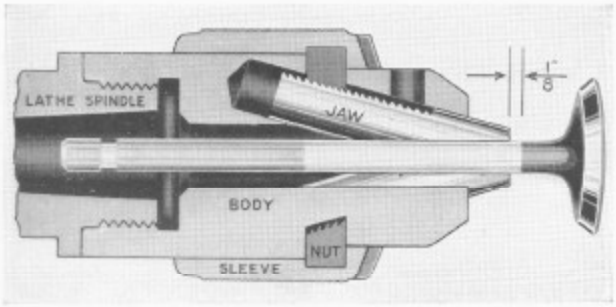


Fig. 3. Cross Section Showing Construction of 3-Jaw Precision Chuck Threaded to Spindle Nose of Lathe. This Chuck Accurately Centers the Valve for Refacing.

The 3-Jaw Precision Valve Chuck shown at left is threaded to the spindle nose of the lathe. This chuck is hollow and will take all types of valve stems, including Ford valves with mushroom end stems. It is made in two sizes, $\frac{5}{8}$" and $\frac{3}{4}$" capacity. The hardened jaws are accurately ground and provide a long, firm gripping surface on the valve stem.

The precision valve chuck automatically centers the valve stem concentric with the axis of the lathe spindle. The valve should be held in the chuck jaws on the valve guide bearing surface. This assures the valve being accurately refaced concentric with the valve stem where it is held in the guide bushing, so that when the valve is replaced in the engine, the valve face will seat in the cylinder block perfectly, and the valve will operate efficiently.

The three chuck jaws operate simultaneously for gripping or releasing the valve stem when the sleeve surrounding the body of the chuck is turned by hand or with the pinion wrench. Do not use this chuck for anything but valve refacing. To do so may impair its accuracy.

All dirt, scale, and carbon deposit should be removed from the valves before they are chucked for refacing in the lathe. This is best accomplished by the use of a rotary wire brush mounted on the spindle of a bench grinder or on an arbor held in the chuck of an electric drill.

Testing and Straightening Bent Valve Stems

Valves with bent stems should be tested and straightened before they are refaced. If the valve stems are badly bent or burned it is not advisable to use them and they should be replaced with new valves. The valve may be mounted in the lathe for testing, as shown in Fig. 4. If there is no center hole in the valve head, a center rest or cup center may be used instead of tailstock center.

The exact point where the stem is bent is easily located when the lathe is started and may be marked with chalk as shown in Fig. 4, at right. The valve may then be placed on an anvil and straightened with one or two light blows of a lead or brass hammer. Repeat the testing and straightening operations until the valve runs true.

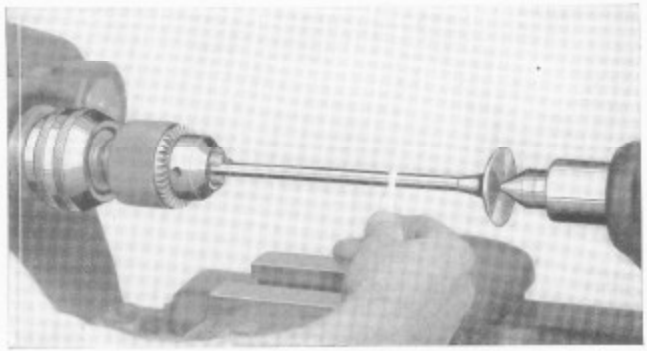


Fig. 4. Valve Mounted in Lathe for Testing and Locating the Exact Point where Valve Stem is Bent.

Setting Up the Valve in the Lathe for Refacing

First swivel the compound rest to the required angle for refacing the valve as shown in Fig. 5. Most valves have a 45-degree angle but valves of any angle may be refaced as the compound rest swivel is graduated 180-degrees and may be set at any angle.

Mount the Electric Grinder on the compound rest top as shown at right and tighten the clamp bolt. The grinder spindle should be parallel with the compound rest top dovetail slide (except for extra large valves) and the center of the grinding wheel should be the same height as the center point of the lathe. See Fig. 6.

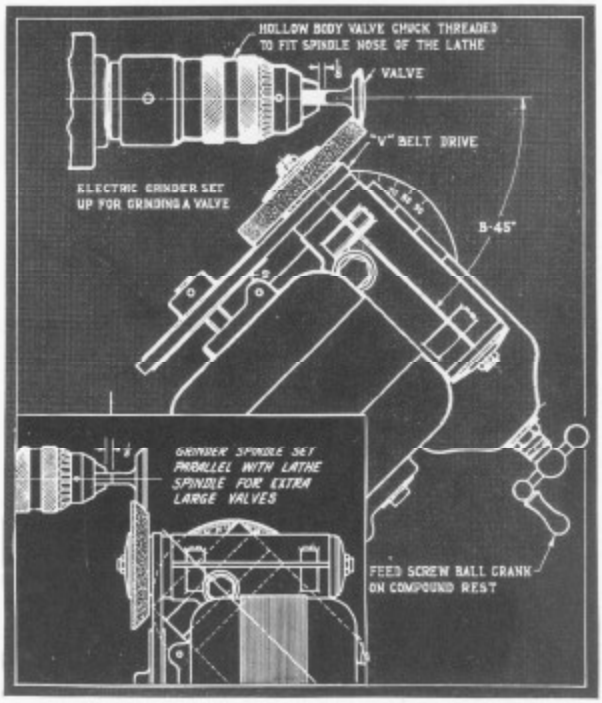


Fig. 5. Electric Grinder Mounted on the Compound Rest of the Lathe and Set to Grind Valve at a 45 Degree Angle.

Screw the Valve Chuck onto the spindle nose of the lathe, being very careful to clean the threads of the spindle and of the chuck thoroughly. Also see that no chips get between the spindle shoulder and the hub of the chuck body. Place valve in Valve Chuck and tighten jaws as shown in Fig. 3, page two. Arrange the lathe to operate at a medium spindle speed. Most valves may be ground with the back gears disengaged and the belt on the largest step of the cone pulley but for some very large valves, a slower spindle speed may produce better results.

Grinding the Valve Face

Before starting to grind, cover the V-ways of the lathe bed with a cloth to protect them from grit. True the grinding wheel as described on page five and repeat at regular intervals to insure a smooth accurate job of valve grinding. Operate the lathe in reverse when grinding so that the top of the valve rotates away from the operator as shown in Fig. 6. Bring the revolving grinding wheel up until it contacts lightly with the valve; then tighten the carriage lock screw.

Grind the valve face by feeding the grinding wheel slowly back and forth across the valve. Take light cuts, using the cross feed screw to feed the grinding wheel in and the compound rest feed knob to feed the grinding wheel across the valve face. Remove just enough to true the face of the valve. Always use a grinding wheel of the proper composition, grain and grade. See page 6.

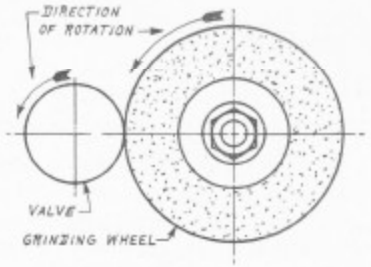


Fig. 6. Correct Height for Setting Grinding Wheel in Relation to Valve.

Grinding Valve Seat Reamers

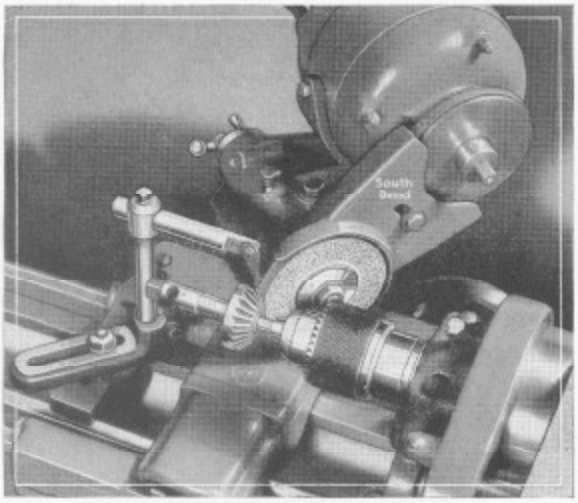


Fig. 7. Sharpening a Valve Seat Reamer Held by Its Own Pilot in a Valve Chuck. Grinder is Set at a 45° Angle.

Both the valve and the valve seat reamer should be ground without changing the setting of the compound rest swivel so they will have exactly the same angle. To set up the lathe and grinding attachment for grinding a valve seat reamer follow the instructions as outlined on page 3 for setting up to grind a valve face.

To grind the valve seat reamer mount it in the valve chuck as shown in Fig. 7 at the left. The pilot of the reamer is held and centered in the chuck which insures that the reamer teeth will be ground concentric with pilot.

Bolt the base of the spring stop holder to the lathe bed as shown and adjust the point of the spring stop approximately 1/16-inch above the lathe center points as shown in Fig. 8 below.

Rub a thin film of Prussian blue on the lands of the reamer blades. Without starting the grinder motor bring the grinding wheel up so that it just touches the reamer blades. Hold the cutting edge of the blade against the spring stop and turn the wheel by hand to mark the blade. This will show whether the set-up is correct to duplicate the original clearance.

Lock the carriage by tightening the carriage lock collar screw. Start the grinder. Hold the reamer blade firmly against the spring stop with one hand and turn cross feed screw with the other hand until the grinding wheel contacts the reamer very lightly. Using the compound rest ball crank, feed the grinding wheel carefully across the reamer blade. Repeat the grinding operation as outlined on each of the remaining blades of the reamer. Remove the reamer from the chuck and ream a valve seat to test the reamer for tooth clearance.

If the clearance is correct, a smooth uniform surface on the valve seat will result when it is reamed. If there is not enough tooth clearance on the reamer it will not cut, and if there is too much clearance it will chatter.

If necessary, adjust the spring stop to give the blades more or less clearance as desired. For more clearance move the stop up and for less clearance move it down. Then repeat the grinding and testing until the desired result has been obtained.

By grinding the valve seat reamer using the same set-up as that used for grinding the valve face, the same angle will be produced on both the reamer and the valve face. The valve will fit perfectly in the valve seat and should not require lapping.

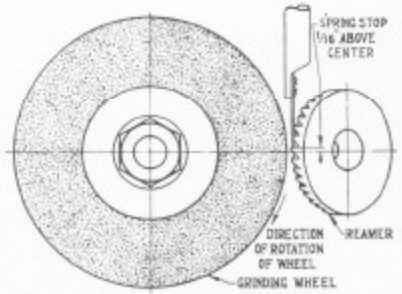


Fig. 8. Position of Grinding Wheel and Spring Stop for Sharpening Reamers

Truing the Grinding Wheel

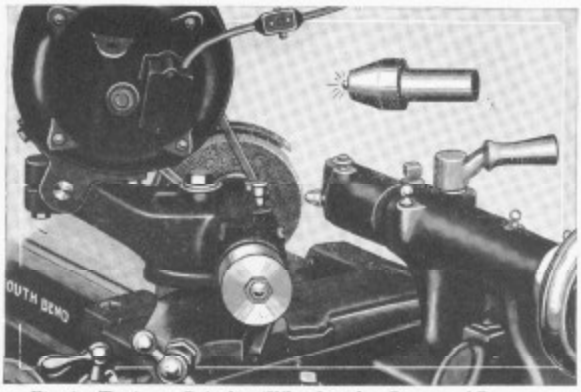


Fig. 9. Truing a Grinding Wheel with a Diamond Dresser Held in a Special Holding Fixture Clamped to Tailstock Spindle of Lathe.

It is important that the grinding wheel be true when grinding valves and sharpening reamers and cutters.

A special diamond holding fixture, fitted to the tailstock spindle, is used for this work. See Fig. 9. This fixture holds the diamond at a 45° angle so that when grinding valves and valve seat reamers the grinding wheel may be trued up as often as necessary without changing the angular position of the electric grinder.

Mount the grinder on the lathe, as explained on page 3, adjust the compound rest to a 45° angle, or any other desired angle, and lock it in position. Move the carriage back toward the tailstock and bring the grinding wheel up close to the diamond (not touching it) and lock the carriage to the bed by tightening the carriage lock collar screw.

Start the grinder motor and adjust the cross feed screw until the face of the grinding wheel just touches the point of the diamond. Then feed the revolving grinding wheel slowly back and forth across the diamond by turning the ball crank on the feed screw of the compound rest slide. Turn in on the cross slide feed screw .001" each time the wheel is fed past the diamond. Repeat this until the face of the grinding wheel is true and smooth all the way around.

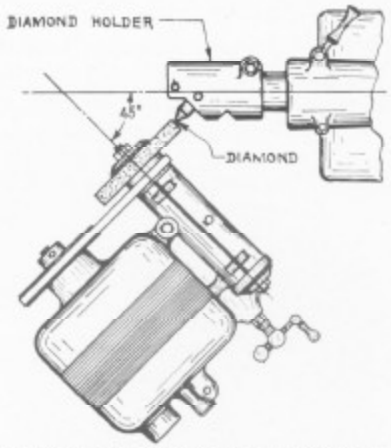


Fig. 10. Electric Grinder Set at a 45° Angle for Truing the Grinding Wheel.

Electric Grinder A Precision Tool

The electric grinding attachment is a precision tool and should be treated as such. It should be used only for precision grinding operations on valves, grinding cylindrical work in the lathe and for grinding valve seat reamers, adjustable blade reamers, milling cutters, etc. Do not use the grinding attachment as a bench grinder for grinding lathe tools, chisels, punches, screw drivers, etc. as this will wear the wheel unevenly and may throw it out of balance.

Selecting the Correct Size of Lathe for Valve Work

Valve servicing can be handled on any size or type of South Bend Back-Geared, Screw Cutting Lathe from 9-inch to 36-inch swing inclusive. If you intend to specialize on small automotive service work such as valves, armatures, pistons, bushings, connecting rods, etc., you will require a lathe of only small swing. We will be glad to help you in selecting the size and type of lathe most suitable for your requirements.

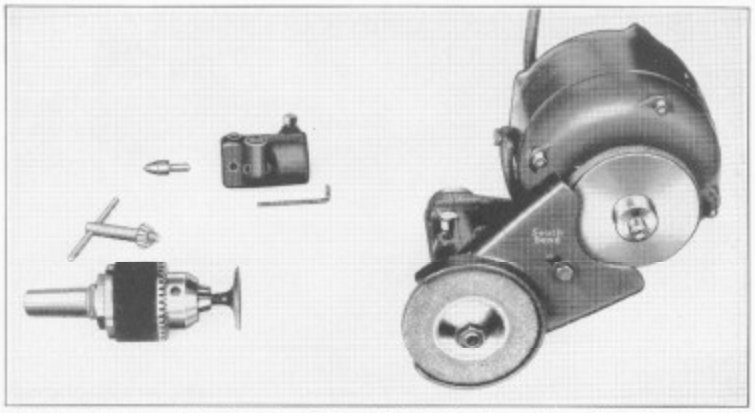


Fig. 11. Equipment for Grinding Valves in the Lathe Consisting of Electric Grinder, Precision Valve Chuck, Diamond Holding Fixture and Diamond Dresser.

Valve Grinding Equipment

Automobile engine valves made of steel, cast iron or special alloys, any size or type, can be refaced by grinding on a lathe fitted with the above equipment which consists of an electric grinder, precision valve chuck, diamond holding fixture and diamond dresser. The grinder may also be used for other jobs such as grinding pistons, bushings, reamers, hardened tools, etc.

The Electric Grinder will produce a smooth, accurate finish on the valve face as it is unusually smooth running and powerful. It has large bearings which are adjustable for wear, a heavy precision-ground shaft, and a positive felt wick oiling system. Grinder operates from an ordinary lamp socket.

Equipment supplied with the grinder consists of: ¼ H.P., 1725 R.P.M., (1-phase, 60-cycle, 110-volt) electric motor, V-belt, belt guard, one Alundum grinding wheel, (specify grain 46N, grade 5B) cord, switch and clamp.

We can supply the electric grinder for every size and type of South Bend Lathe from 9-inch to 18-inch swing, inclusive. Prices supplied on request.

The Precision Valve Chuck is described on page 2. Prices on request.

The Diamond Holding Fixture clamps on tailstock spindle of lathe. It holds the diamond dresser in either of two positions: one at a 45° angle for valve work, and another at a 90° angle for piston, bushing and similar work.

Various other fixtures for special classes of valve servicing are illustrated and described on page 7.

Grinding Wheels for Various Kinds of Work

Although a single grinding wheel may be used for general all-around grinding, better results can usually be obtained by using various grades of grinding wheels for various kinds of work such as cast iron, soft steel, tools, etc. The tabulation at the right shows the grade of Norton Grinding Wheel recommended for different kinds of work.

Kind of Work	Name of Wheel (Norton)	Grain	Grade
Valves	Alundum	46-N	5-B
General	Alundum	46-J	19
Cast Iron	Crystalon	36	K
Steel	Alundum	46	M
Cutting Tools	Alundum	19	50-K
Aluminum	Alundum, Shellac	46	3

Itemized Quotation on the Lathe and Tool Equipment

An itemized quotation on the lathe and tools required for grinding valves will be mailed on request. Specify the size of lathe which you would prefer and the general class of work you wish to do and we will quote on the size of lathe most practical for that work.

Special Attachments for Servicing Valves

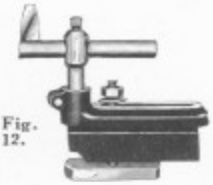


Fig. 12.

Adjustable Holding Fixture

The Adjustable Holding Fixture, above, is used to hold the spring stop when sharpening reamers. See Fig. 7 and Fig. 15. It is also used to hold the V-Block Fixture and Rocker Arm Fixture shown at right. Attachment clamps on lathe bed. Price of Fixture, including spring stop, for any size lathe will be supplied on request.

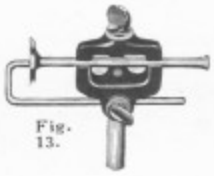


Fig. 13.

V-Block Holding Fixture

The V-Block Holding Fixture, above, is used to hold valves for squaring the ends of the valve stems and for grinding Ford mushroom type valve stems for clearance adjustment. The application of this attachment, which is used in the Adjustable Holding Fixture at the left, is shown in Fig. 17. Price of attachment supplied on request.

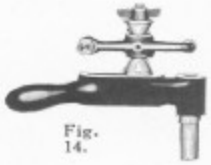


Fig. 14.

Rocker Arm Grinding Fixture

The Rocker Arm Grinding Fixture, above, is used to hold all sizes of rocker arms when truing up the worn face. The attachment fits in the Adjustable Holding Fixture shown at the extreme left and is adjustable for any radius desired. For application of this attachment see Fig. 16. Price of attachment supplied on request.

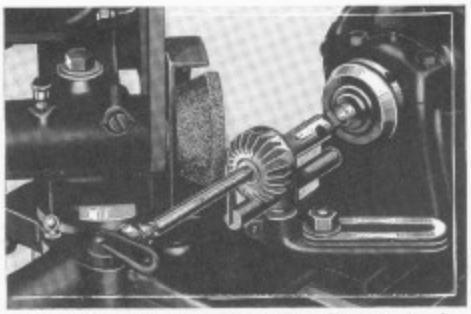


Fig. 15. Sharpening a Valve Seat Reamer in the Lathe Using a Cup Grinding Wheel.

Reamer and Cutter Grinding

Fig. 15 at left, shows another method for grinding and sharpening reamers and cutters in the lathe. This method differs from the one shown on page 4 in that a cup wheel is used instead of a plain emery wheel, and the spring stop is set $\frac{1}{16}$" below the point of the lathe center instead of above it.

Cup wheels may be used for grinding the side face of cutters and other special work. Prices of cup wheels in various sizes and angles will be quoted on request. For valve and reamer grinding, however, we recommend the plain emery wheel shown in Fig. 2, page 1.

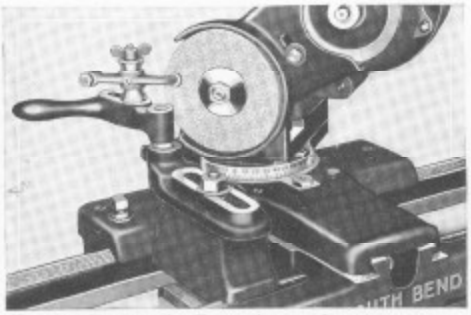


Fig. 16. Truing the Face of a Rocker Arm Using Special Fixture for Obtaining Correct Curvature.

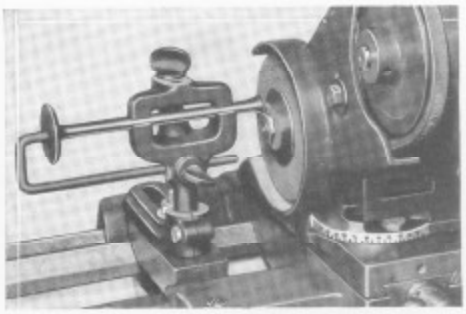


Fig. 17. Grinding the End of a Ford Mushroom End Valve Stem for Clearance Adjustment.

Truing Rocker Arm Face

Fig. 16, above, shows the lathe set up for truing the curved face of a rocker arm used for overhead valves. The side of the grinding wheel is used for this operation, and the fixture pivots about the swivel stud to produce any desired radius on the rocker arm face. The fixture is adjustable for all sizes of rocker arms.

Grinding End of Valve Stem

Fig. 17, above, shows the lathe set up for grinding the end of the valve stem. The adjustable stop permits removing exactly the amount desired from the end of the stem. The graduated collar on the compound rest feed screw, reading in thousandths of an inch, enables the operator to obtain any desired clearance.

Other Important Valve Servicing Jobs

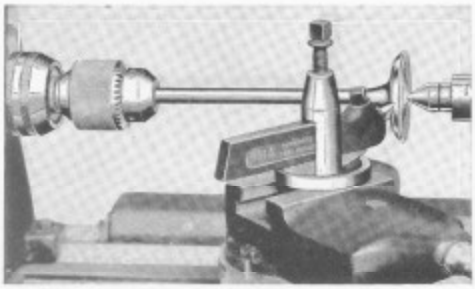


Fig. 18. Machining a Valve in Lathe

Replacement valves may be machined complete in the lathe. Any suitable material such as bar steel, an old shaft, etc., can be used. Large valves may be cut down for engines requiring smaller sizes and old or obsolete valves may be re-worked for later model cars.

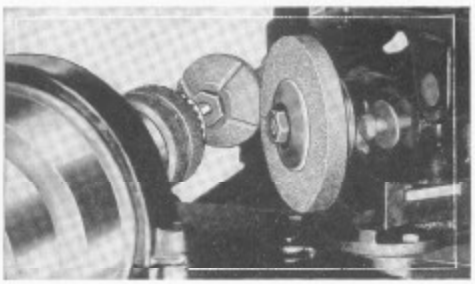


Fig. 19. Truing Valve Seat Hone

Valve seat hones and grinding wheels for truing valve seats can be trued at any angle by using the grinder, as shown above. Another method is to mount a diamond dresser in the tool post of the lathe and feed it across the surface of the hone rotating in the lathe chuck.

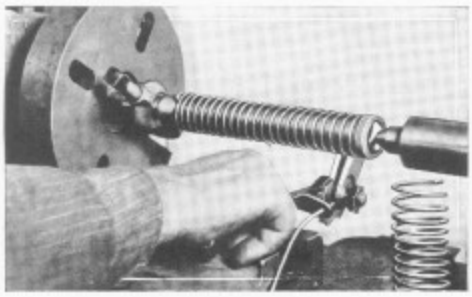


Fig. 20. Winding a Valve Spring

Valve springs of all sizes and types can be wound in the lathe, as shown above. A special spring winding tool is used to guide the wire on the mandrel about which the spring is wound. Attachment makes springs from wire 0" to 3/16" in diameter. Price supplied on request.

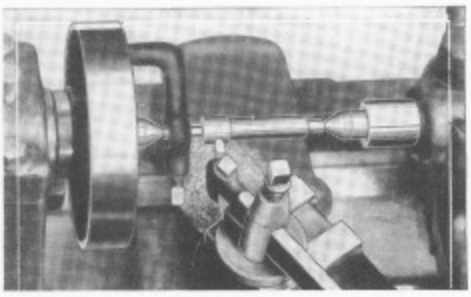


Fig. 21. Making a Valve Guide

Replacement valve guides for orphan cars or for emergency repairs and guides for oversize or undersize valve stems can be made out of cast iron or steel as shown above. The lathe may also be used for making bushings and bearings, making replacement parts, cutting screw threads, etc.

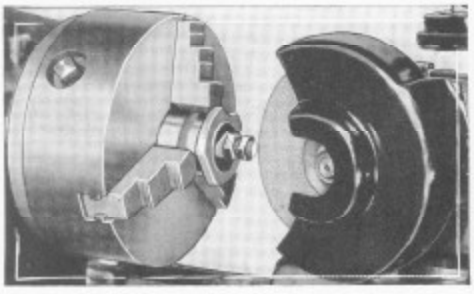


Fig. 22. Grinding Tappet Screw

Tappet Adjusting Screws that have become worn should be ground square on the end, as shown above, to prevent pushing the valve stem to one side and throwing the valve out of alignment. The screw may be held either in the 3-Jaw Universal Chuck, as shown, or in the Hollow Valve Chuck.

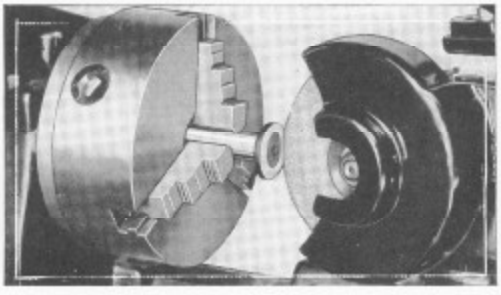
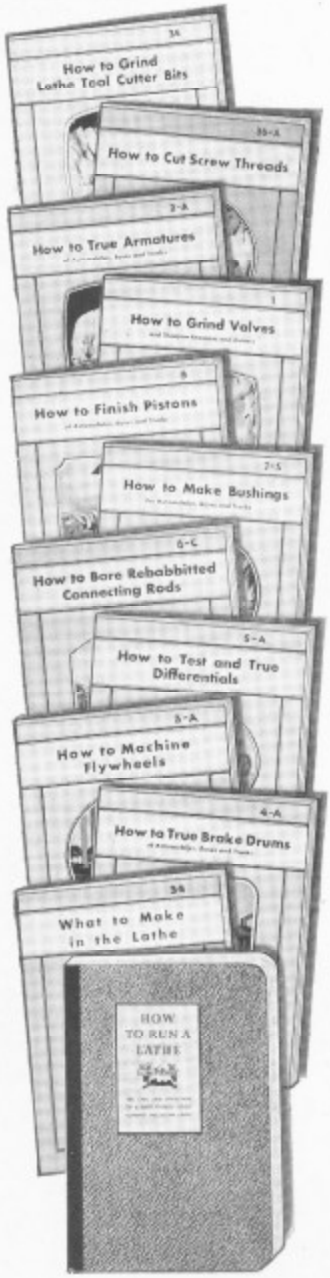


Fig. 23. Grinding a Tappet Face

Worn valve tappets should be ground true and square on the face, as shown above, otherwise, they will not operate properly. The tappet is held in a self-centering 3-Jaw Universal Lathe Chuck and revolves while the grinding wheel is fed across the end of the tappet.

Valuable Books for the Mechanic

The bulletins listed below illustrate and describe how to handle general lathe work and seven major auto service jobs according to the latest shop practice that is followed in the most successful shops and plants in the United States. Thousands of mechanics are using these bulletins in their work. Order some of these for your mechanics—they may be helpful. Bulletins are 6″ x 9″ in size and contain from 8 to 160 pages each. When ordering specify the titles of the bulletins wanted and they will be mailed postpaid on receipt of price indicated. Coin or stamps of any country accepted.



"How to Grind Lathe Tool Cutter Bits" Bulletin No. 35. Explains in detail how to sharpen various types of cutter bits for lathe work. 16 pages, size 6"x9", 50 illustrations. Price postpaid 10c

"How to Cut Screw Threads" Bulletin No. 36-A. Explains various screw thread forms and how to cut screw threads in the lathe. 24 pages, size 6"x9", 65 illustrations. Price postpaid 10c

"How to True Armature Commutators and Undercut Mica" Bulletin No. 2-A. (Automotive). Contains information on truing armature commutators and undercutting mica in the lathe. 12 pages, size 6"x9", 35 illustrations. Price postpaid 10c

"How to Grind Valves and Sharpen Reamers" Bulletin No. 1. (Automotive). Contains information on refacing automobile engine valves, sharpening valve seat reamers, cutters, etc. 12 pages, size 6"x9", 23 illustrations. Price postpaid 10c

"How to Finish Pistons" Bulletin No. 9. (Automotive). Contains detailed information on finishing semi-machined pistons in the lathe, reaming and honing wrist pin holes, etc. 12 pages, size 6"x9", 31 illustrations. Price postpaid 10c

"How to Make Bushings" Bulletin No. 7-S. Contains information on making bushings, lathe mandrels, press fits and running fits. 12 pages, size 6"x9", 28 illustrations. Price postpaid 10c

"How to Bore Rebabbitted Connecting Rods" Bulletin No. 6-C. (Automotive). Illustrates and describes the latest shop practice for boring, facing, and finishing rebabbitted connecting rods. 8 pages, size 6"x9", 25 illustrations. Price postpaid 10c

"How to Test and True Differentials" Bulletin No. 5-A. (Automotive). Contains information on removing the old ring gear, testing and truing the ring gear seat, testing bearings of drive pinions, etc. 8 pages, size 6"x9", 20 illustrations. Price postpaid 10c

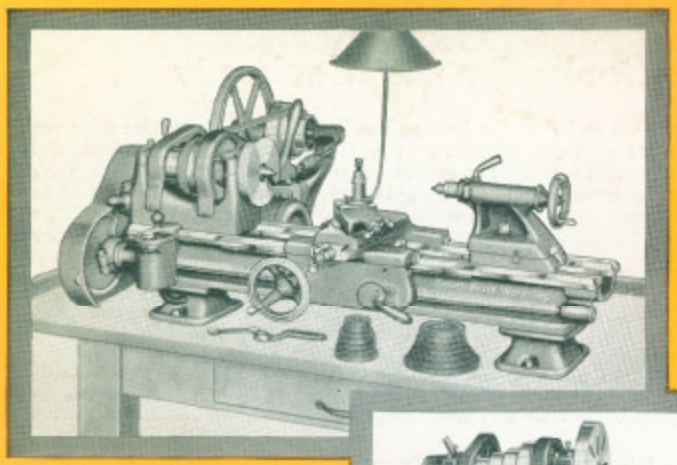
"How to Machine Flywheels" Bulletin No. 3-A. (Automotive). Contains information on turning down flywheels for new starter ring gears. 8 pages, size 6"x9", 24 illustrations. Price postpaid 10c

"How to True Brake Drums" Bulletin No. 4-A. (Automotive). Shows how to mount various types of brake drums in the lathe for truing the drum so that it will be concentric, round and true. 16 pages, size 6"x9", 40 illustrations. Price postpaid 10c

"What to Make in the Lathe" Bulletin No. 34. Illustrates and describes over 65 useful projects for the home and shop including tools, grinders, and other useful objects, also various models such as steam and gas engines, locomotives, airplanes, etc. 28 pages, size 6"x9", 75 illustrations. Price postpaid 10c

"How to Run a Lathe" (32nd Edition). This is an authoritative and instructive manual on the care and operation of a back-geared, screw cutting lathe. It gives the fundamentals of lathe operation in detail with illustrations of various classes of work. Contains 160 pages, size 5¼"x8", and more than 300 illustrations.

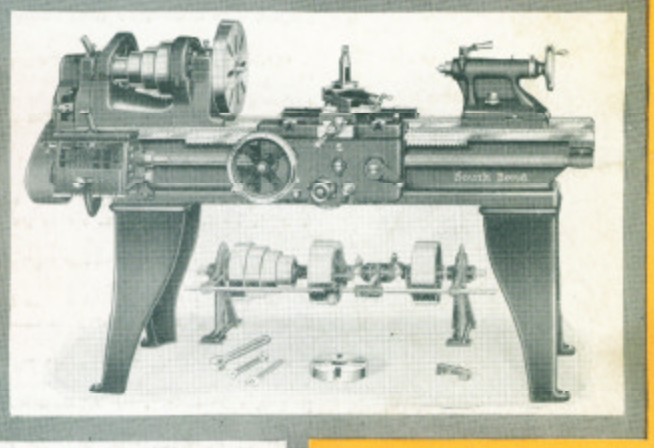
This book is used as a handy reference book by machinists and apprentices in industrial plants, railroad shops and machine shops, and is also used as a text book by students in educational institutions. It is considered the most popular text on lathe work in the world. More than a million and a half copies are in use.
Price postpaid 25c



At Left—No. 415-YA 9" x 3' 1937 Model South Bend "Workshop" Adjustable Horizontal Motor Driven, Back-Geared Screw Cutting Precision Bench Lathe.

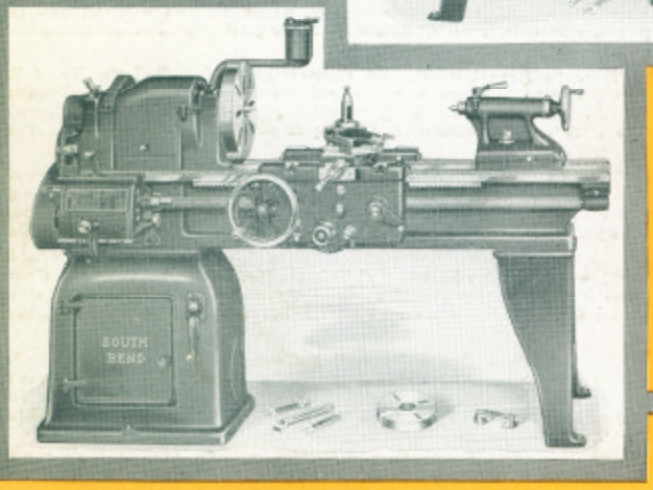
One of the finest small lathes we have ever built.

Prices of lathe, less motor drive, range from $75.00 up.



At Right—No. 17-C 16"x6' 1937 Model South Bend Overhead Countershaft Driven, Quick Change Gear, Back-Geared Screw Cutting Precision Lathe.

A popular type high quality precision lathe.



At Left—No. 117-C 16" x 6' 1937 Model South Bend Underneath Belt Motor Driven, Quick Change Gear, Back-Geared Screw Cutting Precision Lathe.

A practical, efficient and popular motor driven lathe.

Below—The plant of the South Bend Lathe Works at South Bend, Indiana. This organization was founded in 1906 and has grown and developed to an enterprise occupying the buildings shown here, which have a floor space of 180,000 square feet and with a ground area of 4½ acres devoted exclusively to the manufacture of South Bend Back-Geared Screw Cutting Precision Lathes.

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South Bend Lathe Works
SOUTH BEND, INDIANA, U. S. A.